CHAPTER 1 INTRODUCTION

1.1 Background to the Research

Increased participation in global trade has been an important determinant of economic growth for leading economies in the world. In 1991 Larry Summers proclaimed that countries should pursue trade openness via all types of tariff reduction, be they unilateral, multilateral, or bilateral. Summers argued that while global liberalisation may be superior, regionalism is highly likely to be of merit and could just as easily accelerate general liberalisation as retard it. Unilateral trade liberalisation refers to a country going on its own; that is, removing trade barriers without waiting for its trading partners to do the same (Panagiriya, 2004). Since 1950 there has been immense liberalisation of world trade, first under the auspices of the General Agreement on Tariffs and Trade (GATT), established in 1947, and now under the auspices of the World Trade Organisation (WTO), which replaced the GATT in 1993. Tariff levels in high-income developed countries have been reduced dramatically and by 2007, the average tariffs were reportedly slashed down to four per cent (World Bank, 2010). It has also been recorded that there is a reduction in simple average tariff levels in developing countries even though it still remains relatively high at an average of 15 per cent in low and middle-income regions like South Asia and Sub-Saharan Africa (World Bank, 2010). Non-tariff barriers to trade, such as quotas, licenses and technical specifications, are also being gradually dismantled, but rather more slowly than tariffs.

Preferntial Trade Agreements (PTAs), in the form of Free Trade Agreements (FTAs) and Customs Unions, appear to have become fashionable. Although GATT embodies the principle of non-discrimination in international trade, Article 24 of GATT permits the formation of FTAs and "customs unions" among GATT members. A customs union is a group of countries that eliminate all tariffs on trade among themselves but maintain a common external tariff on trade with countries outside the union (thus technically violating Most Favoured Nation (MFN)). This exception was designed, in part, to accommodate the formation of the European Economic Community (EC) in 1958. Policymakers seem to have chosen regionalism as the preferred mode of liberalisation. According to the World Trade Organization (WTO), there are over 250 PTAs currently in force. Most of these agreements have been concluded in the past 15 years, and many new agreements are under negotiation.

In line with trends in the other economies, South Asia has been actively engaged in trade liberalisation over the last decade, both regionally and unilaterally. On a regional basis, the economies of South Asia have sought to promote intra-regional trade as a group, in addition to pursing agreements with economies outside the region. In December 1985, seven South Asian countries: Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka formed the South Asian Association for Regional Cooperation (SAARC) to promote economic, social and cultural cooperation. In April 2007, at the SAARC's 14th summit, Afghanistan became its eighth member. In 1993 the South Asian Preferential Trade Agreement (SAPTA), (which came into effect from December 1995) was initiated by the SAARC to promote greater regional economic cooperation. Subsequently, the member countries of the SAARC intended to transform SAPTA into a South Asian Free Trade Area

(SAFTA) and this arrangement was duly signed on 6th January 2004 during the 12th SAARC summit. The treaty came into force on 1st January 2006 with plans for full implementation to be achieved by 31st December 2015.

SAFTA is intended to strengthen intra-SAARC economic cooperation and maximise the region's economic and social potential through various instruments of trade liberalisation. The agreement binds all contracting states to reduce tariffs to between 0-5 per cent by 31st December 2015. In the 12th SAARC summit held at Islamabad a decision was made to initiate a study into advancing the deadline for the establishment of a South Asian Custom Union from 2020 to 2015, and to form an Economic Union by 2020, including the introduction of a common currency. This was an Indian proposal which won prompt support at the meeting of the Council of Ministers.

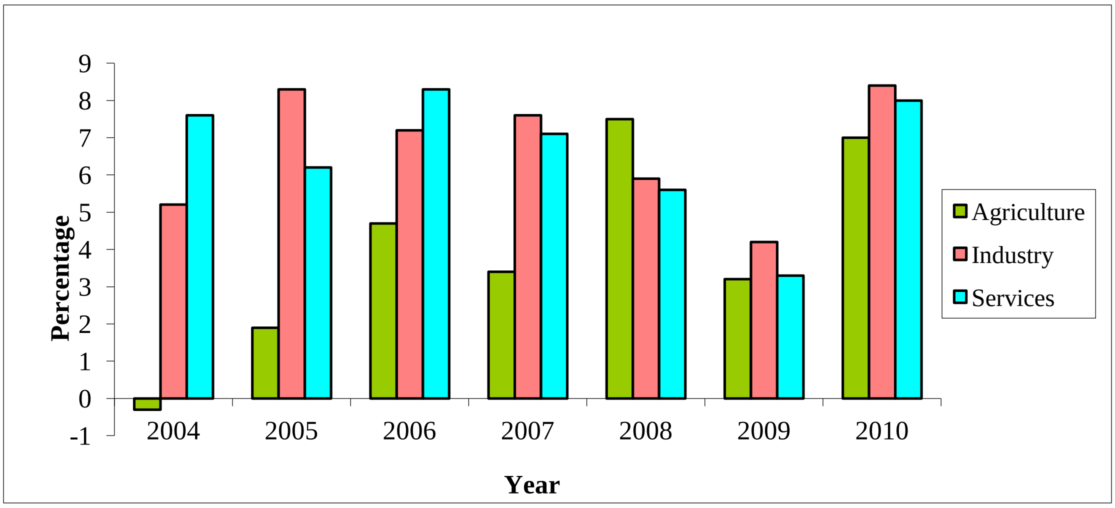
South Asian countries have been slowly moving towards a SAFTA in recent years. Even though regional integration initiatives commenced with the formation of the SAARC, intra regional trade in the region is very low and remained at 4.3 per cent in 2008 (Akhter and Ghan 2010; International Monetory Fund (IMF), Direction of Trade Statistics, 2009). The official data indicates that the industrial countries continue to assume a major share of region’s trade, while developing countries outside South Asia have been the second most important group (IMF, 2009). This is a serious impediment for regional cooperation and economic integration and, therefore, it is important to apply the right policy measures to boost intra regional trade among the SAARC members. In this context, it has become a vital policy issue to determine whether the creation of SAFTA and moving into deeper integration levels (e.g. South Asian Custom Union) would ensure welfare gains for all South Asian members.

Sri Lanka is a member of SAARC and has been engaged in market-oriented economic reforms for nearly 35 years. The country has made considerable progress towards achieving a more liberal trade policy regime. Moreover, it has achieved a high level of human development due to signficant investments in social infrastructure by successive governments. Despite such progress, Sri Lanka continues to have a high incidence of poverty, with about 20-30 per cent of its population living in poverty (Jayanetti and Tilakaratna, 2005). Accordingly, the present study has an objective to investigate in detail how trade liberalisation in South Asia affects the socio-economic aspects of the Sri Lankan economy. It is therefore important to understand some salient characteristics of the Sri Lankan economy to gain an insight into the research.

1.1.1 Sri Lankan Economy and Trade Liberalisation

Sri Lanka is an open economy with its total trade equivalent to 54.5 per cent of Sri Lanka's GDP in 2008 and had an average growth rate of six per cent during the period of 2004-2008 (Central Bank of Sri Lanka, 2010). The service sector is the dominant sector in the economy, accounting for about 59.5 per cent of GDP and 41 per cent of employment in 2008. The industrial sector accounted for 28.4 per cent of GDP and 26.3 per cent of employment while the agricultural sector accounted for 12.1 of GDP and 32.7 per cent of employment in 2008 (Central Bank of Sri Lanka, 2010). Figure 1.1 illustrates the annual growth rates of these sectors from 2004 to 2010.

Figure 1.1 Annual Growth Rates of Sectoral Composition of GDP: 2004-2010



Source: Central Bank of Sri Lanka: Annual Reports, Various Issues

From Figure 1.1, it is clear that the industrial sector recorded the highest sectoral growth in 2010 (8.4 per cent compared to growth of 7.6 per cent in 2007) due to increase in construction and manufacturing activities with the end of civil war. Growth in the agriculture and services sectors in 2010 was also higher than in previous years, 7.0 per cent and 8.0 per cent, respectively.

Trade liberalisation was an important component of the economic liberalisation policy package introduced in Sri Lanka in 1977. Since then, the tariff structure in the country has undergone a major reduction of levels and compression of tariff bands, emphasising the country's commitment to trade liberalisation. As judged by the latest Trade (Most Favoured Nation-MFN) Tariff Restrictiveness Index (TTRI), Sri Lanka's trade regime is considerably more liberal than in an average South Asian country. Sri Lanka's MFN simple average applied tariff of 11.4 per cent is also considerably lower than the simple average applied tariff of South Asia (14.4

per cent) and low-income group (12.6 per cent) averages. MFN duty free accounted for more than a third of its total imports in 2005 (World Trade Indicators, 2008).

In the case of economic cooperation and trade with the rest of the world, regionally, Sri Lanka is a member of SAARC, SAFTA, the Bangkok Agreement, Bangladesh, India, Myanmar, Sri Lanka and Thailand Economic Cooperation (BIMSTEC) and has free trade agreements (FTAs) with India and Pakistan. According to World Bank estimates, trade with FTA partners (notably India and Pakistan) amounted to about 18 per cent of total trade in 2007.

1.1.2 Poverty and Inequality in Sri Lanka

There is growing concern among policy makers in Sri Lanka about income distribution and the poverty implications of trade reforms. As per the Official Poverty Line (OPL) for Sri Lanka[1] and using the Household Income and Expenditure Survey (HIES) of the Department of Census and Statistics, the poverty Head Count Index (HCI) for Sri Lanka in 2009-10 was 8.9 per cent which means 1.8 million people were identified as poor. Table 1.1 shows a decline in aggregate poverty levels during the period of 1990-2010. The fall in poverty is significant in both the urban and the rural sectors. In particular, the percentage of poor has more than halved in the urban sector during the last decade. It also reveals a two-third drop of poverty in estates

[1] The Department of Census and Statistics (DCS) introduced the Official Poverty Line (OPL) for Sri Lanka in June 2004. The 2002 value of the OPL, which was Rs. 1423 real total expenditure per person per month, is updated for the inflation of prices through the Colombo Consumer Price Index (CCPI) calculated monthly by the DCS. According to price index values 3176 in 2002 and 4983 in 2006/07 as reported by the CCPI, the value of the OPL for 2006/07 is Rs. 2233 real total expenditure per person per month.

sector[2], which is almost equal to the poverty head count ratio reported in the rural sector.

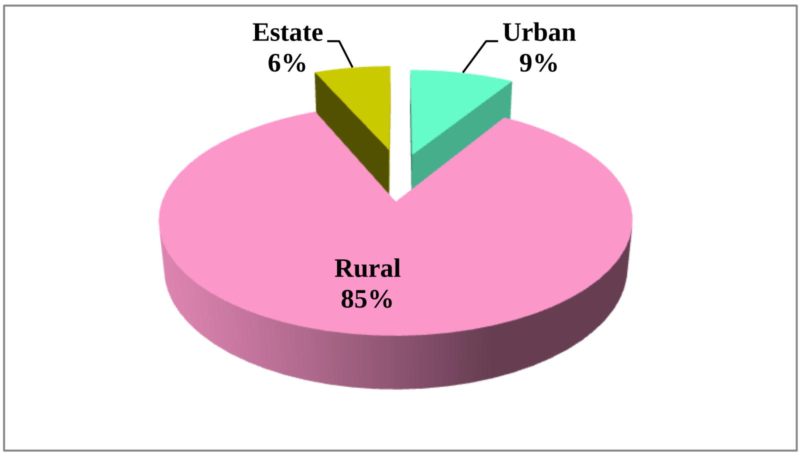
Table 1.1 Poverty Headcount Index in Sri Lanka from 1990–1991 to 2009–2010

Sector	Survey Period			
	1990-91 (%)	1995-96 (%)	2002 (%)	2009/10 (%)
Sri Lanka	**26.1**	**28.8**	**22.7**	**8.9**
Urban	16.3	14.0	7.9	5.3
Rural	29.5	30.9	24.7	9.4
Estate	20.5	38.4	30.0	11.4

Source: Department of Census and Statistics (DCS), estimates based on HIES 1990-1991, 1995-96, 2002 and 2009-10.

Despite the declining trend, poverty is predominantly a rural phenomenon in Sri Lanka (see Figure 1.2).

Figure 1.2 Contribution to Poverty (percentage) by Sector: 2009-2010



Source: Department of Census and Statistics (DCS), estimates based on HIES 2009-2010.

[2] The estate sector is considered to be part of the rural sector. Large plantations growing tea, rubber and coconut were introduced in Sri Lanka during the British colonial period and labour was imported from South India to work on these plantations. These are included in the estate sector, which comprises five per cent of the total population in Sri Lanka (World Bank, 2009).

Table 1.2 shows that there is a significant variation in the incidence of poverty across provinces in Sri Lanka. According to the HIES of 2009–10, poverty incidence is highest in Eastern and Uva provinces (14.8 percent and 13.7 percent, respectively), followed by Northern, North Western and Sabaragamuwa provinces. The Northern and large parts of the Eastern Provinces (which together account for one-third of Sri Lanka's total land area and almost 12 per cent of the population) record high incidence of poverty as these provinces remained mostly cut off from the national economy due to escalation of the civil strife during 1983-2009 (Athukorala, 2012). Yet, the Western region has the least incidence of poverty as Sri Lanka's growth was mostly concentrated in the Western Province, which is also the wealthiest region in the country (Castro and Devarajan, 2006).

Table 1.2 Poverty Headcount Index (percentage) by Province in Sri Lanka: 1990-1991 to 2009-2010

Province	**Survey Period**			
	1990-91 (%)	**1995-96 (%)**	**2002 (%)**	**2009/10 (%)**
Western	19.1	16.3	10.8	4.2
Central	30.7	36.2	25.1	9.7
Southern	30.2	32.6	27.8	9.8
Northern	-	-	-	12.8
Eastern	-	-	-	14.8
North-Western	25.8	27.7	27.3	11.3
North-Central	24.5	24.7	21.5	5.7
Uva	31.9	46.7	37.2	13.7
Sabaragamuwa	31.0	41.7	33.6	10.6

Source: Department of Census and Statistics (DCS), estimates based on HIES 1990–91, 1995–96, 2002 and 2009–10.

The structural changes and the opening up of the economy that brought a reasonable high rate of economic growth in the last 15 years may have helped to reduce poverty in all the provinces in Sri Lanka. The end of the prolong civil war in 2009 has seen the reduction of poverty in the Northern and Eastern provinces in

2009-10. However, there is still a large proportion of the population who remain susceptible and vulnerable to economic changes and income fluctuations because they are clustered around borderline poverty. Table 1.2 indicates that there is a vast regional disparity in poverty reduction in Sri Lanka, and there are some backward regions in the country and therefore, poverty in these regions is still a serious problem.

Poverty levels are particularly high among landless labourers, and among casual labourers employed in the agriculture, mining, construction and the informal sectors (Abayawardana and Hussain, 2002). Greater vulnerability and insecurity of the poor, and those clustered above the poverty line may be due to poor targeting of poverty alleviation programs (e.g. the *Janasaviya* and the *Samurdhi* Programme), large increases in temporary and casual employment, and insufficient attention to risk management in agriculture.

Even though the HIES results indicate that the overall incidence of poverty has been reduced in Sri Lanka, it is important to determine the distribution of income among Sri Lanka's population. This can be understood by observing the trend in income inequality measured by the income based Gini co-efficient. Figure 1.3 illustrates the trends in Gini co-efficient based on both income receivers and spending units[3] in Sri Lanka during the period 1973–2003/04.

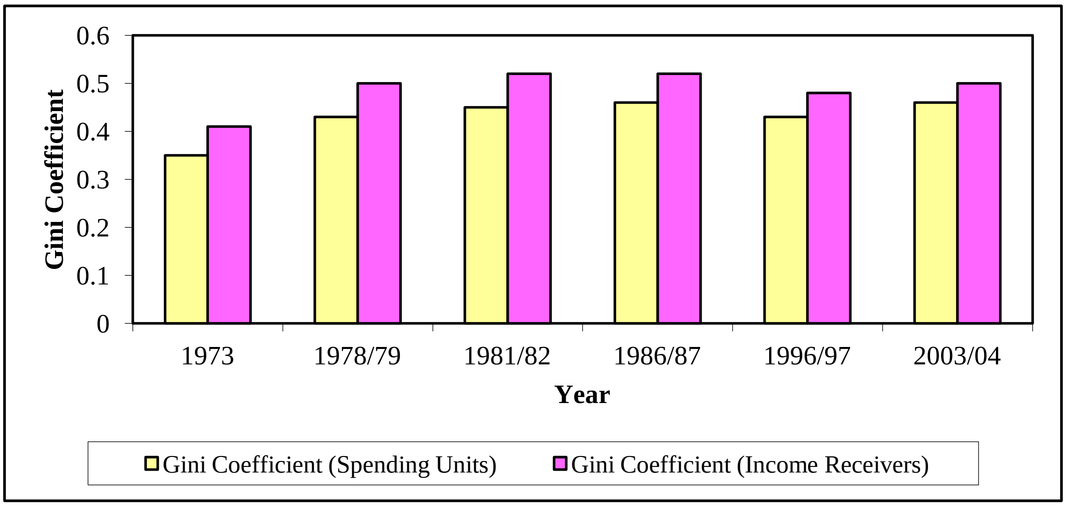
---

[3] An individual who received a minimum one month income of Rs. 250 (US$ 2.55 at 2004 exchange rate) or a minimum six month income of Rs. 1500 (US$ 15.3 at 2004 exchange rate) preceding the date of field interview, was defined as an income receiver.

A spending unit consists of one or more persons who are members of the same household, but who take independent decisions individually or with their own dependents with respect to spending their income (Central Bank of Sri Lanka, CSF, 2003/2004).

Figure 1.3 illustrates that the Gini coefficient increased during the 1981-87 period, declined slightly towards 1996-97 and increased in 2003-04. This movement indicates that the gap between rich and poor in Sri Lanka has widened under the trade liberalisation regime, resulting in an increase in relative poverty. Weerakoon and Thennakoon (2006) also mentioned that in more recent years, there are evidences to suggest that income inequality in Sri Lanka has been on the increase. Hence, improved trade performance and GDP growth in the country after trade liberalisation in 1977 has by no means been a sufficient condition for reduction in income inequality and poverty. The question of interest is therefore, whether trade liberalisation increases the welfare of Sri Lanka's citizens as a whole.

Figure 1.3 Trends in Income Distribution in Sri Lanka: 1973-2003/04



Source: Central Bank of Sri Lanka: Consumer Finance and Socio-Economic Survey Series

1.2 Motivation and Scientific Contribution of the Research

The debate about the impact of globalisation and regionalism has become one of the main policy concerns among trade economists. As noted by the Human Development Report (2006), countries across South Asia have witnessed remarkable growth rates in recent decades due to the liberalisation of their economies (United Nations Development Programme, 2006, Khadija, 2007). The GDP growth rates in India, Pakistan and Bangladesh have been well above six per cent over the period of 2005-2010. However, whether this growth has had a significant impact on poverty reduction is questionable. Therefore, it is vital to understand the effects of trade liberalisation in South Asia on its member economies, as it can have wider impacts on income distribution and the overall standard of living of the people. The literature on trade liberalisation emphasises the elimination of distortions, leading to both gains from trade and an increase in domestic activities that contribute to sustained growth. In that sense, lower income groups should also benefit from these outcomes, thereby reducing poverty levels in the process. In this context it is worthwhile undertaking a detailed study to analyse how the SAFTA and other trade liberalisation scenarios may affect broader socioeconomic variables in the region, and in particular income distribution and poverty, considering South Asia is one of the poorest regions in the world.

A large body of theoretical and empirical literature has demonstrated how trade liberalisation helps to promote growth and reduce poverty (Bourguignon and Morisson 1990, Barro, 2000 and Dollar and Kraay, 2004). However, critics of globalisation argue that, in developing countries, integration into the world economy increases the gap between the rich and poor (Annabi et al., 2005, Khondker and Raihan, 2004).

Much of the research related to the link between openness, growth and poverty has been based on cross-country regressions (Naranpanawa, 2005). In 2001, Dollar and Kraay, using regression analysis, argued that growth is pro-poor. Moreover, their study suggests that growth does not affect distribution and the poor, as well as the rich, could benefit from it. In subsequent work in 2002 they demonstrated that openness to international trade stimulates rapid growth, thus linking trade liberalisation with improvements in the wellbeing of the poor. Several other cross-country studies have demonstrated a positive relationship between trade openness and economic growth (Dollar, 1992; Edward, 1998; Sach and Warner, 1995). Others (Winters 2003, 2004; Rodrik and Rodriguez, 2001; Pritchett, 1996; Edwards, 1993, 1998; Greenaway et al., 1998; Milner and Morrissey, 1999; Rodrik, 1992, 1998, 1999) have questioned the reliability of measurement. To what extent trade openness contributes to economic growth is a major challenge for any study involving the analysis of trade policy? Hence, researchers must confront the fact that there are difficulties in obtaining reliable direct measures of trade policy openness across countries over time. Several approaches have been employed to circumvent the problem and therefore, ultimately, openness and growth have become an empirical matter and so has the relationship between trade and poverty (Ackah et al., 2008).

The weaknesses of the cross-country studies have led to a need to provide further evidence from case studies. Various researchers have adopted different empirical approaches to identify the complex link between globalisation and poverty. Several other studies have found pro-poor effects on trade reforms using partial equilibrium analysis (Dercon, 2001; Minot and Goletti, 2000a) and general equilibrium analysis (Bautista and Thomas, 1997; Ianchovichina et al., 2002), while others have found contrasting evidences (Ravallion and Walle, 1991, Lofgren, 1999 and Harrison et al., 2000). This implies that the results may vary depending on the different methodologies.

Computable General Equilibrium (CGE) models have been used to analyse a wide variety of policy issues relating to trade liberalisation both in developed and developing countries over the last three decades or so. There are both econometric studies at the aggregate level and some economy-wide Social Accounting Matrix (SAM) based CGE models that have attempted to depict the impact of trade reforms on poverty. The use of these models has even become more popular among policy analysts in developing countries, particularly in countries where adjustment policies have been implemented in recent years.

Gilbert (2008) described a new CGE model of South Asia and its application to understand the socio-economic aspects of SAFTA and pointed out that the impact of SAFTA is likely to be positive, if not modest, for most member economies. Khan (2005) assessed the impact of trade liberalisation of South Asia on household income distribution by formulating a Generic Macroeconomic CGE model for South Asia. Further, in 2008 Khan presented a "generic", stylized CGE model for South Asia to analyse the poverty impact of trade liberalisation policies in South Asia.

However, in reviewing the literature it was found that only Gilbert (2008) constructed a regional CGE model for South Asia using the GAMS (General Algebraic Modelling System). Hence, it is important to make further contribution to this field by formulating a multi-country CGE model for South Asia by incorporating broad socio economic aspects to analyse the impact of trade liberalisation on the economies in the region. Unlike the Gilbert's model, the present study disaggregates the household sector of four South Asian countries (India, Sri Lanka, Pakistan and Bangladesh) according to their income and also endogenises poverty lines based on the basic commodities of respective sectors. Hence, the impacts of trade liberalisation on household income distribution and poverty are captured in the model developed in the study. On the otherhand, previous CGE models have been developed for countries in the region, such as India, Pakistan, Bangladesh and Nepal but with little focus on Sri Lanka.

The first task of the research is to formulate a multi country CGE model for South Asia to assess the socio-economic impacts of South Asian trade liberalisation on the economies of the regional trading partners. Second, this study will compare the impact of different trade liberalisation scenarios on South Asian economies in order to recommend the optimum trade liberalisation strategy for South Asia so as to ensure the highest welfare levels of citizens in all economies in the region.

Finally, the research focuses on the Sri Lankan economy because Sri Lanka was the first country in South Asia to introduce free market policies and thus an smooth integration into the global economy.[4] The results of the multi-country CGE model will be used to analyse the micro impacts of macroeconomic policies and the impact of the different trade liberalisation scenarios on trade and income distribution

---

[4] The introduction of economic reforms in 1977 provided the momentum for Sri Lanka's progression towards a free market economy.

of the Sri Lankan economy. The findings of this analysis will be useful for Sri Lankan policy makers in formulating policies to minimise the income distribution gaps in the country.

1.3 Research Questions and Objectives

In this research the implications of different trade liberalisation options on the member countries are analysed. For instance, whether forming the South Asian Customs Union against the rest of the world or unilateral liberalisation of South Asia's trade will bring wider impacts on welfare and income distribution, particularly in the Sri Lankan economy. Hence, the primary objective of this research is to formulate a multi-country Computable General Equilibrium (CGE) model for South Asia, and its application for understanding the socio-economic aspects of the South Asian members: India, Sri Lanka, Bangladesh, Pakistan, and the Rest of South Asia. The model incorporates modifications to the household sector to capture the inter-household income changes under different trade liberalisation scenarios. Further, the pattern of household income distribution, income inequalities and poverty in the Sri Lankan economy is analysed.

The key questions that the research seeks to answer are:

1. What are the effects of trade liberalisation in South Asia on important macroeconomic variables in the South Asian countries?

2. Is there a relationship between trade liberalisation and income distribution of households in the South Asian economies?

3. Does trade liberalisation reduce or increase income inequality and poverty in Sri Lanka?

4. How can South Asian countries strengthen their trade relationships with their regional trading partners and the rest of the world?

In order to address the above questions, the thesis has the following objectives:

1. To formulate a multi-country CGE Model for South Asia and analyse the impacts of different trade liberalisation scenarios on macroeconomic variables, trade and welfare of the South Asian economies.

2. To analyse the impact of trade liberalisation scenarios on income distribution of different household groups of South Asia, namely India, Pakistan, Sri Lanka and Bangladesh.

3. To investigate, in detail, the pattern of income distribution and poverty of households in Sri Lanka.

4. To formulate policy recommendations for South Asian economies to strengthen their trade relationships between SAARC countries and the rest of the world, and to propose strategies to minimise the income distribution gaps, particularly in Sri Lanka.

1.4 The Methodology of the Research

The study uses both qualitative and quantitative methodological approaches in analysing the impact of trade liberalisation in South Asia on member countries focusing on the Sri Lankan economy. The descriptive analysis investigates characteristics of South Asian countries and identifies trends in trade and investment policies in South Asia. The salient features of PTAs in South Asia are illustrated. A detailed descriptive analysis is undertaken to identify the trends in income distribution of different income groups of households in the selected South Asian countries. This is important to determine whether open economic policies would increase or reduce the poverty level of the less favoured households, particularly in Sri Lanka.

The research uses the data and the modelling framework of the Global Trade Analysis Project (GTAP). In addition it incorporates household survey data of India, Pakistan, Sri Lanka and Bangladesh, and extends the GTAP model accordingly in the framework to combine household survey data and macro industries. GTAP is a multi-country Applied General Equilibrium model, which captures various aspects of world economic activity (Hertel, 1997). It is a comparative-static, model of the Johansen type comprising a system of equations in percentage change of variables. At present, multi-country CGE models provide the most appropriate tool for examining the impact of trade liberalisation on world prices, trade and static welfare impacts as analysed in traditional international trade theory. These empirical models have become a work-horse of policy analyses because of their capacity to capture bilateral trade flows, input-output relationships, factor market effects, price and quantity changes and welfare impacts all within a framework that has a consistent foundation in microeconomic and trade theory. This research uses the GTAP version 7 (Database 2004) which covers all bilateral trade, transport and protection data that link country/regional databases and is representative of the world economy in 2004. This version consists of 113 regions, 57 industries, and 5 factors of production. The multi-country CGE model in this study is solved using GEMPACK (General Equilibrium

Modelling Package) software which comes with a number of helpful programmes for simulation analysis of policy issues.

Trade liberalisation can result in a satisfactory GDP growth rate but can also see the most underprivileged social categories becoming increasingly poor. Hence, an analysis of income distribution of households is important. The CGE models are generally recognised as the best tools to analyse the micro-economic impacts of macro-economic policies and more particularly the trade policy impacts on the poverty. DAD (Distributive Analysis/Analyse Distributive) is a software package developed by Duclos, Araar, and Fortin, which is currently used as appropriate software for income distribution and poverty analysis (Duclos, Araar and Fortin, 2002). DAD covers most regular computation and graphing of inequality, poverty and social welfare and is widely used with CGE analysis (Zhang, 2003). Household consumption is often preferred to household income for distribution analysis and DAD software requires that these data be organised in a work file. The DAD software is used in conjunction with Excel to analyse the income distribution of households.

For reliable results, these models must be based on a robust and coherent data base. Hence, the regional data bases are derived from the individual country Input Output tables in the GTAP model. The model in this study is a multi-country CGE model, covering India, Bangladesh, Sri Lanka, Pakistan and an aggregate region representing the remaining countries in South Asia, as well as an incompletely modelled rest of the world (ROW) region. Overall, the structure of the model that is built for this research is similar in many respects to standard GTAP model with modifications to household sector.

1.5 Chapter Organisation

Chapter 2 provides an overview of the South Asian economies, investigates trends in household income distribution, trends in trade and investments, and trade and investment policies in the South Asian countries. Further, some salient features of PTAs in South Asia are also presented to gain an insight into the experimental design.

Chapter 3 is devoted to reviewing the literature in order to shed light on the analysis. The literature review is useful to assist in the design of the conceptual framework of the research. Moreover, a review of the findings of previous research highlights the contribution of this research to the existing literature.

The methodology of the research is presented in Chapter 4. This chapter outlines the theoretical framework of the multi-sector, multi-region/country CGE model for South Asia, which is used in assessing the outcomes of the trade liberalisation scenarios. The model descriptions place particular emphasis on the theoretical foundation and equation linkages used in CGE framework. The multi-country model for South Asia follows the standard neo-classical framework with the assumptions of full employment and factor mobility. The derivation of the equations of the multi-country model for South Asia is based on standard GTAP framework.

Chapter 5 presents the construction of the database and the calibration of the multi-country CGE model for South Asia. In order to incorporate a multi-household dimension to the model, the household sectors of the South Asian countries are disaggregated into different groups based on the level of income and geographical area. Household income and expenditure survey data of the respective South Asian countries are used in constructing the household matrix. The procedure for mapping the household survey data according to GTAP sector classifications is explained in detail in this chapter. The parameter values are extracted from the GTAP database. The benchmark equilibrium is taken from version 7 of the GTAP database, which reflects the global economy in 2004.

The simulation results of the impact of the different trade liberalisation scenarios on trade and household income distribution of the South Asian economies are provided in Chapter 6. The macro effects are measured in terms of trade creation, trade diversion and terms of trade effects. In addition, simulation results on the change in real GDP, regional welfare and welfare decomposition, factor income, unemployment, government transfers and international trade are also discussed. The impacts of trade liberalisation on the consumption of different household groups in South Asian countries are also analysed in this chapter. These results are then used to identify the preferred strategy for the South Asian region. Finally, the chapter reports on the sensitivity analysis conducted as a test of the model's robustness.

The analysis in Chapter 7 focuses mainly on the poverty and income distribution effects in Sri Lanka under alternative trade liberalisation scenarios. In conducting this detailed analysis, DAD is used to compute and graph inequality and poverty.

Finally, the conclusions and policy recommendations that would assist policy makers in South Asia, particularly in Sri Lanka, to strengthen their trade relationships among trade partners and to achieve the benefits of economic integration are presented in Chapter 8.

CHAPTER 2 ECONOMIC INTEGRATION IN SOUTH ASIA – AN OVERVIEW

2.1 Introduction

During the last couple of decades, trade policy reforms have been initiated in almost all South Asian countries with a view to integrating with the world economy and improving their growth prospects. This research examines the impact of trade liberalisation in South Asian countries on the economies of South Asia, with particular emphasis on the relationship between trade policy reforms and income distribution. This chapter presents an overview of the general economic backgrounds of the South Asian economies, patterns of external trade and investments, trade and investment policies, trends in income distribution of the household sectors, particularly in Sri Lanka, and the salient features of the bilateral and regional trading agreements among the South Asian trading partners. Understanding the characteristics of the South Asian countries is important in formulating the multi-country CGE model for South Asia.

2.2 Key Characteristics of the South Asian Economies

The South Asian region includes Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka. The World Development Report in 2010 indicated that the region has about 23 per cent of the world's population and 15 per cent of the world's arable land, but only about 2.7 per cent of GDP, 1.8 per cent of world trade, and less than 4 per cent of world foreign investment flows. The South

Asian region is tremendously diverse in terms of country size, economic and social development, geography, political systems, languages, and cultures. This diversity in culture, language and political practices also makes individual countries unique in the region. Table 2.1 shows the key economic indicators for the South Asian economies.

The South Asian region consists of a single large country, India, surrounded by a number of medium and small nations including Pakistan, Afghanistan, Bangladesh, Nepal, Bhutan, Sri Lanka and Maldives. According to the statistics listed in Table 2.1, India's population in 2010 was 1.21 billion and GDP was about US$ 1159 billion, approximately 3 and 4 times, respectively, of the combined population and GDP of the other seven South Asian countries. Per capita GDP ranged from a low of US$ 370 in Afghanistan to a high of US$ 3640 in the Maldives. The World Bank classifies India, Sri Lanka, Maldives and Bhutan as lower middle-income countries (LMC) and the other four South Asian countries as low-income countries (LIC). Among the three larger countries, Bangladesh, India, and Pakistan, which account for 95% of the region's population, the range of per capita income was narrower: US$ 520 in Bangladesh, US$ 950 in Pakistan and US$ 1040 in India. Three of the eight countries, Afghanistan, Nepal, and Bhutan, are landlocked and mountainous, Sri Lanka is an island and the Maldives is an archipelago of low-lying coral islands in the central Indian Ocean.

Table 2.1 Economic Indicators of South Asian Countries: 2010

	Afghanistan	Bangladesh	Bhutan	India	Maldives	Nepal	Pakistan	Sri Lanka
Land Area ('000 sq km)	652.09	144.00	47.00	3287.26	0.30	147.18	796.10	65.61
Population (million)	29.11	164.42	0.708	1214.46	0.314	29.85	184.75	20.41
Rural Population (% of total population)	74.12	72.34	87.64	60.74	67.07	81.75	65.29	85.49
*% of the population below poverty line	53.0	45.0	31.7	25.0	21.0	31.0	24.0	15.2
GDP (US$ billion)	10.6	79.5	1.10	1159	1.05	12.6	164	40.5
GDP per capita (US$)	370	520	1900	1040	3640	400	950	1780
Real GDP growth (%)	2.3	6.2	6.3	6.1	-3.1	5.3	2.0	6.0
Distribution of GDP (%) - Agriculture	32	19	21	17	6	34	20	13
- Industry	26	29	35	29	10	17	27	29
- Manufacturing	16	18	7	16	7	7	20	18
- Services	42	52	37	52	77	50	53	57
Total Exports (US$ million)	560	15,084	496	162,613	169	812	17,680	7,345
Total Imports (US$ million)	3,970	21,833	529	249,590	967	4392	31,310	10,206
Current Account Balance (US$ million)	-2.45	3345	-78.87	-26,625	-402	-10	-3583	-214
Current Account Balance (% GDP)	-0.02	4.21	-7.17	-2.3	-38.29	-0.08	-2.18	-0.53
Merchandise Trade (% of GDP)	42.7	46.44	93.18	35.57	108.19	41.3	29.87	43.34
Foreign Direct Investment (% of GDP)	3.0	1.0	3.0	3.0	8.0	0.30	1.47	0.96
Inflation, GDP Deflator (%)	21	7.0	6.0	8.0	20.0	12.0	20.0	5.65
Unemployment Rate (%)	8.5	4.3	2.4	7.8	14.4	42	4.98	7.57
Gross Savings (% of GDP)	2.5	17.2	52.1	32.04	17.5	7.9	11.4	18.02

Source: World Bank, World Development Report: 2010 Unemployment rate: Maldives, ,India (2006) Afghanistan(2005), Bhutan, Nepal (2004)
*Survey Years: Afghanistan, Bhutan (2003) ,Maldives, Bangladesh(2004),Sri Lanka(2006/07), India (2002),Nepal(2003/04), Pakistan(2005/06)

Many of the countries share a common past and political history. For instance, India, Pakistan, Bangladesh and Sri Lanka were all a part of the British Empire. India attained independence in 1947 and Sri Lanka in 1948. India and Pakistan have fought three wars. The break up of East and West Pakistan in 1971 was followed by tension between India, Pakistan, and Bangladesh. Sri Lanka and Nepal have faced civil conflicts, which at times has also affected relations with other countries in the region. Such tensions between the countries as well as civil conflict within a particular country have vitiated the atmosphere of cooperation in South Asia.

Indeed strong cultural and trade ties already existed among the countries of the region in the past. Today, South Asia, as a region, is generally characterised by backwardness and low per capita incomes, a high incidence of poverty and poor infrastructure. South Asia is one of the poorest regions in the world and, after Sub-Saharan Africa, is home to the largest concentration of the world population living in poverty. Table 2.2 provides a comparison of the South Asian region with other regions in the world.

.

Table 2.2 South Asia in the World – A Comparison of Population, Land Area and GNP: 2009

Region	Population Total (millions)	%	Number of Poor * Total (millions)	%	Surface Area (Sq Km thousands)	%	People Per Sq. km	GNP Billion US$	%	GNP (PPP) Billion US$	%	GNP Per Capita (US$)	GNP(PPP) Per Capita (US$)
Low & Middle Income	**5,628**	**84.16**	**1374**	**25.0**	**101,485**	**76.0**	**59**	**15,648.9**	**26.9**	**29,847.2**	**42.5**	**2,780**	**5,303**
East Asia & Pacific	1,930	28.86	316	16.8	16,384	12.3	122	5102.0	8.7	10,461.1	14.9	2,644	5,421
Europe & Central Asia	443	6.62	17	3.7	24,208	18.1	19	3258.0	5.6	5298.2	7.6	7,380	11,593
Latin America & Caribbean	566	8.46	45	8.2	20,462	15.3	28	3831.0	6.6	5,837.8	8.3	6,768	10,312
Mid East & North Africa	325	4.86	11	3.6	11,023	8.3	38	1052.6	1.8	2,345.5	3.3	3,237	7,343
South Asia	1,545	23.10	596	40.3	5,140	3.8	324	1487.5	2.5	4,163.4	5.9	963	2,695
Sub Saharan Africa	819	12.25	388	50.9	24,267	18.2	35	882.6	1.5	1,596.5	2.3	1,077	1,949
High Income	**1,069**	**15.84**	**0.0**	**0.0**	**32,082**	**24.0**	**32**	**42,415.0**	**73.1**	**40,253.8**	**57.5**	**39,687**	**37,665**
World	**6,687**	**100**	**1374**	**25.2**	**133,567**	**100**	**52**	**58,063.9**	**100**	**70,101.0**	**100**	**8,654**	**10,415**

Note : Poor is measured as the person who lives with under US$1.25 per day in 2005
Source: World Bank, World Development Report, 2010

2.2.1 Development Trends in South Asia

a) Trends in Sectoral Composition of GDP

Table 2.3 illustrates the trends in sectoral composition of nominal GDP in South Asia from 1980-2009. According to the figures, it is apparent that the share of the manufacturing sector in output did not rise in tandem with the fall in the share of the agricultural sector over the same period. Conversely, it is noticeable there is a remarkable increase in the service sector in all South Asian economies over the period concerned.

Table 2.3 Trends in Sectoral Composition of GDP: 1980-2009

Country	**Agriculture as % of GDP**			**Manufacturing as % of GDP**			**Services as % of GDP**		
	1980	**1990**	**2009**	**1980**	**1990**	**2009**	**1980**	**1990**	**2009**
Bangladesh	32	30	18	14	13	19	48	48	53
India	36	31	18	17	17	15	40	41	55
Nepal	62	51	34	4	6	7	26	34	50
Pakistan	30	26	22	16	17	17	46	49	54
Sri Lanka	28	26	13	18	15	18	43	48	58
South Asia	**35**	**31**	**18**	**16**	**16**	**15**	**41**	**43**	**55**

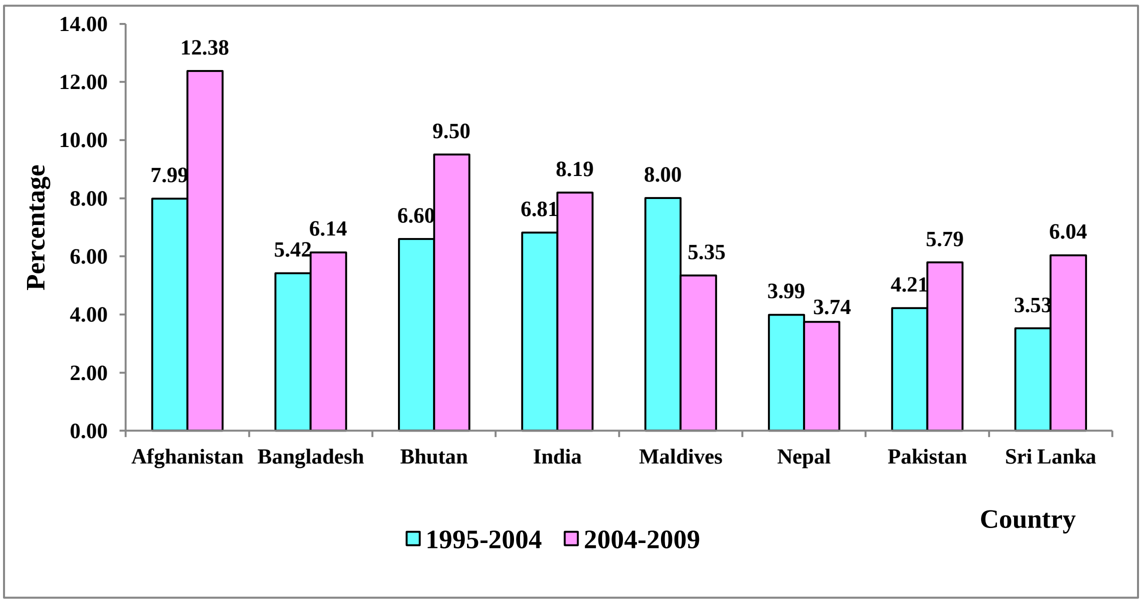
Source: World Bank, World Development Indicators Database, 2010

The agricultural sector continues to play a very important role in South Asia, particularly in the employment of a vast majority of labour force. Though the share of agriculture in nominal GDP declined from 35 per cent in 1980 to 18 per cent in 2009, nearly 55 per cent of the labour force is engaged in this sector (World Bank, 2010). Agricultural trade is characterised by similar types of export and import products, and a high concentration on few products. For instance, the top five exports account for more than 60 per cent of total agricultural sector exports in South Asia (World Bank, 2008). Trade liberalisation reforms contributed to a significant extent in enabling South Asian countries to develop their manufacturing sectors by exposing them to larger markets, for instance for readymade garments exported to the USA and EU. Accordingly, about 85 per cent of South Asian manufactured exports consist of resource-based or labour-intensive items dominated by food products and textiles. A lack of a literate and technically skilled and trained labour force, inadequate transportation and communication infrastructure, energy shortages and lack of a favourable business environment may restrict the expansion of the manufacturing sector in such economies. The services sector is the most dynamic component of the South Asian economies at present and a major driver of the regional economic growth. In 2009, services industries contributed 55 per cent of the GDP and the share of employment also increased from 28.8 per cent in 2000 to 35.3 per cent in 2009 (World Bank, 2010).

b) Accelerated Economic Growth and Stability

Over the last few years, South Asia has been one of the fastest growing regions in the world. Between 2000 and 2004, the region registered an annual real GDP growth rate of 5.6 per cent, which was higher than the average annual growth rate of Southeast Asia of 4.9 per cent but slightly below East Asia’s (the fastest growing region) 6.8 per cent (World Bank Database, 2008). In 2007, real GDP growth in South Asia accelerated to 8.6 per cent per annum, higher than Southeast Asia’s 5.6 per cent and slightly below East Asia’s 10.4 per cent. (World Bank Database, 2008). Although India’s growth was a dominant factor in the high average real GDP growth rate of South Asia, other South Asian countries, with the exception of Nepal, also experienced relatively higher real GDP growth during 2005-2009. However, in 2009 the growth rates have declined in most South Asian countries, mainly due to the global finacial crisis. Figure 2.1 illustrates the average economic growth rates of the South Asian countries from 1995–2004 and 2005–2009.

Figure 2.1 Average Real GDP Growth Rate in South Asia: 1995-2004 and 2005–2009



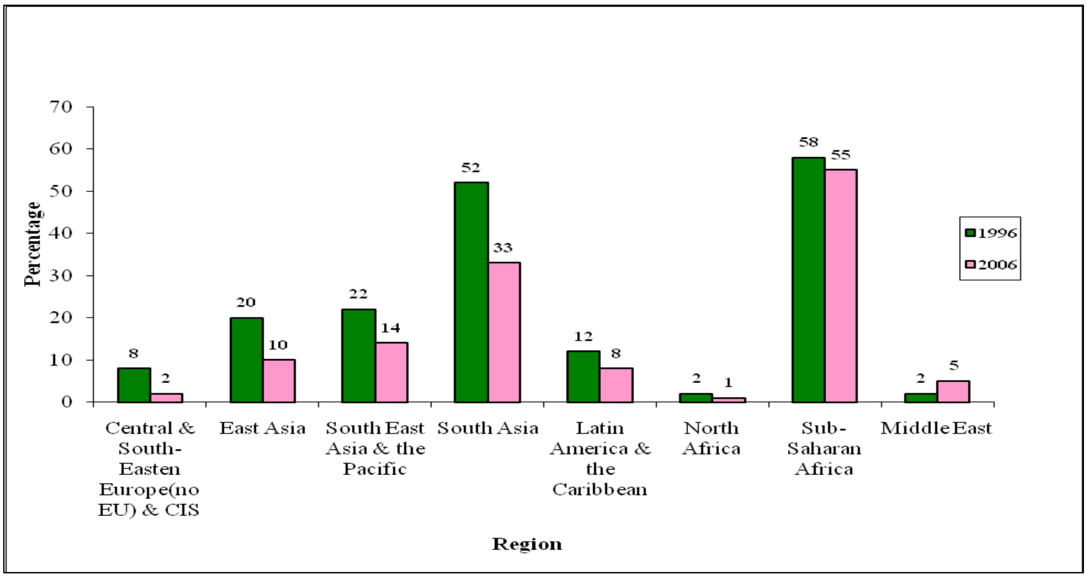
Source: World Bank, World Development Indicators Database, 2010

The improved overall economic performance of the region is a reflection of structural reform and the adoption of liberalisation policies by most South Asian countries from the mid 1980s onwards. Such reforms encouraged market forces and the private sector to play a more prominent role in driving the economies, compared with the state-led development models of the 1960s and 1970s. The region's economy also moved away from a high degree of dependence on primary products to a more diversified economic mix with an increased share of industry and services (see Table 2.3). Increased globalisation and the opening up of South Asian markets to the rest of the world were also important features, particularly since 1990, and contributed to higher growth rates in the region.

c) Poverty and Income Distribution

Despite more rapid economic growth in South Asia in recent years, the region is still home to about 410 million of the 720 million poor living in the Asia and Pacific region (ADB Statistical Database, 2007). Figure 2.2 illustrates that South Asia has experienced a substantial reduction in both the incidence of poverty and the absolute number of poor.

Figure 2.2 Working Poor Living on Less than US$1 per Day by Region: 1997–2006



Source: World Bank, World Development Indicators Database, 2009

Poverty in the South Asian region has fallen from 52 per cent in 1996 to about 33 per cent in 2006. As Bandara (2009) pointed out, although poverty as a proportion to the population has fallen in the region during the past two decades, still there are a significant number of people living below poverty line. Even at present, South Asia has been the second fastest growing region in the world, it faces major challenges in its efforts to reduce poverty. Therefore, definitive empirical answers to the question of whether trade liberalisation reduces poverty in the South Asian region have proved elusive (Bandara, 2009).

- **Income Distribution Pattern**

Table 2.4 depicts the poverty/income inequality profiles of the member countries in South Asia.

Table 2.4 Poverty/Income Inequality Profiles in South Asia

	Year	Head Count	Poverty Gap	Squared Poverty Gap	Gini
	Percentage				
US$ 1.00/day					
Bangladesh	2005	35.3	7.9	2.4	33.2
India- Rural	2005	40.2	9.4	3.1	30.5
India-Urban	2005	19.6	4.2	1.3	37.6
Nepal	2004	24.7	5.6	1.7	47.3
Pakistan	2005	9.0	1.4	0.4	31.2
Sri Lanka	2002	5.8	0.7	0.1	40.2

Source: John Gilbert, 2008

According to the figures in Table 2.4, poverty head count[5] as a percentage of total population in Sri Lanka is substantially lower than in the other South Asian

[5] The poverty gap provides information regarding how far off households are from the poverty line.

The squared poverty gap often described as a measure of the severity of poverty. This takes into account not only the distance separating the poor from the poverty line (the poverty gap), but also the inequality among the poor.

Gini coefficient is the most commonly used measure of inequality. The coefficient varies between 0, which reflects complete equality, and 1, which indicates complete inequality (one person has all the income or consumption; all others have none) (Coudouel, A., J. et al., 2002, pp.35-48).

countries. This may be due to Sri Lanka having a relatively low population in comparison with other member countries presented in the table. It also appears that poverty in rural areas is significantly higher than that of urban cities in India. Poverty in Bangladesh is approximately the same as rural poverty in India.

Figure 2.3 Income Share Held by the Poorest and Richest 20 per cent of the Population

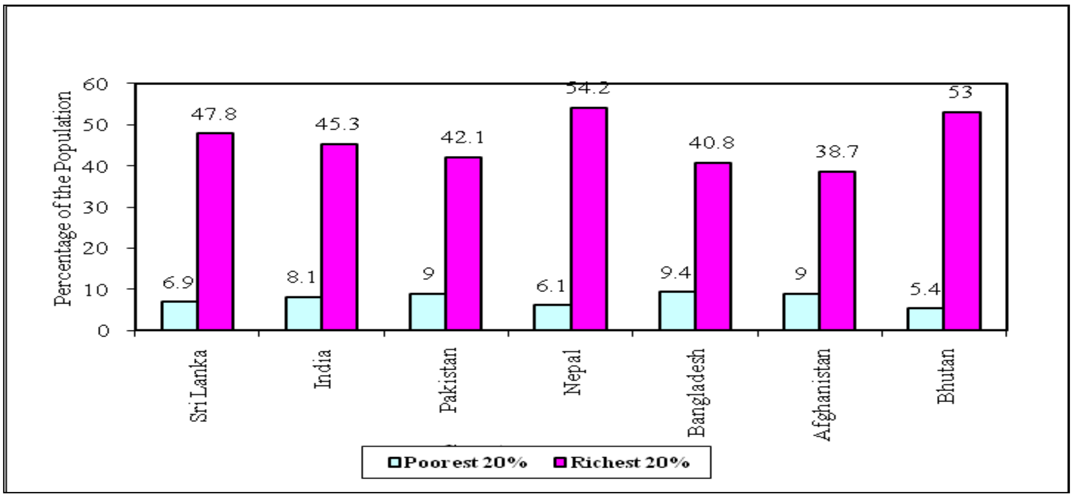
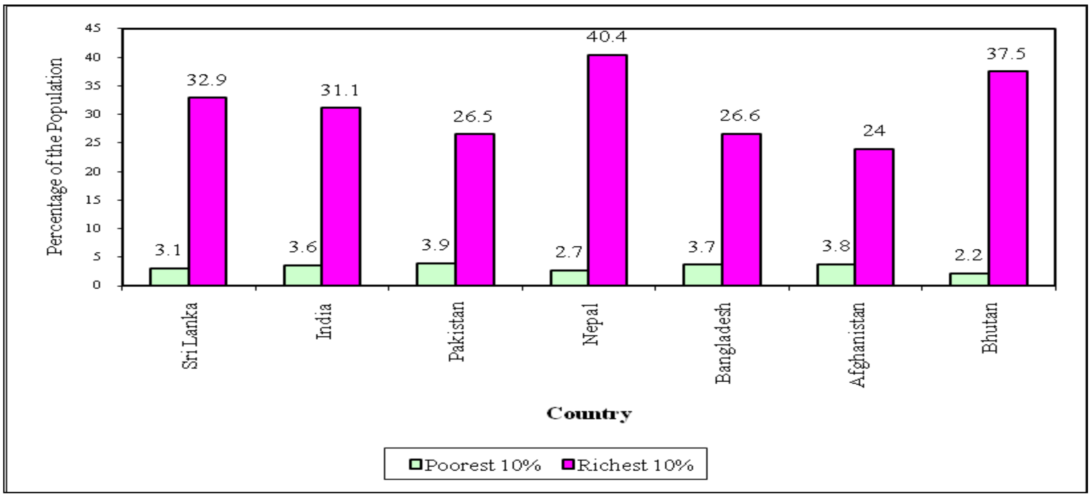


Figure 2.4 Income Share Held by the Poorest and Richest 10 per cent of the Population



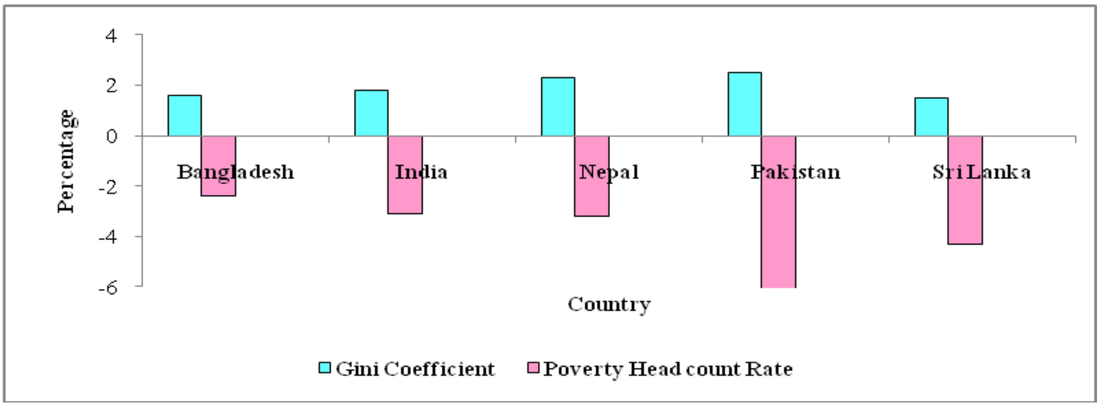
Source: World Bank, World Development Indicators Data Base, 2010
Survey Years: Sri Lanka 2007, Pakistan 2006, India 2005, Nepal 2004 and Bangladesh 2005, Bhutan 2003 and Afghanistan 2008.

Figures 2.3 and 2.4 above depict the pattern of income distribution in South Asia. Figure 2.3 demonstrates the income share held by the richest 20 per cent and the poorest 20 per cent of the total working population, while Figure 2.4 illustrates the income share held by the richest 10 per cent and the poorest 10 per cent of the total working population in the South Asian countries.

Figures 2.3 and 2.4 highlight the considerable differences in income distribution among the South Asian countries. Under both the circumstances, the gap is the largest in Nepal followed by Bhutan, Sri Lanka and India. In examining Figures 2.3 and 2.4, it is evident that even though there has been a decline in overall poverty in the South Asian region, income inequality between the rich and poor has widened in the countries in the region.

Figure 2.5 illustrates the annual growth rate of the Gini coefficient and the poverty headcount rate at the national level in South Asian economies.

Figure 2.5 Annual Growth Rate of the Gini Coefficient and Poverty Head Count Ratio



Source: Estimated from the World Bank database, 2010. Survey Years: Bangladesh (1992-2005); India (1994-2005), Nepal (1996-2004); Pakistan (2002-2006); Sri Lanka (1996-2007)

Compared to other South Asian countries, the average annual rate of poverty reduction and poverty head count ratio in Pakistan was the highest in the region over the period 2002-2006 (6.5 per cent). Inequality (as measured by the Gini coefficients) increased at annual rate of 1.5 per cent in Sri Lanka during the period 1996-2007. This is partly explained by the rate of increase in inequality (as measured by the Gini of per capita consumption) in Sri Lanka being among the highest in the region (0.40 in 2002, p.30), exceeded only by Nepal (0.47 in 2004, p.30). The rise in income inequality in Sri Lanka during the period 1996-2007 was mainly due to a two-decade-long civil war in the country, inadequate infrastructure, particularly in the rural areas, political instability, a stagnant agricultural sector and labour market rigidities (Gunatilleke et al., 2009).

d) Social Development

The Social Development indicators depicted in Table 2.5 suggest that social development remains relatively low in all the South Asian countries in comparison with Sri Lanka. Since, the South Asian region is home to one-fifth of the world's population, it needs international attention and support to address the challenges and the extraordinary complexities in the region.

Progress has been made in limiting population growth and raising literacy levels. The Human Development Index (HDI) is an important measure of social development in a country in comparion with the rest of the world. The HDI provides a composite measure of three dimensions of human development: living a long and healthy life (measured by life expectancy), education (measured by adult literacy and enrolment at primary, secondary and tertiary levels) and having a decent standard of living (measured by purchasing power parity (PPP) income).

Table 2.5 Social Development Indicators in South Asian Countries in 2008/2009

Item	Country						
	Bangla-desh	**Bhutan**	**India**	**Maldives**	**Nepal**	**Pakistan**	**Sri Lanka**
Total fertility rate (births per woman)	2.3	-	2.7	-	2.9	4.0	2.3
Maternal mortality rate (per 100,000 live births)	351.0	260.0	301.0	350.0	281.0	276.0	44.0
Infant mortality rate (per 1,000 live births)	43.0	54.0	52.0	13.0	41.0	72.0	13.0
Life expectancy at birth (years)	66	66	64	72	67	67	74
Female	67	68	65	73	67	67	78
Male	65	64	62	70	66	66	71
Adult literacy (% people 15 and above)	56.0	-	61.3	98.0	59.0	56.0	92.0
Female	77.0	-	46.4	97.2	26.4	28.5	89.6
Male	61.0	-	69.0	97.3	61.6	53.4	94.7
Primary school net enrolment rate (%)	85.0	83.0	91.0	96.0	-	66.0	99.0
Secondary school gross enrolment rate (%)a	42.0	62.0	60.0	70.0	43.0	33.0	-
Public education expenditure (% of GDP)[a]	2.4	-	3.2	-	3.8	2.9	-
Child malnutrition (% of below age 5)[a]	41.3	12.0	43.5	-	38.8	31.3	21.1

Source: World Bank (2010) World Development Indicators

The Human Development report (2008) classifies South Asian countries as middle human development countries. Since the mid 1990s the HDI scores for South Asian countries have progressively increased (Figures 2.6 and 2.7) with Sri Lanka and the Maldives among the leading South Asian countries in human development.

Figure 2.6 Human Development Index in South Asian Countries 1995–2010

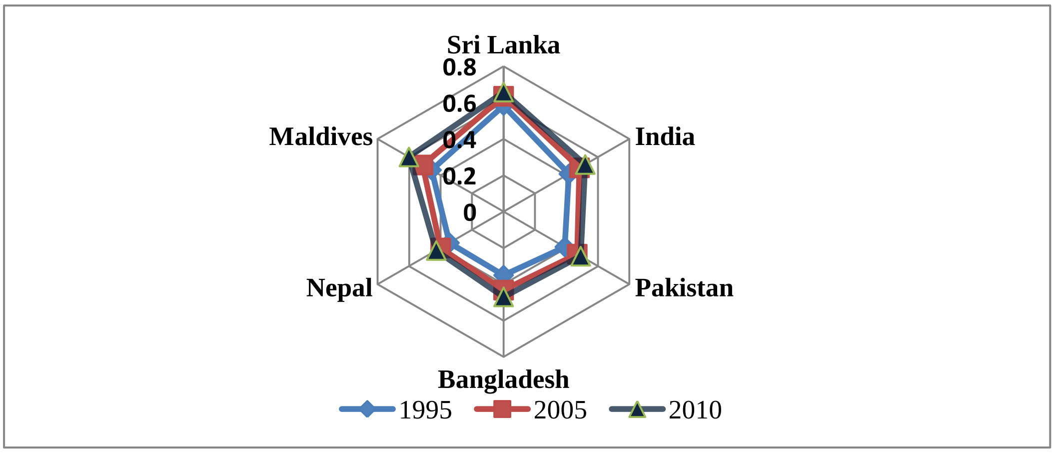
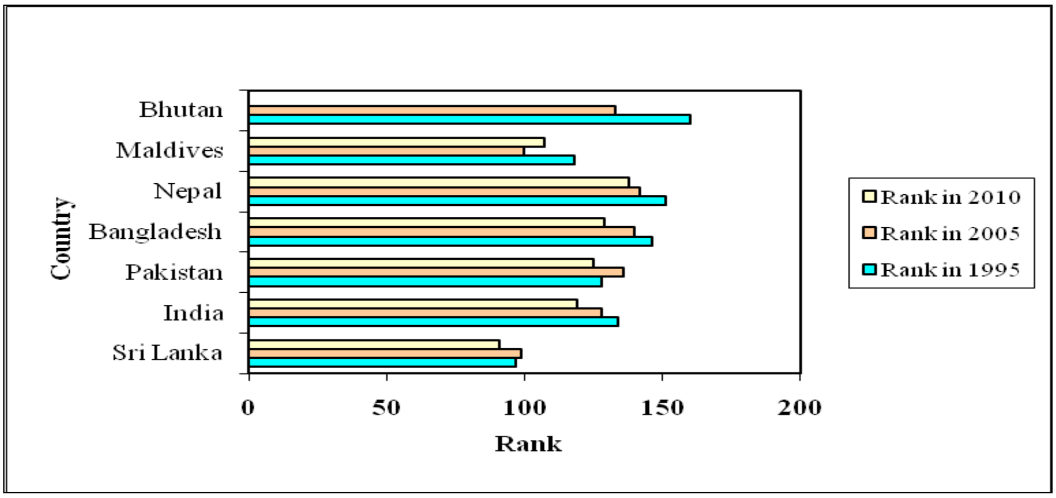


Figure 2.7 Rank in Human Development Index

Source: United Nations Development Programme (UNDP) Human Development Report, 2010 (United Nations Development Programme, 2008 and 2010)



In 2010, 41 of the 169 countries in the world were categorised as low Human Development if they had HDI scores ranging from 0.140 to 0.470. Of the low Human Development countries, 30 countries were in Africa. The countries classified as medium human development countries had HDI scores varying from 0.488 to 0.669. Twenty-four medium human development countries were located in the Asia Pacific region. China and India ranked 89th and 119th with HDI's of 0.663 and 0.519, respectively. The rankings of the South Asian countries and their respective HDI scores were Sri Lanka 91th (0.658), Maldives 107th (0.602), India 119th (0.519), Pakistan 125th (0.490), Nepal 138th (0.428) and Bangladesh 129th (0.469). Sri Lanka ranked the highest of the South Asian countries, which indicates comparatively high human development and quality of life.

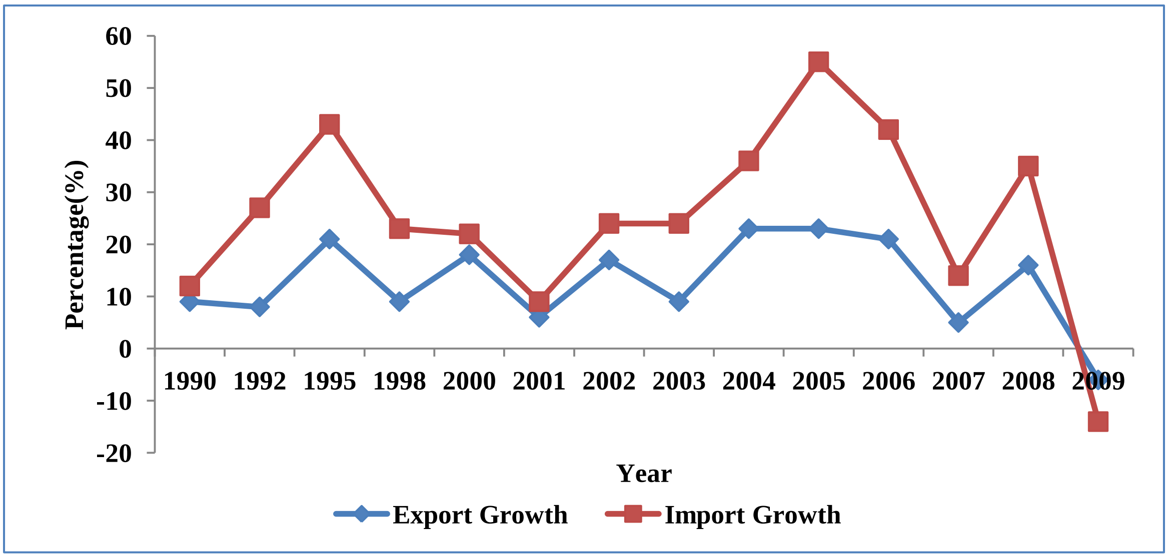
2.3 Trade and Investment Trends in South Asia

An important debate is under way among the countries of the world about the relative merits of pursuing regionalism through preferential trading arrangements versus more outward-oriented approaches to expanding trade and investment. This debate has significant implications for the dimensions of economic welfare and poverty alleviation in developing countries. Therefore, it is important to examine the trends in trade and investment in the South Asian economies.

2.3.1 Trends and Patterns in External Trade

South Asia has moved away from import substitution to more liberal trade and export promotion policies. Consequently its international trade has grown very rapidly. The progress of the trade reforms has meant that South Asian economies have integrated more with the global economy. Figure 2.8 illustrates the growth in exports and imports in South Asia over the period 1990-2009.

Figure 2.8 Exports and Imports Growth in South Asia: 1990-2009



Source: World Bank, Database (2010)

The collapse of the Soviet Union and the success of China under outward-oriented policies convinced policymakers in the South Asian region that rapid growth could not be achieved without wholesale opening of trade regimes. Unilateral trade liberalisation policies, which had begun to be introduced in the second half of the 1980s, were introduced on a more systematic basis in the 1990s. These changes contributed to a more rapid expansion of South Asia's trade with the outside world. Their largest trading partners, accounting for more than 50 per cent of their total trade, are the major industrial countries in the European Union, along with the United States and Japan. A substantial portion (40 per cent) of the region's trade is with countries in the Asia-Pacific region, including China, the Southeast Asian countries, Australia, New Zealand, and the high-income East Asian countries (Hong Kong, Japan, South Korea, Singapore, and Taiwan).

Figure 2.8 shows that growth rates in exports and imports increased significantly during the early 1990's. However, these double-digit growth rates in exports and imports declined drastically in the mid-to-late 1990s due to a change in South Asia's competitive position in the world market. Most South Asian countries produce and export labour-intensive products, and countries such as India, Pakistan, Bangladesh, Sri Lanka and Nepal compete with China in the production of labour-intensive manufactured goods. The services sector comprises more than one-quarter of South Asia's total exports. India's pioneering efforts in the provision of off-shore information and communication technology (ICT) and business process services expanded rapidly in the early 2000s with India becoming one of the key out sourcing markets in the world (Gupta, et al., 2010).

Furthermore, the recession in Organisation for Economic Cooperation and Development (OECD) countries will almost certainly lower the export prospects for all South Asian countries[6]. It is apparent that South Asian economies experienced negative growth in exports and imports in 2009 due to the world economic crisis. In addition, South Asia remains the most energy import-intensive developing region and has been hard hit by the escalation of world oil prices. This resulted in a rapid expansion of imports in the mid 2000s. It is evident that liberalising economic policies has meant that South Asia has become more integrated with the world economy and, therefore, their economies are now more influenced by global economic events.

[6] South Asia is a major exporter of textiles and garments that are vulnerable to the recession in the OECD economies

2.3.2 Intra-Regional Trade in South Asia

Despite efforts to strengthen regional economic cooperation through SAFTA, intra-regional trade was only 4.9 per cent of total trade in 2007, though there have been fluctuations around this level since SAPTA's formation in 1995. Table 2.6 depicts the intra-regional trade of the South Asian countries as a percentage of total trade.

Table 2.6 Intra-Regional and Total Trade of South Asian Countries, 1991-2007

Year	Value of Intra-Regional Trade (US$ millions)	Value of total trade with the world (US$ millions)	Share of intra-regional trade with total trade of South Asia (Per cent)
1991	2107.43	64200.05	3.28
1992	2731.73	72890.08	3.75
1993	2687.16	74048.78	3.63
1994	3160.34	82473.64	3.83
1995	4546.27	104650.37	4.34
1996	5237.61	111977.32	4.68
1997	5369.79	119764.89	4.48
1998	5726.78	119011.10	4.81
1999	5381.40	129465.34	4.16
2000	6008.67	142747.17	4.21
2001	6648.02	151793.55	4.38
2002	7719.43	157993.97	4.89
2003	10923.62	192854.11	5.66
2004	13386.91	245104.51	5.46
2005	17458.79	319130.20	5.47
2006	19961.28	411956.83	4.85
2007	30816.52	628908.69	4.90

Source: IMF Direction of Trade Statistics (DOTS), 2009. (The above data covers the eight South Asian countries of Afghanistan, Bangladesh, India, Maldives, Nepal, Pakistan and Sri Lanka and Bhutan. The data for Bhutan is taken from Royal Monetary Authority of Bhutan).

Based on the figures in Table 2.6, it is clear that intra-regional trade in South Asia has remained in the bandwidth of 3-5 per cent of its total external trade in the last 17 years. In 2007, the total value of merchandise trade reported by the South Asian countries was US$ 299 billion, of which only US$ 18.8 billion was destined for regional partners. Although in value terms intra-SAARC trade has increased substantially over the last 15 years from US$ 2.10 billion in 1991 to US$ 32.8 billion in 2007, it remains insignificant as a proportion of the region's total external trade.

Table 2.7 shows percentage shares of intra-regional exports and imports in total exports and imports of the South Asian countries. Intra-regional trade performance of individual countries indicates that both exports and imports grew significantly during the last decade. During the period 1990-2007, regional trade of most South Asian countries has made a four-fold increase. However, the pattern of the intra-regional exports and imports varies from country to country. For example, the share of intra-regional imports in the total imports of Bangladesh, Nepal and Sri Lanka stood at 16.09, 17.18 and 32.68 per cent respectively in 2007. Pakistan and India met only 5.11 and 0.80 per cent, respectively, of the import requirements from the region in the same period. These figures demonstrate that the share of intra-regional imports in Sri Lanka and Bangladesh increased rapidly over the period 1990-2007. The shares of India, Pakistan and Nepal show some fluctuations but also increased over the same period.

Table 2.7 Percentage Shares of Intra-Regional Exports and Imports in Total Exports and Imports in SAARC Countries: 1990–2007

Year	Country															
	Afghanistan		Bangladesh		Bhutan		India		Maldives		Nepal		Pakistan		Sri Lanka	
	X	M	X	M	X	M	X	M	X	M	X	M	X	M	X	M
1991	14.20	14.53	3.63	15.40	96.87	82.31	2.73	0.41	7.66	13.40	13.99	12.15	3.98	2.18	3.69	9.70
1992	7.90	1.81	4.72	15.16	96.84	84.47	3.48	0.48	6.09	19.64	19.23	14.06	3.36	1.86	3.05	15.48
1993	6.26	14.30	2.25	18.74	96.77	60.08	3.74	0.83	13.02	17.41	25.90	14.65	4.95	1.93	2.07	15.25
1994	1.70	10.74	2.37	21.10	99.38	70.29	3.91	0.46	4.90	16.78	29.65	15.63	2.96	2.23	2.50	14.55
1995	11.56	12.85	2.29	22.34	99.55	71.32	4.22	0.51	4.06	17.75	24.91	17.61	3.27	1.90	2.69	15.29
1996	13.06	10.23	2.69	36.76	97.91	72.22	5.06	0.58	8.30	9.80	22.62	13.19	3.16	2.11	2.66	14.34
1997	23.57	6.59	1.85	34.26	98.18	64.00	5.10	0.55	8.30	4.49	18.53	20.19	2.77	3.15	2.67	15.82
1998	24.03	9.70	2.27	24.49	98.77	69.38	4.72	0.58	25.37	27.27	16.09	21.27	2.62	2.63	2.59	13.39
1999	31.55	15.00	2.70	33.44	98.08	65.93	4.94	0.97	36.25	31.67	17.35	21.80	4.90	2.68	2.36	13.44
2000	46.59	24.84	1.92	25.00	98.65	74.61	4.08	0.87	2.17	14.01	19.57	20.99	3.57	2.37	3.09	13.60
2001	42.41	27.30	1.60	18.91	99.02	79.13	4.21	0.89	42.90	5.70	18.13	23.03	3.18	2.84	3.48	12.96
2002	54.12	34.81	1.61	22.65	99.39	77.73	5.38	1.07	47.78	39.62	22.20	23.70	2.87	3.20	3.34	15.09
2003	50.94	29.77	1.36	22.43	98.35	75.41	5.05	0.89	60.22	41.99	15.49	26.35	2.32	2.31	5.48	19.94
2004	30.56	36.71	1.75	25.81	99.28	88.43	6.20	0.85	53.98	57.64	13.92	24.26	2.86	2.64	6.82	22.90
2005	47.23	34.71	1.64	24.83	99.02	54.69	5.65	0.85	58.48	58.66	12.69	21.16	3.72	4.14	8.80	27.35
2006	42.84	44.34	2.20	24.94	92.89	75.11	5.24	0.92	67.36	59.72	17.38	17.36	4.56	4.44	10.24	31.03
2007	45.57	43.15	1.79	19.06	79.99	68.66	5.38	0.80	68.57	61.99	12.69	17.18	5.09	5.11	10.76	32.68

Source: Computed from the United Nations Trade and Development (UNCTAD) Database
Note: X–Exports M–Imports

In terms of intra-regional exports, Bangladesh's share has decreased from 3.63 per cent in 1991 to 1.79 in 2007. The shares of Maldives (68.57 per cent in 2007) and Sri Lanka (10.76 per cent in 2007) also increased significantly over the period. Although the shares in Pakistan and India are relatively small, they do show an increasing trend over the same period.

Sri Lanka's dependence on the South Asian region has been more on imports than exports. Sri Lanka's imports from the region are higher compared to other non-Least Developed Countries (LDCs) of the region. Sri Lanka's largest trading partner in the region is India, and other important partners include the Maldives, Pakistan, Bangladesh and Nepal. The figures in Table 2.7 indicate that the smaller countries in the region, like Nepal, Bhutan and Maldives, trade more with their regional trading partners. Afghanistan's trade with SAARC countries also shows an increasing trend and its shares of intra regional exports and imports were 45.57 and 43.15 per cent, respectively in 2007.

2.3.3 Investments in the South Asian Region

The impacts of Foreign Direct Investment (FDI) on economic growth have been debated quite extensively in the literature. The 'traditional' argument is that an inflow of FDI improves economic growth by increasing the capital stock, whereas recent literature points to the role of FDI as a channel of international technology transfer (Lensink and Morrissey, 2001). Further, it has been pointed out that when countries liberalise their economies, it could attract more FDI inflows, which would result in accelerating economic growth and poverty reduction in the economy (Alfaro, 2003).

Most South Asian countries undertook far-reaching economic reforms in the 1990s and have adopted industrial policies that encourage FDI inflows. Table 2.8 illustrates the FDI inflows to South Asian countries during the period 1980 to 2009.

Table 2.8 FDI Inflows to South Asian Countries: 1980-2009

Country	1980-4[1]	1985-9[1]	1990-6[1]	1997-9[1]	2000-4[1]	2005	2009
	Value, US$ million						
Bangladesh	5	0	51	487	414	692	716
Bhutan	0	0	1	0	2	9	36
India	67	195	964	2807	4956	6676	34613
Nepal	0	1	4	13	6	2	38
Pakistan	80	142	433	583	633	2201	2387
Sri Lanka	57	43	113	261	201	272	404
South Asia	211	386	1573	4164	6225	9866	38185

Source: Compiled from UNCTAD World Investment Database
Note 1: Annual Averages

The figures in Table 2.8 indicate that FDI inflows to India in 2009 were 515 times greater than in the early 1980's (a 51,562 per cent increase). Over the same period FDI inflows in Pakistan have increased by 2884 per cent, in Bangladesh by 14220 per cent and in Sri Lanka by 608 per cent. As mentioned previously, the civil war prevailed in Sri Lanka hindered capturing the full benefits of economic opening and therefore, FDI pariculary in long-term ventures was seriously hampered by the lingering fear of sporadic attacks by the rebels (Athukorala, 2012).

The FDI inflows as a percentage of global flows in different economies and regions during the period 1980 to 2009 are depicted in Table 2.9.

Table 2.9 FDI Inflows as a Percentage of Global Flow: 1980–2009

Region/Country	1980-4[1]	1985-9[1]	1990-6[1]	1997-9[1]	2000-4[1]	2005	2009
	Percentage						
Developed economies[2]	68.1	82.6	66.0	72.1	71.4	62.4	50.8
Developing economies[2]	31.9	17.4	32.9	26.5	26.3	33.2	42.9
Africa and the Middle East	2.6	2.2	1.9	1.4	1.9	3.1	5.3
Latin America & Caribbean	10.8	5.2	9.1	11.4	8.9	8.0	10.5
Transition economies[3]	0.0	0.0	1.1	1.4	2.4	4.4	6.3
Developing Asia	9.4	9.5	20.8	13.2	14.3	17.7	27.0
East Asia	3.7	5.5	12.4	8.9	10.6	12.3	13.9
China	1.1	2.0	9.2	5.7	6.1	7.7	8.5
Hong Kong	2.2	2.3	2.3	2.2	3.4	3.6	4.3
South-East Asia (ASEAN)[4]	5.5	3.8	7.7	3.7	2.9	4.3	3.3
South Asia	0.3	0.2	0.6	0.5	0.7	1.0	3.4

Source: Compiled from UNCTAD World Investment Database
Note 1: Annual averages
Note 2: Based on the United Nations standards classification
Note 3: Transition economies in Central and Eastern Europe
Note 4: Member countries of the Association of Southeast Asian Nations

Based on the figures in Table 2.9, the developed economies attracted 50.8 per cent and developing economies 42.9 per cent of global FDI inflows in 2009. The amount of FDI inflows attracted by the South Asia region relative to East Asia increased considerably over the period. During 1997–1999 period, it was US$ 4.16 billion, a mere 0.5 per cent of global flows and rose to 3.4 per cent in 2009, which is about 240 per cent increase. FDI flows to South Asia excluding India was just only 0.6 per cent of the global flows.

The 1990s saw a marked increase in FDI to India, a trend that represents a clear break from the preceding two decades. India’s share of FDI in total developing country inflows increased from 0.4 per cent in the 1980s to over 1.5 per cent in the first two years of the new millennium. Total annual FDI inflows to India during 2009 amounted to 2.8 per cent of the global flow. A notable aspect of FDI flows to India is that they have behaved quite independently of the global trends in FDI inflows to developing countries. This pattern clearly suggests that the domestic investment climate (demand-side factors in the investment market) has been the prime mover of investment flows to the country. FDI inflows to Bangladesh, Pakistan and Sri Lanka have registered notable increases over the past two decades, but they still only accounted for a tiny share of total flows to developing countries during the same period. Overall it appears that even though FDI inflows as a percentage of global flows to the South Asian region has been increasing, its share in global flows is still relatively low in comparion with other regions in the world.

A notable feature within developing Asia is the dramatic increase in inflows to China. China and Hong Kong received more than 12 percent of global inflows. Over the past two decades China has been by far the largest developing-country recipient of inward FDI (Athukorala, 2006). For the ten years 2000–09, China has been the second largest recipient of foreign investment in the world at about US$95 billion per annum (accounting for 8.5 per cent of total gross inflows) after the US which has received about US$130 billion per annum (or 12 per cent of total inflows) (Athukorala, 2006).

2.3.4 Impediments to Regional Integration in South Asia

The conclusions from the preceding sections reveal that despite efforts to strengthen regional economic cooperation, intra-regional trade and investment in the SAARC region is relatively small. The following are the main factors that are responsible for weak economic ties in the region.

a) Similarity of factor endowments or identical comparative advantage

The World Bank suggests that substantially different factor endowments are necessary in order for countries to have successful regional integration. In South Asia, the similarity of factor endowments (including quality and capabilities) among countries has rendered regional trade unattractive. While the South Asian countries have a comparative advantage in relation to rest of the world, mostly in labour intensive products, the trade and economic benefits from regional trade are limited.

b) Low complementarity of the products in the region and lack of regional value chains among the common products

South Asian countries trade little with each other but trade much more so with other nations of the world including Europe and the Group of Eight (G8) countries, particularly North America. The composition of each country's exports to these regions is similar, with the overwhelming share accounted for by ready-made garments. Therefore, the trade between South Asian countries is rather more competitive than complementary.

Ahluwalia (2004) noted that trade complementarities could well be developed within the region if the regional partners are able to achieve vertical specialisation through production sharing arrangements. Vertical specialisation would not only allow South Asian economies to strengthen their trade ties, but also enable them to reap economies of scale by concentrating on a specific production process in the value addition chain. Ahluwalia states that for this purpose, evolving production agreements on a regional basis in a specific sector would be essential. For instance, several sectors like textiles and clothing, leather, rubber and electronics could qualify for these production integration schemes. This would eventually lead to each member country specialising in a particular spectrum of the value addition chain and emerging as a niche player in that particular segment.

Additionally, it is clear from the fact that Bangladesh, India and Sri Lanka are competitors in the world tea market (Mansur, 2006). In this scenario, it would be in the interest of South Asian countries to forge alliances for the joint marketing of their competing export products. As Ahluwalia (2004) points out this would promote mutual economic cooperation in the region, and also allow regional exporters to collectively reap the benefits of improved export opportunities.

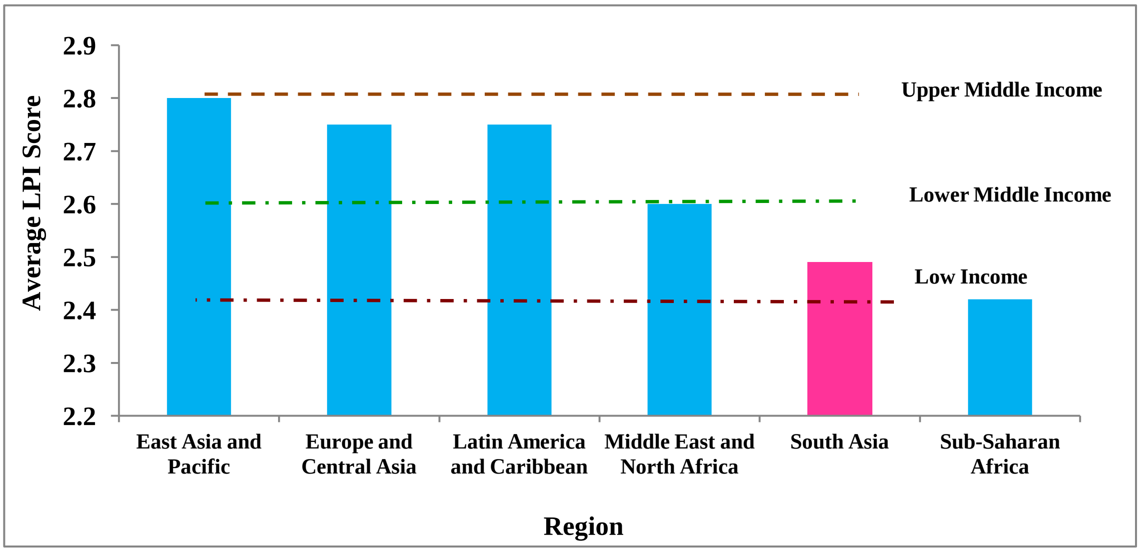
c) Restrictive trade policies

South Asian countries that had very open economies in the immediate post–independence period in the 1940s had become some of the highest protectionist economies in the world by the 1970s. Tariffs and, more importantly, non-tariff barriers (NTBs), were extremely high, state interventions in economic activity had become pervasive, attitudes to foreign investments were negative and often hostile, and stringent exchange rate controls were in place. Sri Lanka, as an exception, benefited from deep liberalisation undertaken in the late 1970s but most South Asian countries largely ignored these lessons until the early 1990s. However, some momentum in the direction of trade liberalisation became noticeable in the region during the late 1980s and early 1990s with trade policies introduced in India, Pakistan, Bangladesh and Nepal. Section 2.4 discusses these trade policies in more detail.

d) Lack of regional transport network and transit systems

The availability of transport infrastructure is crucial in providing impetus to economic activities, especially international trade. There is a need to strengthen trade instruments such as transport linkages among the South Asian members. The World Bank's Logistics Performance Index (LPI) 2010 is a comprehensive index of logistics performance in 155 countries. Logistics encompasses an array of essential activities for trade-including transport, warehousing, cargo consolidation, border clearance, distribution, and payment systems. Hence, it is considered as a useful tool in comparing logistics performance across countries and identifying key reform priorities within countries (World Bank, 2010). This index is based on numerical ratings of 1 (weakest) to 5 (strongest) to assess logistics performance.

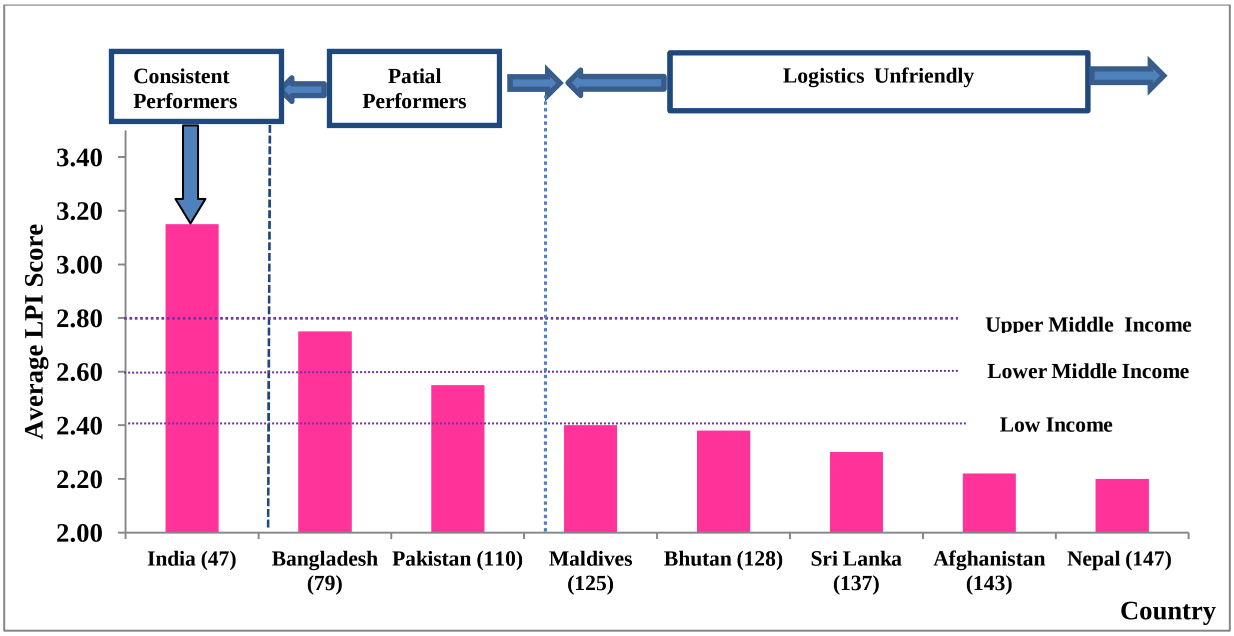
Figure 2.9 South Asia and Other Regions in International LPI



Source: World Bank, LPI (2010)

Figure 2.9 illustrates that South Asia's overall performance as measured by the International LPI, lagged behind most regions, only surpassing Sub-Saharan Africa.

Figure 2.10   SAARC International LPI Index: 2010



Source: World Bank, LPI (2010)

In terms of individual countries (see Figure 2.10), India and Bangladesh are the best performers within the region –ranked 47th and 79th out of 155 countries, while Afghanistan (143rd) and Nepal (147th) are the last in the overall LPI ranking. Hence, the current level of intra-trade can be increased if appropriate regional arrangements on roads, rail, shipping air and other logistic are put in place enabling seamless movement.

e) Informal trade among the SAARC members

According to recent studies, there has been a considerable amount of so-called "informal" trade among member countries of the region. A study undertaken by Pitigala (2005) revealed that the official trade statistics omit large volumes of unrecorded informal trade (up to as much as half of the recorded trade, and even more during some periods) in the region. This takes a number of forms including traditional smuggling that physically bypasses customs ports (especially at the land borders), "official" or “technical” smuggling, which involves misclassification (e.g. under-invoicing at customs), and direct smuggling (e.g. exports from Pakistan and India which are routed through Dubai or Afghanistan).

A more recent survey by Taneja et al., (2005) found that India’s bilateral informal trade with Nepal and Sri Lanka continues to thrive, even after the implementation of the free trade agreements. The main factor encouraging informal trade in goods is lower transactions costs, including faster delivery times, absence of procedural delays, absence of paperwork, avoidance of domestic taxes and faster realisation of payments. In some cases, the reasons cited for informal transactions among traders were lack of understanding about the terms and conditions of trade agreements (e.g. Indo-Sri Lanka Free Trade Agreement) and ethnic ties.

f) Inter-state conflicts

Some analysts believe that the political tension between the two large countries in the region (i.e. India and Pakistan) is a main constraint to regional integration. Recent nuclear tests conducted by India and Pakistan, the border war and the political change in Pakistan are major obstacles to regional cooperation.

In order to benefit from regional cooperation and economic integration, South Asian countries should seek to increase intra-regional trade in goods and services, investment and the development of supply chains. They should also seek to increase cooperation in the areas of harmonisation of product standards and customs procedures, and in travel rules and facilities.

2.4 Trade and Investment Policies in South Asia

2.4.1 Trade Regime in South Asia

During the last decade, South Asia's five largest countries – India, Pakistan, Sri Lanka, Bangladesh and Nepal – have been implementing trade policy reforms, gradually moving their economies away from protectionism toward greater trade openness and global economic integration (World Bank, 2004). In the late 1980s and early 1990s, the four mainland countries began to follow the liberalising course on which Sri Lanka had embarked in the late 1970s. Tables 2.10 and 2.11 show that South Asia as a region has become much more open over the past two decades. Imports, exports and trade as a proportion of GDP have all increased for the major economies of the region during 1991–2007.

In 1997, trade liberalisation in India moved ahead in a major way with the removal of most remaining quantitative restrictions (QRs), but stalled and went backwards in some other respects. However, the liberalising momentum resumed with large cuts in industrial tariffs between 2002 and February 2004.

Table 2.10 Mechandise Exports as a Percentage of GDP

Country	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Afghanistan									4.06	6.19	7.62	7.29	7.66	4.4	4.10	4.6	3.9
Bangladesh	7.67	8.69	9.23	10.45	11.42	11.61	12.40	14.03	12.94	12.93	13.46	14.40	15.3	16.4	18.3	19.3	16.9
Bhutan	27.56	24.11	33.19	30.01	29.93	26.80	26.06	21.13	19.79	18.89	22.33	24.51	29.62	44.1	43.8	40.6	93.8
India	7.87	7.76	8.62	8.59	8.55	8.08	7.98	9.27	9.10	9.68	9.50	10.94	11.15	13.8	12.4	16.0	11.8
Maldives	16.35	21.19	21.31	17.75	17.64	17.71	15.53	17.41	17.60	20.60	22.00	22.84	20.88	24.2	26.2	26.3	11.5
Nepal	10.49	8.90	7.84	8.51	8.25	9.76	11.96	14.63	13.19	10.21	11.31	11.27	11.22	9.3	9.2	7.5	6.5
Pakistan	13.05	14.26	13.24	14.79	14.03	13.69	13.38	12.31	12.92	13.87	14.49	13.92	14.39	13.0	24.0	12.4	10.9
Sri Lanka	27.61	27.37	29.15	29.47	30.74	30.45	29.34	33.25	30.59	28.42	28.09	28.71	26.71	24.4	23.9	20.8	17.5
South Asian Countries	**9.19**	**9.24**	**9.89**	**10.14**	**10.10**	**9.74**	**9.58**	**10.75**	**10.41**	**10.58**	**10.78**	**11.89**	**12.11**	**14.0**	**12.9**	**15.8**	**12.0**
Source: World Development Indicators, Various Issues																	

Table 2.11 Merchandise Imports as a Percentage of GDP

Country	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Afghanistan									40.62	37.16	50.04	39.92	43.78	29.2	25.4	25.7	27.4
Bangladesh	12.04	13.63	17.64	17.29	17.16	17.00	18.79	19.51	19.19	18.06	20.09	21.25	23.10	23.2	27.3	30.0	24.4
Bhutan	38.15	33.61	36.09	38.41	34.75	33.25	40.89	35.94	35.65	32.92	41.81	59.42	47.39	44.6	42.7	42.3	43.2
India	8.32	8.32	9.77	9.84	10.11	10.39	10.51	11.27	10.58	11.11	11.86	14.08	16.33	20.2	18.5	26.4	18.1
Maldives	59.24	62.36	67.17	67.05	68.67	65.54	68.22	62.31	62.88	61.18	68.18	85.65	96.99	99.6	91.7	110.2	65.6
Nepal	24.32	28.40	30.29	30.92	34.42	25.66	28.25	28.63	26.36	25.51	29.98	27.88	25.16	26.7	26.0	28.4	35.0
Pakistan	18.54	17.21	18.99	19.25	18.66	15.00	16.21	14.82	14.25	15.71	15.83	18.67	22.87	22.4	22.7	25.8	19.6
Sri Lanka	38.68	40.68	40.72	39.16	38.86	37.38	38.07	43.94	37.93	36.92	36.57	39.76	38.24	36.3	33.5	34.3	24.3
South Asian Countries	**11.23**	**11.07**	**12.78**	**12.77**	**12.86**	**12.52**	**12.83**	**13.54**	**12.69**	**13.12**	**13.88**	**16.01**	**18.31**	**21.2**	**19.9**	**26.8**	**19.0**
Source: World Development Indicators, Various Issues																	

In Bangladesh, from the mid-1990s, some aspects of trade policy reform continued, although rather slowly, but in other respects import policies steadily became more selective and protective until this trend was reversed to some extent in Bangladesh's 2004/05 budget. Pakistan's comprehensive liberalisation of its trade policies since 1996/97 (including its agricultural trade policies) and Sri Lanka's potential to resume long-deferred reform as prospects improve of ending its civil war, contribute to a regional picture of very mixed achievement but widely shared opportunity.

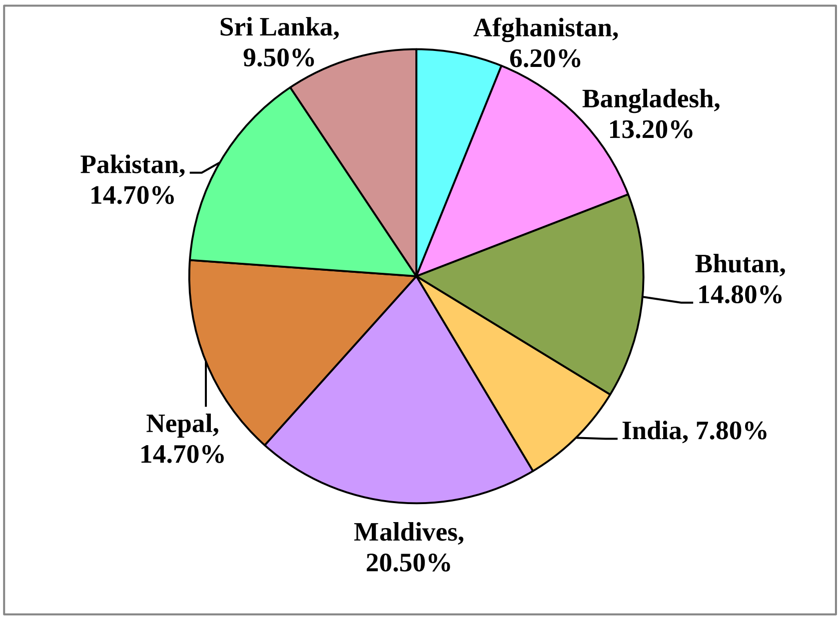
The South Asian countries have missed the tide that carried many of their East and Southeast Asian neighbours to record high rates of growth and poverty reduction during the 1960s and 1970s (World Bank, 2004). However, their later trade policies and other liberalising reforms came in time for them to benefit from the expansion of production and trade with the rest of the world during the 1990s. The process of trade liberalisation for South Asian countries started in the 1980s with unilateral trade liberalisation followed by multilateral trade liberalisation in the 1990s. The signing of SAFTA in the mid-1990s added a regional dimension to the process of trade liberalisation in South Asia. The South Asian region as a whole was a latecomer in embracing liberal trade policies as a result of which, a lot remains to be done in terms of trade openness, global economic integration and benefiting from the process of globalisation. Following are the traditional trade policies which affect imports and exports i.e. tariffs, non-tariff barriers (NTBs), anti-dumping, export policies and, to a limited extent, aspects of sanitary and technical regulations which affect trade.

a) Tariffs

Tariffs are now the principal means by which the South Asian countries protect their domestic industries. Sri Lanka embarked on trade liberalisation and reduced tariffs substantially in the 1ate 1970s, and currently has the 1owest average tariffs in the region. During the 1990s, the other four major South Asian countries steadily reduced their tariffs from very high levels – and prohibitive levels in the case of India, Pakistan and Bangladesh.

Bandara (2009) noted that although the SAFTA members managed to reduce the weighted average tariff rate up to 13 per cent by 2007, South Asia is still a highly protected region in the world according to World Trade Indicators 2008. Figure 2.11 depicts the trade weighted average tariff rates in South Asian economies in 2007, lowest in Afghanistan (6.2 per cent) and highest in Maldives (20.5 per cent) in 2007.

Figure 2.11 Weighted Average Tarrif Rate in South Asian Economies: 2007

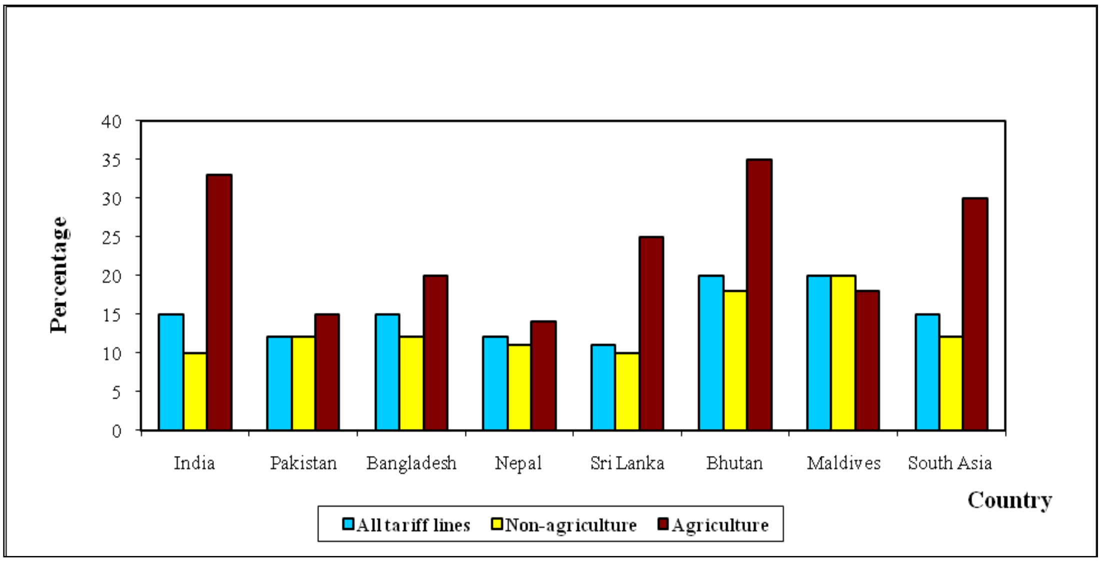


Source: World Bank and World Trade Organisation, 2008

The tariffs tended to discriminate against the agricultural sector where most poverty is located, through the use of state monopolies and other restrictions over agricultural exports and, indirectly, through much higher protection of manufacturing than of agriculture. Figure 2.12 below illustrates that the average applied tariffs MFN (simple average tariff) in South Asia were around 15.7 per cent in 2007 (excluding Afghanistan).

Sri Lanka had the lowest tariff rate (11.4 per cent) while Bhutan had the highest (21.9 per cent). The World Trade Organisation (WTO) notes there has been a major reduction in the average Indian ad valorem tariff since 2002/2003, which has fallen from 35 per cent to 15 per cent in 2007. Whereas previously, Indian tariffs were much higher than tariffs in the other South Asian countries, on average, they are now on par with these economies, except in relation to agricultural products. Further, the WTO (2007) highlighted that in the case of Bangladesh, after allowing for para tariffs, the average protective rate declined only slightly from 1995/1996 to 2003/2004 (32 per cent to 29.2 per cent), but a sharp drop (14.6 per cent) occurred in the budget of financial year 2007 as a part of its trade reforms. Sri Lanka's tariffs on non-agricultural products are lower than in the other South Asian countries and, with the important exception of agriculture, Sri Lanka has been a low-to-medium tariff country by the general standards of developing countries since 1978.

Figure 2.12 Average Tariffs in South Asia: 2007

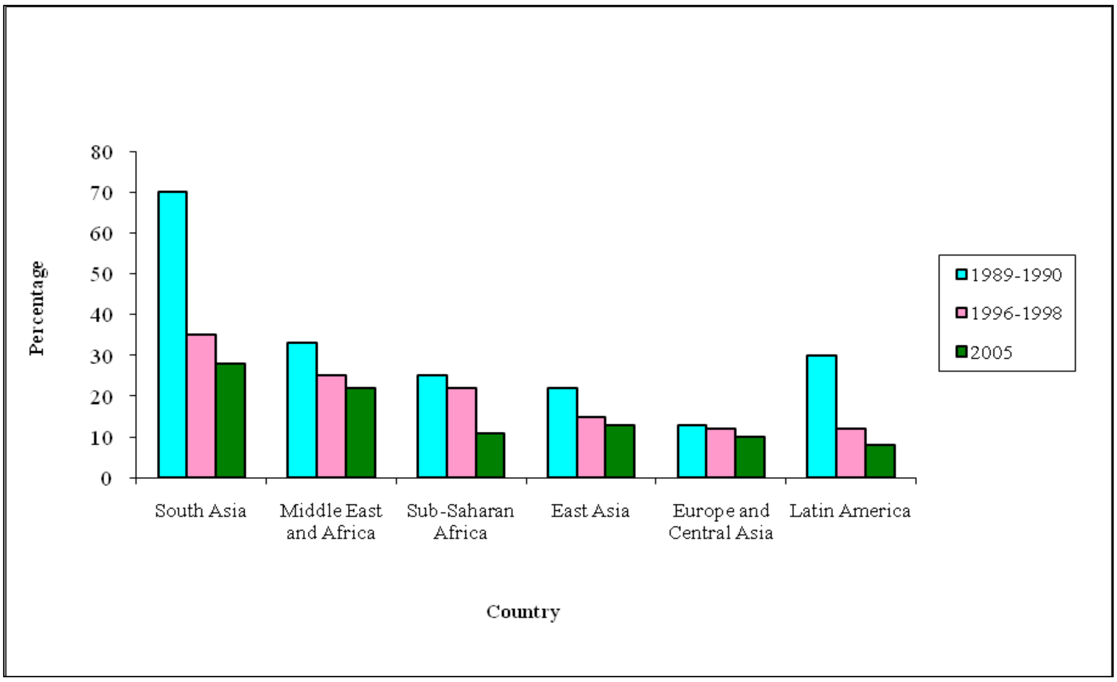


Source: World Trade Organisation (WTO), United Nation Conference on Trade and Development (UNCTAD) database (2008).

It is clear that the South Asian countries may have to fulfil in the ongoing negotiations on industrial tariffs, or under Non-Agricultural Market Access (NAMA). Negotiations under NAMA focus on market access for all products (mostly industrial) that are not covered by negotiations on agriculture and aim to reduce, if not possible to completely eliminate tariff or non-tariff barriers (NTBs) that restrict trade in these products (Kamal et al., 2005). In the case of South Asia, Bangladesh, Nepal, Bhutan, Maldives are considered as LDCs and therefore, under NAMA negotiations it is considered to formulate appropriate mechanism to safeguard these countries along with other LDCs. For Bangladesh, a major concern is the duty free access of garment and other products like fish and fish products, and leather and leather goods to US and other countries. Nepal, a LDC with low level of industrialisation, has a significant stake in the ongoing NAMA negotiations in the WTO. Nepal's objective is to resist sectoral initiatives emphasising developed and developing countries to expand market access for products of export interest to Nepal (Kamal et al., 2005).

Under the NAMA negotiations, India wants to gain greater market access in developed countries, not much through the reduction of their tariffs, which are already low but through the dismantling of NTBs to trade and some Generalised System of Preferences (GSP) (e.g. the proposed EU-GSP on Textiles and Clothing). Pakistan, similar to other South Asian countries, believes that the tariff peaks be removed, the tariff escalation minimised and the developing countries are provided free market access. Sri Lanka's negotiating position on NAMA puts the fact that the developed countries should eliminate barriers to free market conditions and ensure duty free, quota free market access for non-agricultural products originating from developing and least developing countries. The details of the tariff structure in South Asian countries are illustrated in Table A.1 in Appendix A. Figure 2.13 illustrates the average tariff of South Asia in comparison with the other regions in the world.

Figure 2.13 Avearge Tariffs of South Asia and Other Regions



Source: World Bank, World Trade Organization and International Monetary Fund

b) Non-Tariff Barriers

South Asia's non-tariff barriers declined more than 85 per cent between the 1980s and 1990s (UNCTAD, 1994 and 1999). Nevertheless, import restrictions and prohibitions remain on over a quarter of all tariff lines in India and on a very small number of commodities in other South Asian countries (Regmi, 1999). Export restrictions, licensing, monopoly control and export taxes generally burdened the agricultural sector in South Asia. Export restrictions have been removed on almost all agricultural commodities in Bangladesh, Pakistan and Sri Lanka, and on a number of agricultural commodities in India since the reform policies implemented in the 1990s. However, parastatal control of exports and licensing requirements continue to inhibit the export of most major agricultural commodities in India and some agricultural commodities in Pakistan.

Since India phased out most of its QRs in April 2001, Bangladesh is the sole country in South Asia still using these traditional devices, some with the explicit purpose of protecting local industries. Although India, Pakistan and Sri Lanka have done away with QRs, except in regulating agricultural and food imports with sanitary and phytosanitary controls, all South Asian countries still impose non-tariff barriers of various sorts.

c) Other import taxes and levies

At present India, Bangladesh, Sri Lanka and Nepal employ protective taxes on imports in addition to custom duties. The practice is a major problem in Bangladesh, where three other protective taxes presently provide very high levels of nominal tariff protection to local producers in distinctly non-transparent ways. Because of import taxes other than custom duties that have protective implications, Bangladesh and India currently have de facto general maximum protective tariffs of 34 per cent and in agriculture as high as 100 per cent.

d) Anti-Dumping

The anti-dumping cases already decided in India and the potential for unrestricted anti-dumping to undermine the liberalisation of the trade regime that has been achieved so far suggest that a review of current anti-dumping policies and practices is urgently needed. An unfortunate consequence of anti-dumping activity in India is that producer groups looking for a way of obtaining extra protection in the neighbouring South Asian countries are using India's example as another reason why their governments should introduce anti-dumping laws and develop the technical capacity to implement them. So far there are no systematic economic evaluations of the consequences of India's anti-dumping policies.

e) Special Protective Treatment

In all South Asian countries, the announced "maximum" general Custom tariffs are not actual maximums. In addition to and apart from the use of other protective import taxes on top of customs duties, every country has industries that receive special high-tariff treatment. Many of these industries are large and have a public-sector production and/or regulatory presence. They also often benefit from exemptions from input tariffs, NTBs of various kinds and subsidies. As a result, if weighted by the domestic production protected, average tariffs in most of South Asian countries (especially India) would be considerably higher than un-weighted average tariff lines. Since they would rise well above import weighted tariff averages, where high tariffs reduce or keep out imports, they therefore systematically understate the extent to which tariffs are protecting domestic industries.

As elsewhere, a number of industries in South Asia receive special treatment in various forms from the government. In addition to NTBs of various kinds, protection can come from especially high tariffs that exceed the country's highest normal tariff band, from a combination of high-to-moderate output protection and especially low-input protection, from direct and indirect subsidies, and by other means. By definition, since the industries receive special treatment, an influential interest is always involved, one which will have to be dealt with in any thorough ongoing trade liberalisation process.

Given that by now overwhelming accumulation of evidence across the globe suggesting that over the long term trade openness is a more trustworthy friend of the poor than protectionism, India and its neighbours should welcome further, liberalisation. There is little evidence to show that a country has achieved rapid growth without an expansion of trade. On the other hand, trade reform is only a necessary condition, not a sufficient one, for an improved growth performance. Reaching that goal requires other complementary policies and an improved overall investment climate.

Having scrapped most of its QRs in the course of its 1977 reforms, and dropped others in the following two decades, Sri Lanka, in 1998, retained only 3.7 percent of its tariff lines subject to import restrictions explicitly aimed at protecting local industries. The residual QRs, however, carried significant weight. Not only did they apply (in the form of seasonal import licensing) to rice, potatoes, chillies and onions, the main import substitution food crops, but also restricted imports of such industrial products as timber, chemicals, some drugs and motor vehicles. Losing its argument before a WTO panel that the GATT balance of payment clause justified such practices, Sri Lanka did away with QRs in May 1998 except for GATT sanctioned health and safety, and technical standards and regulations, and the import monopoly over wheat (which is not grown in Sri Lanka) justified under the GATT state trading provision.

The role of protecting import substitution crops has not disappeared, but shifted to seasonally varying tariffs and specific duties. Still, its protective tariffs are markedly lower than those in India and Bangladesh. Sri Lanka is a relatively low tariff country by the general standards of developing countries (see Figure 2.12), subject to some qualifications.

On the export side, Sri Lanka was a regional-pioneer entrant in developing a garment industry aimed at foreign customers. However, in two other major export industries, tea and spices, export taxes, though few and minor, nonetheless impede efficient development by disallowing imports of tea varieties for blending with local teas, and spices for partial processing and re-export during periods when domestic spices are not available. Both restrictions appear to be in response to lobbying by domestic growers who object to the potential competition and the adjustments that would be required if the imports were allowed.

2.4.2 FDI Policies in South Asia

FDI is a vital requirement for sustained economic growth in South Asia. It can generate employment in the host countries, in addition to supplementing domestic savings and helping meet the huge demand for investment. FDI can also bring foreign currencies into the host countries by stimulating exports of goods and services. Expectations of significant future domestic demand can result in FDI from foreign companies establishing large production bases for these domestic markets, especially in countries with large populations such as those in South Asia. Such FDI will expand product variety and consumer choices, and promote technology transfers and knowledge spillovers through forward and backward linkages in the host economies.

The South Asian countries maintained a restrictive regime in the early years following independence and they have only made their FDI policy environments conducive to foreign investment since the 1990s. The South Asian countries have been making consistent efforts to attract more FDI by liberalising their FDI policy frameworks to compete with other regions in the world. The data in Table 2.10 highlights the increase in FDI inflows in South Asian countries after most of their economies were liberalised in the 1990s. However, Table 2.11 illustrates that the level of FDI inflow into South Asia is still low when compared to other Asian regions. A poor business climate, poor infrastructure, restrictive labour policy and labour unrest, political uncertainties and civil conflicts, weak regulatory systems, and rampant corruption in the region are all considered reasons that inhibit FDI inflows.

a) FDI Policy in India[7]

In India, there has been a gradual change in the government's attitude towards FDI since 1948. As local industries started to develop in the late 1960s, the

[7] A summary of the South Asian counters FDI policies is provided in Table A.2 of the Appendix A.

government adopted a more restrictive policy towards FDI. In 1973, the new Foreign Exchange Regulation Act (FERA) came into force, requiring all foreign companies operating in India with up to 40 per cent equity to register under Indian corporate legislation (Pravakar, 2006). In the 1980s, the FDI policy started to liberalise in India as a part of the industrial resolutions. In 1991 a series of policy measures were introduced through new economic and industrial policies in order to liberalise the FDI environment in the country. Consequently, India currently possesses one of the most attractive FDI policies in the South Asian region.

The FDI policy in India is reviewed on a regular basis and changes in sectoral policy/sectoral equity caps are notified through Press Notes by the Secretariat for Industrial Assistance (SIA), Department of Industrial Policy and Promotion. The Reserve Bank of India (RBI) should also notify the FDI policy under the Foreign Exchange Management Act (FEMA) (Pravakar, 2006). Most of the sectors/activities are under the Automatic Approval Route, except for a few sectors where there are additional restrictions on FDI such as equity caps, divestment conditions and lock in periods on investment. The imposition of these restrictions were in view of sectoral requirements, security and strategic concerns, and in the interest of domestic investments. Only a few sectors do not permit FDI.

b) FDI Policy in Pakistan

Pakistan took the first step towards liberalisation of FDI in 1984 with the announcement of the industrial policy statement giving an equal plank to the public and private sectors. Foreign private investment was encouraged in the form of joint equity participation with local investors and in areas, which require advanced technology, managerial and technical skills, and marketing expertise. The Foreign Private Investment Act (Promotion and Protection Act) of 1976 provides an adequate legal framework for foreign investment and the Act guaranteed the remittance of profit and capital, and the appreciation of agreements on the avoidance of double taxation.

Pakistan introduced a new industrial policy package in 1989 once the economy began to liberalise its FDI policies in recognising the role and importance of the private sector. A number of regulatory measures were taken to improve the FDI environment and to attract more FDI, for instance, setting up the Board of Investment (BOI) attached to the Prime Ministers' secretariat to help generate opportunities for FDI and provide investment services. To facilitate foreign investment, Pakistan has signed bilateral agreements on the promotion and protection of investment with 46 countries (Pravakar, 2006).

The government of Pakistan announced a New Investment Policy in 1997 that included major policy initiatives to attract FDI, which was earlier restricted to the manufacturing sector. It has now opened up to sectors such as services and agriculture, which constitute three-fourths of GNP (Pravakar Sahoo, 2006). The main objective of the new policy is to attract more foreign investment in the fields of industrial base expansion, infrastructure and software development, electronics, engineering, agri-food, value added, textile items, tourism and construction industries.

c) FDI Policy in Sri Lanka

Sri Lanka's FDI policy has two distinctive phases; from 1948 to 1977, when the public sector was the dominant entity and controlled the country's resources and the post-1977 period, when Sri Lanka launched its economic reforms which favoured private-sector led, export-oriented development, including a greater role for FDI. Many barriers to trade and payments were dismantled after the liberalisation policies in 1977; for example, the exchange rate was unified, agricultural and export taxes were restructured, administered prices were adjusted, and restrictions on pricing and investment by the private sector were reduced.

The most important feature of FDI policy measure in Sri Lanka was the establishment of the BOI in 1992 with wide powers of tax relief and administrative discretion in all matters related to FDI. Neighbouring South Asian economies such as India have a long negative list of sectors where FDI is barred, or where foreign investors may only take a minority stake in an enterprise. A comparative study among Asian countries shows that Sri Lanka’s list of restricted activities is relatively small (Pravakar, 2006). However, there are a few areas totally reserved only for Sri Lankans, such as money lending, pawn broking, retail trade investment, providing personal services other than for the export of tourism sectors, coastal fishing, and the education of students and award of local educational degrees. However, there are regulated areas such as the growing and processing of primary commodities, mining, timber-based industries, education where foreign investment is restricted to 40 per cent and approval by the BOI is required.

d) FDI Policy in Bangladesh

Bangladesh announced a series of measures and liberalised its FDI policy framework in the late 1980s and the 1990s. In recent years, Bangladesh has significantly improved its investment and regulatory environment, including the liberalisation of industrial policy, abolition of performance requirements and allowance of full foreign-owned joint ventures. New sectors have opened up since 1996 for foreign investment, including the telecommunications sector.

Foreign direct investment is encouraged in all industrial activities in Bangladesh, excluding those on the list of reserved industries such as production of arms and ammunitions; forest plantation and mechanized extraction within the bounds of a reserved forest, production of nuclear energy, and printing and minting fresh currency notes. Such investments may be undertaken either independently or through joint ventures, with the local, private or public sector. The capital market also remains open for portfolio investment. The policy framework for foreign investment in Bangladesh is based on the Foreign Private Investment (Promotion and Protection) Act, 1980, which provides measures for the non-discriminatory treatment and protection of foreign investment and guarantees repatriation of profit, capital and dividend, and equitable treatment with local investors.

e) FDI Policy in Nepal

Nepal introduced FDI policy in the 1980s with the enactment of the Investment and Industrial Enterprise Act of 1987. In its pursuit of outward-oriented policies, Nepal began to encourage private foreign investment in every industrial sector (medium- and large-scale), with the exception of defense activities. Joint ventures were the preferred form of investment, and limitations were set on the level of foreign equity holdings. Medium enterprises were restricted to foreign equity of 50 per cent while up to 100 per cent foreign equity was permissible for large industries under the proviso they export more than 90 per cent of their total production. In other large industries, the maximum was set at 80 per cent foreign equity. New projects by foreign investors required the formal approval of the Foreign Investment Promotion Division of the Ministry of Industry. In a step to further liberalise its foreign investment policy, Nepal announced a new set of incentives through the 1987 Act, which allowed for the full remittance of dividends for investments in convertible currency. The Act made the repatriation of capital possible and allowed for the importation of foreign workers when nationals were not available. Approval was given for a five-year tax holiday on profits, which was later extended to ten years. Imports were given duty free status through either a duty drawback or bonded warehouse facility.

Most sectors have opened access to foreign investors, allowing up to 100 per cent equity or joint ventures with Nepalese investors. These sectors are manufacturing, energy based industries, tourism, mineral resource based industries, and agro based industries and services. However, there are a few industries where investment is prohibited, including national security; cottage (i.e. craft) industries; personal services of a kind that would normally be performed by self-employed people and real estate. Sectors that do not permit FDI include: retail businesses; travel agencies; cigarette, tobacco and alcohol production other than for export; and a range of small tourist related activities including tourist lodging.

Although there are many convincing arguments in favour of FDI, there are several sound arguments against FDI as well. For instance, one of the strong arguments against FDI is that, it has potential to lead to a gradual loss of host country’s technological edge. Another argument which not in favour of of FDI is that, it creates unlevel playing field as foreign companies are given unfair advantages through state and local government incentives, which includes tax holidays, low interest rates on loans and import of raw materials on duty free etc. Hence, South Asian economies need to devise strong policies to ensure level playing field to both foreign and domestic investors (Giese et al., 1990).

Furthermore, South Asian countries need to maximise efforts aimed at macroeconomic and political stability, institute appropriate regulatory and policy frameworks for foreign investment, promote infrastructure development, facilitate the development of small and medium-sized enterprises, enhance the quality of local labour through education and training, and facilitate greater regional cooperation in terms of promotion of trade and investment. These measures are also necessary to sustain the current momentum of economic growth in the region and eradicate poverty in the region.

2.4 Preferntial Trading Agreements (PTAs) in South Asia: Some Salient Features

The process of economic integration in South Asia gathered momentum with the implementation of SAPTA in 1995 under the broad framework of the SAARC. In December 1991, SAARC approved the establishment of an Inter-Governmental Group (IGG) at the Sixth Summit held in Colombo to formulate an agreement to establish a "SAARC Preferential Arrangement" (SAPTA) by 1997. Given the consensus within SAARC, the SAPTA Agreement was signed on 11 April 1993, (much ahead of the schedule) and it came into force on 7 December 1995. SAPTA was envisaged as the first step in the transition to SAFTA, leading subsequently towards a Customs Union, Common Market and Economic Union. The process of economic integration in South Asia gathered momentum with the implementation of the agreement.

South Asian Free Trade Agreement (SAFTA)

SAFTA was signed on 6 January 2004, during the Twelfth SAARC Summit in Islamabad. The agreement entered into force on 1 January 2006, and was formally launched on 1 July 2006. The special needs of the Least Developed Contracting States were recognized by adopting concrete preferential measures in their favour on a non-reciprocal basis. The Committee of Experts proposed the tariff reduction schedule in two phases, as illustrated in Table 2.12.

Table 2.12 Tarrif Reductions Proposed under SAFTA

Country	Existing Tariff Rate	Proposed SAFTA reduction	Timeline
First Phase			
Non Least Developed Countries : India, Pakistan and Sri Lanka	More than 20 %	Reduce Maximum Tariff rate to 20%	Within 2 years (January 1st 2006- 1st January 2008)
	Less than 20 %	Further annual reduction of 10%	Each of 2 years (January 1st 2006- 1st January 2008)
Least Developed Countries: Bangladesh, Nepal, Bhutan and Maldives	More than 30 %	Reduce Maximum Tariff rate to 30%	Within 2 years (January 1st 2006- 1st January 2008)
	Less than 30 %	Further annual reduction of 10%	Each of 2 years (January 1st 2006- 1st January 2008)
Second Phase			
Non Least Developed Countries	20% or below	0-5%	Within 5 years (1st January 2008- 1st January 2013, Sri Lanka: January 1st 2014)
Least Developed Countries	30% or below	0-5%	Within 8 years (1st January 2008- 1st January 2016): Primary products within 3 years and other products within 5 years)

Source: The World Bank, Trade Policies in South Asia: An Overview – 2004

The arrangement is a traditional trade barriers reducing exercise. Its major objective is to eliminate obstacles to trade, both tariff and non-tariff, and facilitate the cross-border movement of goods between the territories of the Contracting States. The parameters set out for SAFTA in these discussions included the following:

- Tariff eliminations without any import restrictions
- Removal of "structural impediments" to regional trade
- Harmonising of customs procedures and documentations
- Bank facilitation
- Port and transport facilitation
- Facilitation of trade-related services
- Establishment of a reviewing and monitoring mechanism
- Ensuring "equitable" benefits to all member countries.

Under the trade liberalisation programme, the member countries agreed to gradually and eventually bring down their import tariffs on trade at the end of SAFTA implementation to a range of 0 to 5 per cent. However, it should be noted that the described tariff reduction schedule may not be applied to items on the "Sensitive List", which are to be negotiated among the contracting members.

In addition to SAFTA, three bilateral free trade agreements exist between South Asian countries, namely: India – Bhutan, India – Sri Lanka and Pakistan – Sri Lanka. There is also one sub-regional preferential arrangement among India, Bangladesh, Sri Lanka, Philippines, Lao PDR and Korea, known as the Asia Pacific Trade Agreement (APA) and a further seven trade agreements between India – Nepal, India – Bangladesh, India – Maldives, Bangladesh – Nepal, Bangladesh – Pakistan, Pakistan – Nepal and Sri Lanka – Nepal (Aggarwal, 2008). Others are in the process of being agreed. India and Sri Lanka also have a comprehensive Economic Partnership Agreement to liberalise services and investment. Table 2.13 provides an overview of sub regional/bilateral PTAs involving two or more South Asian countries.

Table 2.13 Regional Trade Agreements in South Asia

	Bangla-desh	**Bhutan**	**India**	**Mal-dives**	**Nepal**	**Pakis-tan**	**Sri Lanka**
Bangla-desh	1						
Bhutan	BIMSTEC[a]	1					
India	TA** BIMSTEC[a] APTA	FTA BIMSTEC[a]	1				
Mal--dives			TA**	1			
Nepal	BINSTEC[a]	BIMSTEC[a]	TA** BIMSTEC[a]		1		
Pakis-tan	TA**				TA**	1	
Sri Lanka	BIMSTEC[a] APTA	BIMSTEC[a]	FTA BIMSTEC[a] APTA		BIMSTEC[a] TA**	FTA	1

Source: Aggarwal (2008) ** Trade Agreements [a] Poposed

After a number of deliberations of Inter-Ministerial Consultation with the active support of the Asian Development Bank (ADB), a regional economic forum was formed in 1997 comprising four countries, Bangladesh, India, Sri Lanka and Thailand. Myanmar subsequently joined this sub-regional group and it formally became the Bangladesh-India-Myanmar-Sri Lanka-Thailand Economic Co-operation (BIMSTEC). The main aim of this group is to fully utilise the existing potential of member countries for promoting economic co-operation in the areas of investment, industry, technology, human resource development, agriculture and infrastructure (Mehta and Agarwal, 2003). BIMSTEC provides an opportunity to optimise complementarities in trade, investment and production between South and Southeast Asia countries. This sub-regional group is considered an important step in the process of economic cooperation between different regions of Asia. The Bay of Bengal

Initiative for Multi-Sectoral Technical and Economic Cooperation (i.e. BIMSTEC) aims to achieve its own free trade area by 2017. Finally, four PTAs are under negotiation; India-Pakistan, India-Bangladesh, Sri Lanka-Maldives and Pakistan-Bangladesh (Chaturvedi, 2007).

Preferential trade agreements are proliferating around the world, including in Asia and the Pacific region. Looking forward, a proliferation of PTAs, unaccompanied by continuing unilateral and multilateral liberalisation, could run the risk of leading to suboptimal trade patterns (Tumbarello, 2006). Other concerns associated with the proliferation of PTAs arise from the so-called "noodle bowl effect," which refers to the potential problems arising from lack of coherence among different overlapping agreements. For example, some individual SAFTA members are negotiating bilateral agreements with non-SAFTA countries even if SAFTA itself negotiates with the same country. While the provisions of preferential agreements vary considerably, there has so far been little effort toward regulatory harmonisation and consistency among them. As a result, restrictive and inconsistent rules of origin across agreements can complicate outsourcing decisions by firms and add fragility to the trading system. Moreover, the outcome of a trade dispute between two members has the potential to spill over to other countries in the region and can create problems for other regional trade relations. For instance the nuclear tests conducted by India and Pakistan, the border war, and political change in Pakistan have acted as major obstacles for regional cooperation in South Asia.

Therefore, to minimise the risks that PTAs may entail, it is important that their implementation is within a well-designed and comprehensive framework. Best practices in designing PTAs include:

- Low external barriers and a continued commitment to Most Favoured Nation (MFN) liberalisation
- Open access to membership
- Consistency among different agreements
- Comprehensive coverage of goods and services with few exclusion
- Symmetrical and simple rules of origin with transparent and consistent regulations
- Behind-the-borders reforms to promote synergies and strengthen the supply response
- Establishment of dispute settlement provisions to resolve conflict in a timely fashion (Asian Development Bank, 2006; Tumbarello, 2006)

Well-designed trade agreements can expand trade opportunities and benefit participants as they can strengthen political ties between countries in the region.

2.5 Concluding Remarks

The overview of the South Asian economies provided in this chapter enables indentification of the characteristics and the trends in important economic indicators over the liberalisation periods. Following the liberalisation of most of the economies in South Asia, the rate of economic growth accelerated and it has averaged around six per cent during the last decade. In examining the pattern of income distribution and the poverty head count ratio, it seems that although absolute poverty has been reduced during the post-liberalisation period, the income distribution gap among the rich and poor has widened in most of the countries.

In observing the trade policy, it is clear that the average tariff has been reduced during the post- liberalisation period with Sri Lanka having the lowest average tariff in the region. Average tariffs in the agricultural sectors are higher than the non-agricultural sectors in all economies in the region. The South Asian economies initiated liberalisation of their FDI policies in the 1990s and consequently, FDI inflows into the region gradually increased over the period.

The process of economic integration in South Asia commenced with the establishment of SAARC in 1985 and continued with SAPTA in 1995. Subsequently the SAFTA Agreement was signed in January 2004 and was implemented with effect from 1 January 2006. At present most of the South Asian countries have entered into FTAs with India, since India is the dominant trading partner in the region. Even though, the regional trading partners have entered into bilateral and other types of trading agreements, for South Asia as a region it is appropriate to focus on SAFTA and to try to move to a deeper level of integration (such as a customs union or economic union). Only then can the region become successfully integrated into the world economy and face the challenges exerted by globalisation. Furthermore, PTAs need to be implemented in such a way that all citizens in the region benefit from integration without inflicting harm on any individual group in the economy. The focus of the next chapter is to acertain the theoretical impacts of trade liberalisaiton and the empirical findings of previous studies to highlight the contribution of the present study to the exsiting literature.

CHAPTER 3 TRADE LIBERALISATION AND POVERTY: POVERTY FOCUSED CGE APPLICATIONS IN DEVELOPING COUNTRIES

3.1 Introduction

Poverty reduction and income distribution in developing countries became vital policy issues in the 1990's and since then there has been growing interest to investigate the link between trade liberalisation and poverty. Many developing countries are determined to achieve the United Nation's Millennium Development Goals (MDGs) with particular emphasis on reducing poverty by 50 per cent towards the end of 2015 (Babakar Fall, 2006). Consequently, economists are currently attempting to integrate poverty analysis into traditional modelling tools, with varying degrees of success.

It is acknowledged that sustained economic growth brings about poverty reduction[8]. However, this in itself is inadequate without understanding the nexus between trade liberalisation, poverty and income distribution. To investigate these links, economists have employed different theoretical and empirical methodologies such as cross-country or single country case studies, which may also have their own limitations. Section 3.2 examines the theoretical and empirical evidences, which concentrate on trade liberalisation, factor endowment and income distribution. Section

[8] Bourguignon and Morisson (1990); Li, Squire and Zou (1998); Barro (2000); Dollar and Kraay (2002, 2004) and Lundberg and Squire (2003)

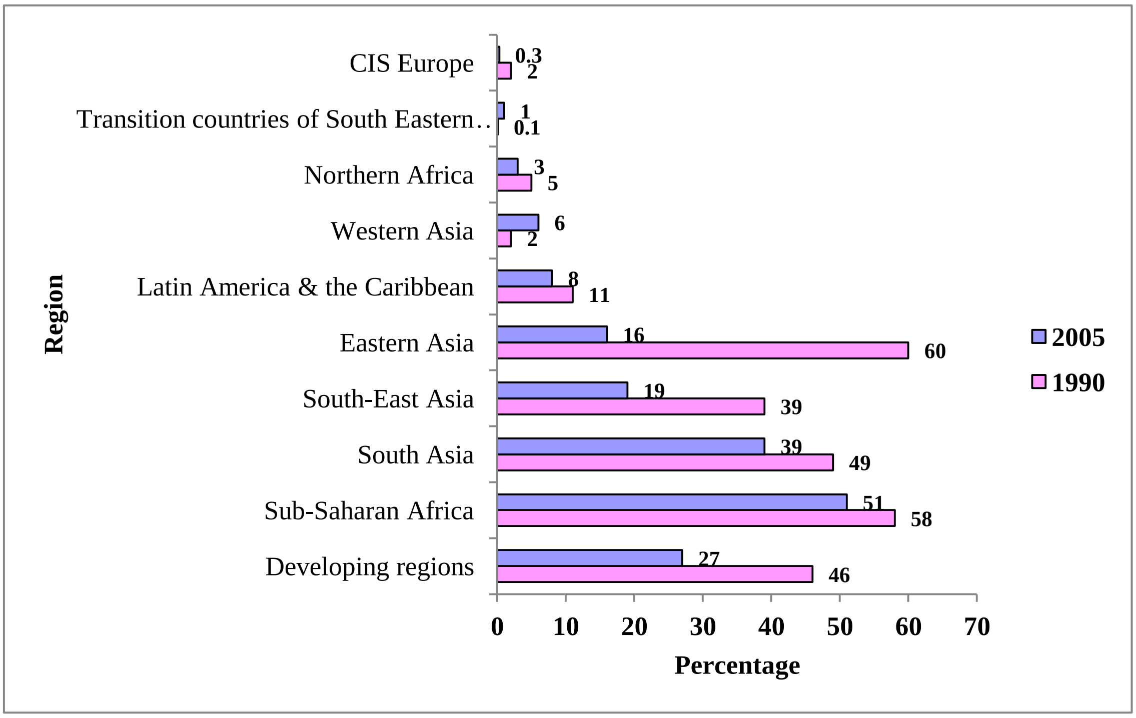
3.3 discusses empirical methodologies of trade liberalisation, poverty and household income distribution in developing countries.

Apart from the fact that many different empirical approaches have been used to analyse the impact of trade liberalisation on household income distribution and poverty, Computable General Equilibrium (CGE) modelling is by far the most recognised analytical tool to address the policy issues (Bandara, 1991). In recent years CGE models have been used to address trade and tax policies, income distribution and poverty, agricultural and environmental issues, development strategies and regional development in both developed and developing countries (Bandara, 1991 and Bandara et al., 2011). In this research, the focus is on a multi country framework rather than single country as has been used widely by many other CGE modellers (e.g. Naranpanawa, 2005, Sothea, 2009) to address the impact of trade reforms on household income distribution. Section 3.4 provides further insights into this area with particular focus on developing countries. The conceptual framework of the research is illustrated in Section 3.5. Concluding remarks are provided in Section 3.6.

3.2 Theoretical Models and Empirical Evidence based on Trade Liberalisation and Poverty

The role of trade policy in economic development has been a key debate among economists and policy makers over the second half of the twentieth century. Many developing countries commenced trade liberalisation policies in the 1980s with Structural Adjustment Programmes. It is believed that trade reforms reduce poverty through two mechanisms, the positive impact on economic growth and its favourable impact on income distribution (Davis, 1996). Figure 3.1 illustrates that poverty has been reduced in most of the developing regions since the 1990s, hence, one can argue that trade reforms play an important role in poverty alleviation.

Figure 3.1 Percentage of Population Below US$ 1.25 per day



Source: Millennium Development Goals Report 2010, United Nations

Economists believe that trade reforms promote economic efficiency, growth and poverty reduction (Edwards, 1993). Given such apparent benefits, why do some countries still oppose or hesitate to reduce trade barriers? In this sub section a critical analysis of the theoretical and empirical evidence of the way in which trade reforms can affect different groups in society in the short run and long run is given.

International trade theory emphasises the view that free trade maximises economic welfare and trade liberalisation causes convergence in the returns to factor income across countries. The classic link between trade and income distribution was put forward by the Heckscher-Ohlin (H-O) model in the 1930s and the Stolper-

Samuelson theorem (S-S) in the 1940s. James Gerber (1999, p.59) explains the H-O theorem:

> Countries have comparative advantage in goods with production requirements that intensively use the relatively abundant factors of production. Conversely, countries will not have comparative advantage in goods with production requirements that intensively use the relatively scarce factors of production.

According to the H-O theorem, the trade pattern depends on the factor endowments in the country. It predicts that trade reforms will lead to greater specialisation and a rise in national income in all participating countries, following more efficient utilisation of resources inspired by the principle of comparative advantage. The outcome of the H-O theorem was explained in the S-S theorem which states that specialisation will lead to convergence in the prices of goods exchanged and also in factor remunerations. Furthermore, in the H-O model, it is believed that developed countries have abundant skilled labour, whereas in developing countries the opposite is the case. For this reason, the H-O theorem recommends that developing countries should specialise in the production of products such as textiles, wearing apparel and footwear using unskilled labour while developed countries should focus on the production of goods such as machinery and electronic items using skilled labour (Goldberg and Pavcnik, 2004). To strike a balance with this model, developing countries should export unskilled labour intensive products while developed countries should export skilled labour intensive products. If this occurs the relative demand for unskilled labour in less developed countries (LDCs) increases and the same would decrease in developed countries. This trend will widen the inequality gap between the high and the low skill workers in the developed countries and narrow the gap in the LDCs. The same could be said with respect to gains from capital compared with labour. If industrialised countries are considered to be rich in capital, capital-labour inequality would expect to rise in these countries as a result of trade with developing countries. This means that trade openness in developing countries would be “pro-poor” in addition to being “pro-growth” (Ramkishen and Graham, 2002). These predictions are expected to occur in the long run under the assumption that factors are mobile across sectors within the country and therefore, price changes affect only the economy-wide returns to factors of production. It is improbable that this will occur in the short run due to so-called “specific factor” which is based on traditional modelling approaches. This model assumes that in each sector, there is at least one sector specific factor which cannot change sector employment. According to this model, the sector specific factor in the import competing sector will lose due to trade reforms.

The contributions of the H-O and S-S theorems to analyse the distributional impacts of trade reforms is considerable even though the empirical evidence of the impact of trade liberalisation on poverty is mixed and does not always support the conclusions of the H-O and S-S theorems (Davis,1996). This is because such models have been based on restricted assumptions and once some of these assumptions suspended the power and capacity to predict issues relating to trade liberalisation, income distribution become questionable (Goldberg and Pavcnik, 2004).

The H-O model outcome holds under the assumptions that two countries are producing two goods with two factors (capital and labour), using the same technology that remains constant over time. The model also specifies that there are no economies of scale, factor markets are efficient (characterised by free factor mobility across sectors and full employment of factors) and there is balanced trade and symmetric trade liberalisation by all trading partners. However, in reality, trade occurs between multi-country, multi-goods and multi-factor contexts, in which most of the above mentioned assumptions do not hold. If these assumptions are waived the predicted efficiency and equality outcomes are unlikely to be achieved.

The H-O model is criticised by modern economists because of its flaw in predicting the distributional effects of trade among similar countries. Industrialised countries in fact tend to trade more with other industrialised countries than with developing countries (Martin, 2001). The H-O model also fails to explain the dynamism of countries exporting primary commodities that have been produced because of the unequally distributed abundant factor. As a result of unskilled labour surplus prevalent in the rural labour market in LDCs, it is unlikely that an increase in demand for agricultural workers will raise subsistence wages in line with an increase in export revenue in such economies. Due to the large influx of poor households into the agricultural sector, it is important to pay attention to the prices of agricultural commodities. Changes in prices (lower prices of agricultural products relative to prices of industrial products) may affect poor households depending on whether they are net producers or consumers of agricultural products. In any case, it is crucial that workers should be able to move from a declining import substitution sector to an expanding export sector in a liberalised trade regime. The difficulty in labour mobility across sectors from within arise from structural rigidities and governance problems such as regulations on migration (as in Uzbekistan), lack of infrastructure and housing where industries are located (as in Sub-Saharan Africa), labour laws limiting transfer of workers across industries (as in India), lack of social safety nets to assist redundant workers until they find new employment (as in China), narrow credit markets and lack of new investments to absorb labour moving to a tradable sector may limit the reallocation of resources towards an export sector due to trade liberalisation (Cornia, 2004).

Further limitations of the H-O model can be seen in situations of trade among countries where comparative advantage evolves over time because of change in trade policy decisions by other countries. The typical example is the case with the entry of labour intensive manufactured products by China, India and other low-wage economies affecting the comparative advantage and exports of middle income countries in Latin America, Eastern Europe and South-East Asia in the 1990s (Cornia, 2011). Bhagwati (1994) noted that the shares of trade to GDP have risen virtually everywhere in the world during the last two decades due to globalisation of the world economy. Hence, international competitiveness has become more intensive among countries and there has been considerable convergence of technical know-how, partly brought about by the global activities of multinationals. Bhagwati (1994, p.239) further states that:

> The result of kaleidoscopic comparative advantage, a kind of knife edge, where only one day I have comparative advantage in X and you in Y, and tomorrow it may be the other way around, and then back again: a sort of musical chairs.

According to Bhagwati (1994), there are two new challenges to free trade. The first being the fact that producers become very sensitive to their foreign competitors as they gain ‘unfair’ advantage that they do not have. The fact that all producers in the world do not have to follow the same environmental regulations (e.g. proposed carbon tax in Australia) or do not have to meet the same safety standards (e.g. setting minimum wages in Mexico) are among the most common complaints today in the countries which have stiffer standards. The second consequence is that the volatility of comparative advantage will result in higher labour turnover and would impede the acquisition of skills on the job thereby flattening the growth curve of wages. Bhagwati (1994) says that these are novel reasons why trade may impact adversely on wages.

An important argument put forward by Milanovic (2002), explains that the effect of trade reform on income distribution may also depend on initial income levels. His findings revealed that at a very low average income level, it is the rich who benefit from open trade. As the income level rises, the situation changes and it is the relative income of the poor and the middle class that rises compared with the rich. In the LDCs, unskilled labour intensive sectors are protected prior to trade reforms and therefore, wages of unskilled workers are expected to decline because of trade liberalisation. Conversely, several studies on countries including Colombia, Mexico and Morocco noted that unskilled labour intensive sectors were protected prior to trade reforms and when the protection was lifted wages of the unskilled workers declined (Winters et al., 2004). This situation could also be explained using the S-S tariff theorem. Minabe (1974, p.329) has noted that:

> The S-S tariff theorem asserts that an ad valorem import tariff will bring about a more than proportionate rise in the price of the corresponding intensive factor in that industry.

From the aforementioned, it is assumed that the import tariff would increase the relative price of imports in the domestic market and consequently, the returns to the factor which is intensively used in the production of that factor would be expected to increase. Even so, Metzler (1949) pointed out, an ad valorem import tariff has two effects on the domestic price of imports. On one hand, the tariff would result in a direct increase in import price and on the other hand, the resulting decrease in demand for imports depress the foreign prices of such goods relative to the corresponding prices of export goods (terms of trade).

Therefore, whether an import tariff would increase or reduce the return to the intensive factor of the import industry (which is usually a scarce factor of production in the home country, other than in the case of Leontief Paradox) seems to depend upon the magnitude of the above-mentioned two forces. Metzler (1949) further explained that a tariff may not increase the relative domestic price of imports if the foreign elasticity of demand for the country's exports, is less than one. From these perspectives, the effects of the tariff on the distribution of income are exactly opposite to the conclusions reached by Stolper and Samuelson and therefore this is called the 'Metzler paradox'.

The evolution of income inequality due to the process of economic development has been dominated by the Kuznets hypothesis. Kuznets (1963), using cross-country data, found an inverted U-shaped relation between income inequality and GNP per capita. These findings suggest that there is a transition in income distribution from rural to an industrial economy due to urbanisation and industrialisation. Hence, income inequality should increase during the early stages of development and decrease later as a result of industries attracting a large fraction of the rural labour force. This theory has made an important contribution to the analysis of the impact of trade liberalisation on income distribution in the 20th century.

Philippe et al. (1999) noted that Kuznets hypothesis has been tested for USA and it was found that the share of total wealth owned by the ten per cent of the richest households rose from 50 per cent around 1770 to about 75 per cent around 1870, and then reversed to 50 percent in 1970. This phenomenon has also occured in OECD countries and appears to be a virtuous circle, which means lower inequality would speed economic growth and this would further result in reducing inequality. Nevertheless, Philippe et al. (1999) affirmed that this downward trend in inequality, experienced by most of the OECD economies, declined in the mid 20th century and subsequently there was a significant increase in wage inequality. Accordingly, it is clear that traditional trade models alone are inadequate in explaining international trade in the 21st century and one needs to apply new trade theory based on factors such as imperfect competition, economies of scale and intra-industry trade in analysing the issues relating to trade liberalisation and income distribution. Hanghiri and Kerr (2008, p.101) state that:

> The centre of international trade debates no longer hinges on issues such as tariffs levels, the size of the import quotas and elimination of non-tariff barriers through conversion to tariffs. Instead, current negotiations encompass broader subjects in international trade including grade and quality standard procedures, sanitary and phytosanitory regulations, rules of origin, labeling requirements, inspection procedures, government procurement, environmental standards, professional certification, and protection of intellectual property rights, public health policy, animal welfare, labour standards, and subsidisation mechanisms.

Recent studies have found that the technological change has a higher impact than trade on inequality, for instance, Jaumotte et al. (2009) found that technology is the main driver of inequality, in terms of the Gini Index. In addition, the World Trade Report (2008) noted that in the context of increasing inequality in most regions of the world, most of the empirical literature in the 1980s and 1990s focused on the question of whether trade is one of the main drivers of changes in inequality or merely one among others. Table 3.1 illustrates the trend of Gini coefficients by region from 1970-2000.

Table 3.1 Trends in Gini Coefficients by Region: 1970-2000

Years	OECD	LAC	EAP	SAS	AFR	ECE
1970	0.352	0.561	0.444	0.380	0.649	0.298
1980	0.339	0.556	0.489	0.384	0.631	0.301
1990	0.353	0.552	0.485	0.381	0.651	0.307
2000	0.368	0.572	0.520	0.334	0.668	0.428

Note: LAC: Latin America and the Caribbean; EAP: East Asia; SAS: South Asia
AFR: Africa; ECE: East and Central Europe.
Source: Dikhanov (2005)

The estimated Gini coefficients (see footnote 5) in Table 3.1 indicate that inequality has increased over the period from 1970-2000 in most of the regions, except in South Asia where it fell by about 12.1 per cent in 2000. The World Trade Report (2008) notes that towards the end of 1990s the literature on trade and income distribution converged to the view that international trade only contributed to about 20 per cent of rising wage inequality. The report therefore, emphasised that other forces such as technological and institutional innovations, demographical changes and cyclical fluctuations are more important than trade in driving changes in income distribution. Although international trade is assumed to account for only 20 per cent of rising wage inequality, it is nontheless important to research the extent to which the trade liberalisation affects income distribution in a developing region such as South Asia.

As mentioned above, one can conveniently say that trade liberalisation is likely to have a positive economic impact at the national level. However, its effects at the industry level and on the welfare of the various household groups may be quite different. Theoretically, it is understood that the industries with less protection may rapidly expand production and develop faster while those which are not strong and competitive enough, may not be able to face challenges exerted from international competitiveness. The elimination of tariffs may significantly affect government revenue in developing countries and indirectly affect each household group’s income through the transfer process either one way or another (Nguyen et al., 2005). A reduction in a government budget changes the structure of the economy and adjustments in relative prices may favour certain categories of households while hurting others. This is particularly applicable in the South Asian region where the substantial percentage of the population (see Figure 3.1) is living below the poverty line.

Although most trade models suggest that free trade will raise aggregate efficiency in the economy, such models demonstrate that a movement to free trade is likely to cause redistribution of income between individuals in the economy. The individuals who are adversely affected by trade liberalisation may lobby policy makers for protectionism. Conversely, those who are expected to gain from free trade will not favour protectionism. It is possible, using an appropriate compensation policy to redistribute income from the winners to losers in such a way that in the long run every individual will gain from free trade (Suranovic, 2006). Economists (e.g. Dixit et al., 1986) suggest that instead of enforcing barriers to free trade, it is the duty of the policy makers and the government officials to decide appropriate compensation policy to address the issues arising from income disadvantage of the ‘losers’. For instance government can formulate such compensation policies to facilitate short-term support to affected industries until revenues recover and can also provide temporary income for smoothing consumption of most vulnerable households in the short-term to allow them to adjust to the shock provided by employment or income loss.

In order to implement such policies, one needs to carefully identify who are the winners and losers of such trade reforms. Therefore, it is important to use an appropriate methodology, which is capable of assessing the economy-wide impacts of trade liberalisation on poverty and income distribution. The next section reviews the empirical approaches that have been used to scrutinise the connection between trade liberalisation and poverty.

3.3 Empirical Approaches in Analysing Trade and Poverty Linkage

There has been difficulty in establishing precise links between trade reforms and the impact on poverty. One reason is that trade reforms affect individuals in diverse ways including employment, redistribution of resources, change in prices of consumer goods, government revenue and expenditure (Winters et al., 2004). As already discussed in Section 3.2, the classical theoretical models of international trade support the argument that trade liberalisation stimulates long run growth and reduces income disparities across countries. There is no suggestion that trade liberalisation is harmful for growth (Fiestas, 2005). Different empirical approaches using single-country to cross-country data have provided greater insights into the link between trade liberalisation and poverty.

Reimer (2002), in a literature survey of thirty-five studies, pointed out that most research on trade liberalisation and poverty focused on the analysis of one or two of the aforementioned trade reforms on individuals. These studies considered the consumption side of the trade poverty relationship. Reimer also emphasised the importance of factor market effects, as households tend to be much more specialised with regard to factor earnings (that is, income derived from productive factors such as labour, capital and land) than they are with regard to consumption.

Reimer (2002) noted that these studies may take various dimensions: micro-simulation (representative households or actual households), static or dynamic, single or multi-country and partial or general equilibrium. Reimer proposed four main approaches that could be used to analyse the trade/poverty relationship namely; cross country regression, partial equilibrium or cost of living analysis, general equilibrium models based on Social Accounting Matrix (SAM) and micro-macro synthesis.

i. Cross Country Regression

Dollar and Kraay (2004) used cross-country regression analysis to determine if free trade accelerates economic growth. A group of countries with large tariff reductions and a high trade to GDP since 1980s (globalisers) were sampled. A positive link has established between the change in trade volume and growth rates. Dollar and Kraay observed that the income of the poorest household groups of society increases as a consequence of economic growth; hence free trade is seen as beneficial to the poor. Krisha et al. (2010) also used cross-country analysis using a sample of countries in South Asia (Bangladesh, India, Nepal, Pakistan and Sri Lanka). Countries with a smaller proportion of their populations experience greater reduction in poverty rates following trade liberalisation.

In contrast, Alan (1999) pointed out that the effectiveness of free trade depends on its policies in the short run and long run. In the short run, trade liberalisation puts great stress on certain actors in the economy and in the long run free trade may lead some individuals into poverty. He therefore cautioned developing countries contemplating access to free trade to carefully examine their policies before implementing free trade measures. In a similar vein Rodrik (2000) questioned the appropriateness of measurements used to estimate the relationship between trade policy, economic growth and poverty. A further issue is the selection of endogenous variables that could occur due to availability of limited data. This is because, as trade reforms may affect growth through many channels (e.g efficiency gains, terms of trade effect), it is difficult to develop a single, universal measure that includes all aspects of how trade affects growth.

Although there are limitations in the cross-country regression method, Reimer claimed that this method has its own advantages in investigating links between trade liberalisation and poverty. One of the advantages is the use of traditional statistical tools for testing hypotheses rather than making predictions where results can be more general than country specific in single country simulation models. Moreover, this method may be used to analyse dynamic aspects of trade reforms rather than static simulation models.

ii. Partial Equilibrium or Cost-of-living Analysis

Partial equilibrium analysis is a way of obtaining an estimate of the impact of a change in the economy that does not require the complete solution of a new equilibrium system (Whalley, 1975b, p.301). Partial equilibrium models use household expenditure data to measure poverty. Most of the studies are regarded as micro-simulation models where analysis is based on the behaviour of individual households as opposed to representative households. These micro-simulation models can sometimes be used in conjunction with general equilibrium models. An example of this can be seen in Cockburn's (2001) study on Nepal. Other examples are discussed in section 3.4.

Levinsohn et al. (1999) and Friedman and Levinsohn (2002) followed a representative household approach. They attempted to estimate the impact of a change in prices on poor households in Indonesia due to the economic crisis in 1997. They used a Laspeyres cost of living index and compared these calculated values across different household groups, for example, urban/rural locations, household size, income and education. Their findings suggest that, regardless of the locations, low-income households experienced a large increase in cost of living and were most vulnerable to the external shocks.

Reimer argued there were two main drawbacks of this study. Firstly, the study focused only on the consumption side of the crisis and did not consider the factor market effects in analysing issues relating to income distribution. Secondly, the study did not consider the other effects such as natural disasters (e.g drought and widespread forest fires) that occurred during the same period.

Minot et al. (2000) also used partial equilibrium analysis to investigate trade and poverty issues in relation to rice market liberalisation in Vietnam. They adopted a descriptive analysis by collecting information from a market survey covering rice producers, traders and other market participants, as well as estimating household demand behaviour using the Vietnam Living Standard Survey, which included 4800 households. In addition, Minot et al. used Foster-Greer-Thorbecke (FGT) poverty index to estimate poverty using rice as a labour intensive product in Vietnam. The results indicated that a rise in rice prices would lead to increase in demand for agricultural labour, thereby improving income of rural poor and reducing poverty. The main assumption of this study is that the factor demand and the wage rate is constant, therefore limiting the analysis of the link between increases in rice prices and poverty.

Limitations of partial equilibrium analysis can arise as a result of either restrictions in scope or assumptions made when undertaking the study. However, partial equilibrium or cost of living analysis is a useful method of analysis when there are a limited number of markets, there is a need to incorporate detailed household survey data, and if there are time constraints.

iii. General Equilibrium Models based on Social Accounting Matrix (SAM)

In addition to the single industry or single factor limitations alluded to above, the partial equilibrium approach has limited scope to handle issues relating to poverty and income distribution because trade reforms affect the output and the prices of many industries in the economy. Consequently, general equilibrium analysis is the favoured approach in addressing poverty issues in developing countries. General equilibrium models can be used to assess the impact of economic shocks across sectors and regions within the country or other countries in the world.

In analysing poverty, a CGE model can be calibrated using SAM data as a comprehensive and disaggregated snapshot of the socioeconomic system during a given year. CGE models are generally based on neoclassical theories where households, firms and the other economic agents behave optimally to achieve equilibrium in the economy. Although most of the CGE models are static in nature, dynamic versions of these models are used to address poverty. Section 3.4 provides examples of CGE models that have been used to analyse the impact of trade liberalisation on poverty in developing countries.

iv. Micro-Macro Synthesis

Micro-Macro synthesis is carried out in a two-fold manner. Firstly, a CGE model is simulated to get the commodity and factor price changes and secondly price changes are fed into a framework that calculates the impact of trade liberalisation on poverty based on highly disaggregated representative households. This enables the use of various poverty measures such as the FGT poverty index to analyse the distributional effects of the shocks.

Micro-Macro synthesis is similar to poverty analysis in a partial equilibrium/cost of living framework except the latter considers only price changes in consumer goods and is based on real world observations rather than from counterfactual simulations. Examples of studies that have adopted micro-macro synthesis are Robilliard et al. (2003), Hertel et al. (2001), Ravallion et al. (2002) and Nin et al. (2003).

Hertel et al. (2003) used seven countries (Indonesia, Philippines, Uganda, Zambia Brazil, Chile, and Thailand) to examine the effects of global trade liberalisation on poverty. The CGE model was designed to capture factor market effects in addition to incorporating commodity market and terms of trade effects. In the instance the GTAP model was simulated to generate a vector of factor and commodity price changes due to policy experiments for 14 regions in the world. As the GTAP database is designed for broad country coverage and limited to one representative household per region, this analysis was not suited to investigating poverty issues. Therefore, these price changes were fed into a post-simulation analysis framework incorporating households’ income and consumption profiles based on International Comparison Project (ICP) data and household survey data for the seven developing countries. The findings suggested that, multilateral trade liberalisation will reduce overall poverty in Indonesia, Philippines, Uganda and Zambia, but increase overall poverty in Brazil, Chile and Thailand. It further revealed that within countries/regions the results vary considerably for different household groups.

According to Reimer (2002) the main limitation of this approach is its failure to transmit back the reactions of the households to a change in commodity and factor prices from the post simulation analysis to the general equilibrium model. However, Nin et al. (2003) argued that micro-macro synthesis is regarded as a relatively recent approach and appears to be especially suited to the analysis of the impact of trade liberalisation on smallholder producers.

Reimer (2002) categorised the aforementioned four methodologies used to analyse the trade and poverty relationship into two main approaches (“top-down” and “bottom-up”). The “top-down” approach tries to trace the link from the macro to micro level by generally incorporating additional linkages between trade and poverty, such as factor earnings and terms of trade effects. Whereas, the “bottom-up” approach attempts to capture complexities at micro level, which builds on detailed survey information and emphasises the heterogeneity of individual households as well as commodity market linkages between trade and poverty. The general conclusion of Reimer’s survey is that any analysis of trade and poverty needs to be informed by both the bottom-up and top-down perspectives.

McCulloch and Calandrino (2002) suggested three empirical approaches that could also be used to examine the relationship between trade and poverty: the descriptive or qualitative approach, the database approach and the modelling approach. Naranpanawa (2005) described the qualitative approach as useful in analysing the historical pattern of executing trade policy and the evolution of incidence of poverty over the period concerned. This approach has the advantage of explaining the nature of trade reform processes and the welfare status of implementing such trade reforms during the same period.

The limitation is that it does not provide evidence of a scientific link between trade liberalisation and poverty or a mechanism for testing any theoretical hypothesis of this relationship. A database approach provides a more productive framework than the descriptive approach by enabling the researcher to empirically test the theoretical hypothesis of the link between trade liberalisation and poverty based on empirical data. Though this approach allows testing of the above-mentioned hypothesis, the validity of the results is constrained by the availability and other limitations in data and also ignores a number of qualitative factors (e.g. cultural factors) in testing the hypothesis. This approach is also difficult to use in forward-looking policy projections.

In the case of a modelling approach, the models are constructed based on well-defined theoretical frameworks and can be used to estimate the parameters on the basis of using actual data. The main advantage of using this approach is its ability to undertake "what if" analysis that predicts likely outcomes after implementing the policy reform. Therefore, this method can be used to analyse forward-looking policy projections as opposed to a database approach. Building a model has the advantage of giving a modeller more flexibility to incorporate different types of linkages that exist between trade liberalisation and poverty by introducing different functional forms into the model. McCulloch and Calandrino (2002) mentioned that the modelling approach consists of different models mainly based on the point of focus. For instance, the models can be built based on a geographical focus (multi-country/global or regional models), sectoral focus (single sector/multiple sectors) and they can be static (counterfactual analysis) or dynamic (models that allow the determining of a time path by which a new equilibrium is reached). Models can also be built based on household disaggregation where highly aggregated or disaggregated households exist.

3.4 Poverty Focused CGE Applications in Developing Countries

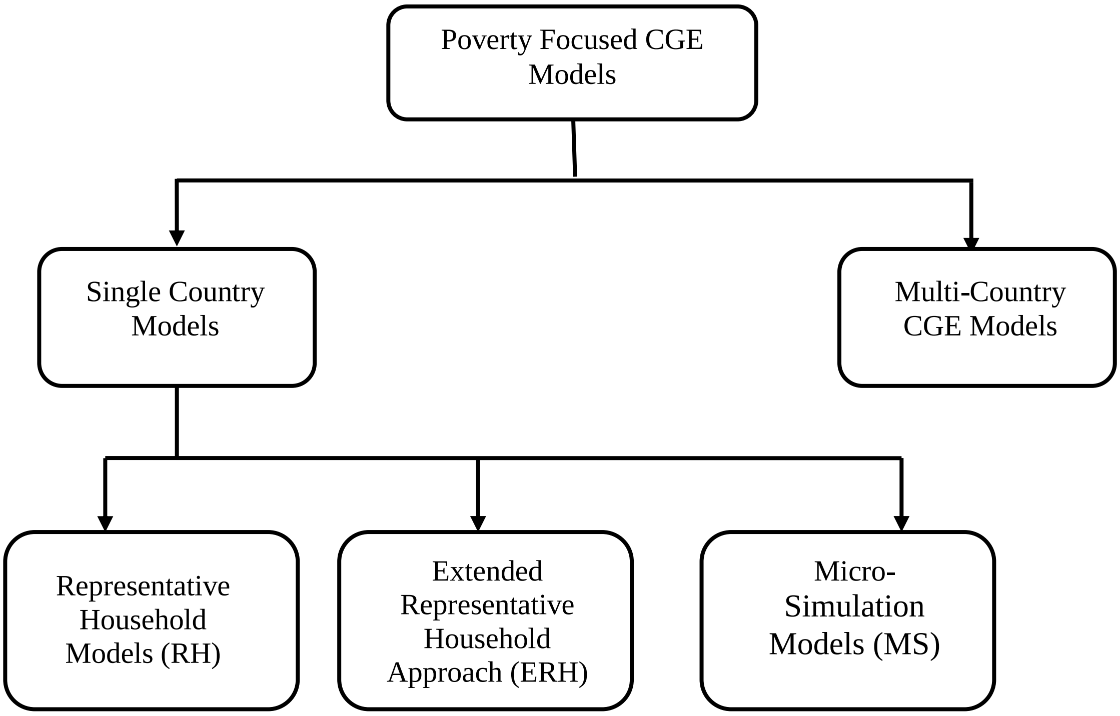
Previous section highlights that the relationship between trade reforms and poverty is a complex issue. Hence, one needs to carefully consider the appropriate method selected to examine this relationship. To date, CGE models have been the most popular empirical tool used to assess the impact of trade liberalisation on income distribution and poverty as they are able to incorporate various channels through which trade reforms may affect the poor. The pioneers of CGE modelling in developing countries are Adelman and Robinson (1977) who developed a model for South Korea to analyse the impact of trade reforms on household income. Others followed their work including Taylor and Lysy (1979) for Brazil, Dervis et al. (1982), and Bourguignon et al. (1983) for Venezuela. In the 1990s, poverty focused CGE models constructed by Thorbecke (1991), de Janvry, et al. (1991) and Morrisson (1991) provided significant contributions to the CGE literature. All these studies followed a similar approach, combining real and monetary dimensions in a CGE context to analyse the impact of macroeconomic shocks on income distribution

(Boccanfuso et al., 2002). The late 1990s saw the emergence of new ways of analysing poverty using the CGE models as a key objective of the research. As Thorbecke (2001, p.2) notes:

> The fundamental reason for analysing and measuring poverty within a general equilibrium framework rather than a partial equilibrium framework is that interaction and interdependence within a socioeconomic system matters as does the prevailing structure of the economy. Policy measures and shocks have direct effects on sectors of production, institutions (such as different socioeconomic groups and firms) and factors of production. However, indirect effects of policies and shocks are often as, or more, important as direct effects.

As mentioned before, poverty is multidimensional and extremely complex issue. Hence, in order to understand its causes, it is important to analyse the underlying economic and social circumstances and the processes (World Bank Development Prospects Group, 2004). Winters (2002) identifies several key connections that exist between trade reforms and poverty, namely; the price and availability of goods, factor prices, income, employment, government transfers influenced by changes in revenue from trade taxes, incentives for investment and innovation, which affect long-run economic growth, external shocks due to changes in the terms of trade and short-run risk and adjustment costs. As noted in Section 3.3, most poverty-based studies consider the consumption side of the trade–poverty linkage. However, the impact of trade reforms could reach households through channels such as change in product prices, factor payments and government transfers in the short and medium term, and adjustments to investments and capital accumulation in the long run. The classification of poverty focused CGE models is illustrated in Figure 3.2.

Figure 3.2 Classification of Poverty Focused CGE Models



Source: Adopted from Naranpanawa (2005)

As indicated in Figure 3.2, CGE models can be developed as single-country or multi-country models. Section 3.4.1 discusses the applications of single-country CGE models and different approaches that could be followed in analysing poverty issues. The poverty focused multi-country and global CGE models are presented in Section 3.4.2.

3.4.1 Single Country CGE Models

Single-country CGE models are designed to examine a single economy and are suitable to analyse issues concerning resource allocation and income distribution. This is done within a national economy faced with exogenously given world market conditions. Furthermore, single-country CGE models are typically used to analyse the impact of unilateral trade liberalisation on the economy while multilateral trade liberalisation scenarios are more appropriately dealt within a multi-country or global CGE modelling framework. Two widely used examples of single-country models are ORANI (Dixon et al., 1982) and the World Bank model (Dervis et al., 1982).

Filho and Horridge (2004) and Savard (2005) provide useful applications and discussions on income distribution and poverty within a CGE modelling framework. Applications of CGE models in poverty analysis can be classified into three main categories, depending on how households are integrated into the CGE model (Sothea, 2009). They are (1) the standard representative household (RH) approach, (2) the extended representative household approach (ERH), and (3) the micro-simulation (MS) approach.

a) Representative Household Models (RH)

Most of the pioneering single country CGE models dealing with poverty and household income were based on the RH approach. These models are designed by disaggregating the household sector into several groups assuming that a representative agent from a particular group will constitute the behaviour of the whole group (Naranpanawa, 2005). Accordingly, in the RH approach, poverty analysis is conducted by using the fluctuations in expenditure or income levels of the RH which will be generated by the model in conjunction with the household survey data. Sothea (2009) pointed out that the RH approach is a traditional method and easy to implement. However, the main limitation of this model for income distribution and poverty analysis is that there are no intra-group income distribution changes because all households are aggregated into a single representative entity.

Agénor et al. (2004) attempted to compare three approaches to linking RH macro models with micro household income data in terms of their implications for measuring the poverty and distributional effects of policy shocks. These three approaches are a simple micro-accounting method, an extension of that method to account for changes in employment structure, and the Beta distribution approach. Agénor et al. formed the representative household groups according to their education level (skilled and unskilled), their location (rural and urban), and their sector of employment. They evaluated these three methods by performing a set of simulations with Mini-IMMPA (Integrated Macroeconomic Model for Poverty Analysis), a disaggregated dynamic CGE model that can be readily linked to household survey and labour market policies. The authors further used the FGT index to measure poverty and the Gini coefficient and the Theil index to measure inequality. Their findings were that these three methods generated similar results in absolute terms. However, the measurement of distributional and poverty effects of policy shocks are significantly different under each policy scenario considered in the research.

Bourguignon et al. (2003) applied the RH approach and micro-simulation approach in modelling inequality. Results from their study indicate that the RH and micro-simulation approaches can give quite different estimates of the distributional effects of macro-economic shocks and policy changes. For instance, in analysing the effects of devaluation on household income using these two approaches, it was revealed that the results have different signs. This means that the micro-simulation approach points strongly towards the unequalising effect of devaluation due to reduction in foreign savings, whereas the RH approach predicts a slight improvement in the distribution of real household income due to the same effect. Bourguignon et al. gave two reasons for differences in the results, firstly the micro-simulation approach takes into account changes in occupations of households as an important source of actual changes in the distribution of income; a factor which is absent in the RH approach. Secondly, the micro-simulation approach explicitly accounts for heterogeneous consumption behaviour within the group (intra group) whereas RH approach only accounts for inter-group inequality.

Savard (2004b) also constructed three simple CGE models with RH and micro-simulation (top-down/bottom-up) approaches to investigate whether the two approaches produce compatible results when they are used in the context of poverty analysis. Savard constructed these three simple models by adding some heterogeneity from one to the other with the objective of verifying changes in results produced by the two approaches. The results of the poverty analysis based on the two approaches were found to be dissimilar.

The common observation by those who have used RH based CGE models is that, these models do not account for intra-group heterogeneity, and cannot provide much insight into the analysis of the impact of exogenous shocks on income distribution.

a) Extended Representative Household Approach (ERH)

The basis of the ERH approach is to capture the distributive impacts by extending the disaggregation of the representative households in order to identify as many household categories as possible corresponding to different socio-economic groups. Essama-Nssah (2005) noted that there are different ways of extending RH. One is to model within group size distribution where poverty analysis requires the specification of the size of a well-known distribution such as lognormal, Pareto or

Beta functions (Dervis et al., 1982 and Decaluwé et al., 1999). Alternatively, the data that have been directly drawn from a household survey can be used to represent the size distribution of economic welfare, which is consistent with the micro-simulation approach. The main advantage of using this approach is that it provides much information on inter-group income distribution (Ravallion et al., 2004 and Bourguignon et al., 2003). Therefore, this method is better suited to capturing absolute poverty in comparison to the first approach.

Essama-Nssah (2005) adopted the ERH approach to illustrate how the Lorenz curve can help to link an extended functional distribution to measure the distribution of economic welfare in analysing the poverty impact of macroeconomic events. Inequality and poverty measures can be computed from a particular level of income or expenditure, the associated density function, and a poverty line (for poverty measures) (Essama-Nssah, 2005). Furthermore, Ravallion et al., (1991) and; Datt (1992, 1998) used the Lorenz curve to simulate the poverty implications of macroeconomic events based on their assumed impact on the mean of the distribution. These models assume that the mean of the income distribution could be determined endogenously while its variance remains fixed or is determined exogenously. Accordingly, once a comparative static simulation has been carried out, a new mean income for each representative household is generated within the model. Since the variance remains fixed, the household income distribution will shift either to right or left after the policy shock, depending on the extent to which the mean income changes, while the shape of the distribution remains unchanged. Therefore, this approach limits the analysis of the distributional impact of shocks and policies to their effects on the mean welfare within that number of representative socioeconomic groups.

Decaluwé et at. (1999) built a CGE model of an archetype African economy using the ERH approach and incorporating poverty dimensions. The model was developed with additional features compared with a conventional CGE model by incorporating a more flexible income distribution function (Linear Expenditure System demand function), intergroup distributions, so as to conform to different socioeconomic characteristics of the group, and adding a poverty line which could be endogenously determined within the model. The Beta distribution function was used to introduce the characteristics of the household groups into the income distribution. The authors considered that, unlike lognormal, the Beta function is more flexible in analysing household income distribution. These distributions can be used to evaluate the poverty incidence within each group in a general equilibrium framework. This idea was expanded by Huppie and Ravallion (1991) and Ravallion and Chen (1997) in the case of Indonesia's adjustment process from 1984 to 1987. It was found that inequality falls during the high economic growth period in developing countries and it is unlikely that the distribution neutrality prevails following policy shocks due to negative growth (e.g during the Asian financial crisis of 1996). Probing beneath the surface, Dervis et al. (1982) noted that complete endogenisation of intra-group income distributions following policy shocks remain the biggest challenge in analysing income distribution in a general equilibrium framework.

Thorbecke and Azis (2001) constructed a CGE model for the Indonesian economy to analyse the effects of the Asian financial crisis in 1996. The model contains a detailed financial sector and a poverty module similar to the CGE model of the African economy (Decaluwé et at., 1999). They also attempt to endogenise the urban to rural migration that occurred during the crisis period from 1997 – 1999. In addition, a detailed income distribution analysis was undertaken using household survey data with a total sample of about 250,000 households. The poverty measurement index, such as FGT, was used to assess the impact of a given sectoral output change on poverty alleviation by calculating a poverty headcount ratio and poverty gap. The results indicated that the intra group income distribution for seven Indonesian socio-economic household categories were very similar after the crisis in 1999 compared with the crisis of 1996.

Most studies, such as those discussed above, did not attempt to make comparisons between different functional forms, such as lognormal, Pareto or Beta function. One study to do so, Boccanfuso et al. (2002) compared six alternative functional forms to model within-group distributions and concluded that no single form is more appropriate in all cases or groups of households. Where detailed disaggregation is required, they advocated the use of flexible functional forms such as the Beta function which allows the distributions to be negatively or positively skewed depending on the analysis. This is also the conclusion of Decaluwé et al. (1999, 2000) where they argue in favour of placing the Beta distribution on top of the others in analysing household income distribution. The unique property of the Beta function to skew the distribution left or right makes it more flexible in representing the types of intra-category income distributions. Because of this high degree of flexibility, the assumption of Beta distributions may be a preferred choice in analyzing household income distribution in a real country case. Boccanfuso et al. (2003) underscored the difficulty of using restrictive functional forms as distribution could change before and after simulations, and large variations in poverty indices may arise depending on the functional form employed.

b) Micro-simulation (MS) Models

For the past 20 years, MS models have been increasingly applied in qualitative and quantitative analysis of economic policies. Orcutt (1957) laid the foundation for MS models and Orcutt et al. (1961, 1986), Atkinson and Sutherland (1988), Merz (1991), Citro and Hanusheck (1991), Harding (1993) and Gupta and Kapur (2000) built on it. MS models can be simulated to analyse the impact of trade reforms on economic agents (e.g. households, firms) at the individual level. Since the early 1980s' there has been an increase in the use of MS as a consequence of the availability of large datasets on individual agents and improvements in computing technology.

Bourguignon and Spadaro (2006) point out that the MS technique is useful in analysing economic policies in two ways. Firstly this method fully takes into account the heterogeneity of the behaviour of economic agents (e.g. households) observed in micro data, unlike the RH or ERH methods, which only work with typical households (actual/real households) or typical economic agents. Although RH and ERH methods can provide a general conclusion in relation to the consequences of the trade reforms on household income distribution, they can hide unexpected effects from certain combinations of individual characteristics that are not captured through typical household groups considered in the model. Hence, MS models are superior to RH and ERH as the models allow for the incorporation of thousands of actual economic agents rather than few hypothetical groups. Therefore, this avoids the difficulty in identifying the clear winners and losers, which is crucial in evaluating the overall welfare effects of implementing a trade reform. Secondly, MS models can evaluate the aggregate costs and benefits of new trade reforms. Individual level results obtained from the model can be aggregated at the macro level, which allows the policy maker to evaluate the overall impacts, for instance the impact of the trade policy on government revenue.

Dixon et al. (1995) and Meagher (1996) incorporated a MS model with a partial equilibrium framework in the 1980s. Others have subsequently attempted to use MS models by fully integrating households into a CGE model (Cogneau et al., 2000; Decaluwé et al., 1999; Cockburn, 2001; Savard, 2003, 2004; Bourguignon and Spadaro, 2006). The use of CGE models, complemented with household survey data, is now recognised as well suited to identifying the mechanisms by which macro-economic shocks affect poverty and income distribution (Winters et al., 2004; Hertel and Reimer 2005). Most studies have developed static MS models; however a few have developed dynamic MS models (e.g. Annabi et al., 2005 and Selim Raihan, 2010).

There are two approaches in incorporating households into a CGE model (Naranpanawa, 2005) namely, integrated MS models and micro-macro models. These two approaches are identified on the basis of the way that households are integrated into the CGE model and the mechanism used in connecting MS and the CGE models. Integrated MS models attempt to incorporate all individual households from a household survey directly into a CGE model, unlike the RH and ERH approaches. Therefore, these models enable explicit analysis of poverty impacts of macro-economic shocks on each household. Hence, this method avoid the limitations in RH and ERH approaches, since individual household behaviour and income distribution is directly captured without using any functional form, such as lognormal or Beta function.

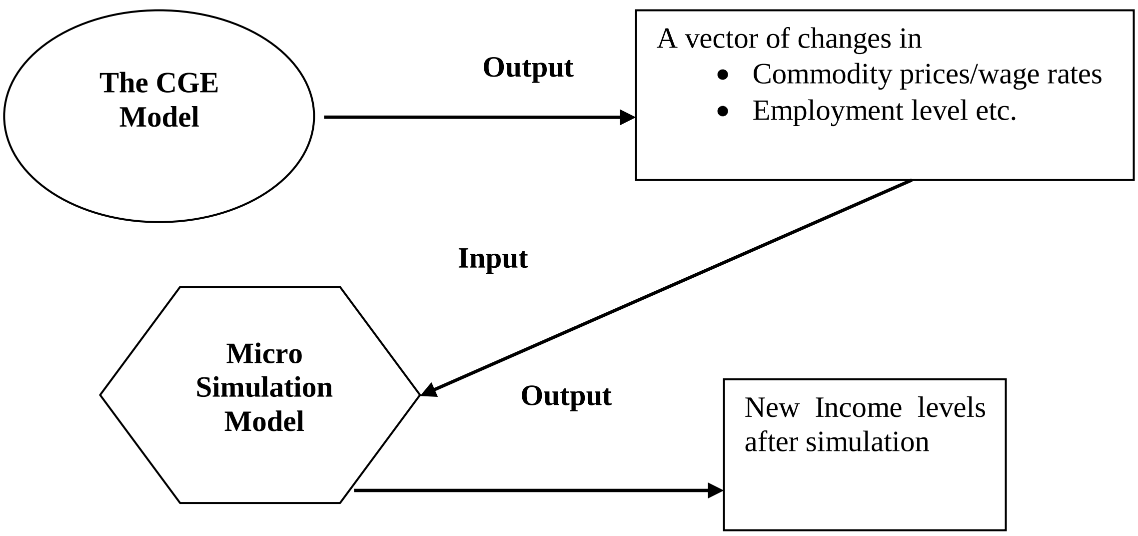
Cockburn et al. (2010) noted that constructing an integrated CGE-MS model is technically straightforward as the modeller merely integrates every household from a nationally representative household survey rather than incorporating representative household groups. In these models therefore, each household (all are actual households) has an income and expenditure vector and all the other regular assumptions of the basic CGE model can remain unchanged. The only notable change in modelling is defining the code to increase the number of households in the set describing household activities, while the simulations could be carried out in the same manner as in standard CGE model. In order to implement an integrated MS model, it is necessary to prepare the database in a standard SAM framework and to obtain data from a nationally representative household survey with complete information on household income and expenditure. It is also necessary to prepare the survey data to establish a link and consistency with SAM which is used to implement the CGE model. The resulting policy shock would alter the individual household's income through change in product prices, factor prices and transfers to/from the government. By utilising these newly generated household incomes, new income distributions for different household groups could be estimated and therefore this process completely endogenises the household income distributions by estimating the mean incomes and variances. In this case, depending on the simulation, the mean household income would shift either to the right or left while the shape of the distribution also changes as a result of change in the variance. Hence, this approach could capture intra-group income variability explicitly in comparison with the other two approaches. Cockburn et al. point out that this approach provides a better tool in analysing the impact of trade liberalisation on poverty in a CGE framework.

Cockburn (2001) used a similar approach to investigate the impact of trade liberalisation on poverty in Nepal. The study constructed a CGE model that explicitly incorporates all households (3373 households) from the Nepalese Living Standards Survey (NLSS), which is a nationally representative household survey. Since this method integrates all the households into the CGE model, it avoids the representative agent hypothesis. In this model households are characterised primarily by their source of income and their consumption patterns, which in turn determine how individual households are affected by the external shocks. The simulation results illustrate that trade liberalisation has quite complex poverty and distributional impacts which can be properly identified in this type of micro simulation model. The findings suggest that urban households substantially gain from trade liberalisation as initial tariffs were highest in agricultural sectors. Furthermore, it was noted that poverty falls in urban areas and increases in rural areas, particularly among the moderately poor. Hence it is concluded that the strength of the impacts increases with the level of income and this is also true when observed at the highest income levels. Typical examples of this can be seen in the Savard (2003, 2004); Cororaton and Cockburn (2006); Bourguignon and Spadaro (2006) where the MS approach was integrated within a CGE model.

The micro-macro modelling approach is similar to that discussed in Section 3.3 under Micro-Macro synthesis, where a general equilibrium simulation is coupled with some form of post-simulation analysis based on household survey data. Under this approach there are two distinct models namely; a CGE model to assess the impact of trade policies on the economy at large and a MS model to assess the impact of trade reforms on household income and poverty. Both models are treated separately and the linking of the two is carried out consecutively.

Filho and Horridge (2004) explained that the main advantages of the two-model (CGE and MS) approach are that the scaling of the microeconomic data to match the aggregated macro data can be avoided. Additional households can be accommodated in the MS model, and may incorporate discrete-choice or integer behaviour that might be difficult to incorporate into the CGE model. From this viewpoint, the CGE model is simulated to obtain values for changes in prices of commodities, wages, total employment and other important macroeconomic variables due to trade liberalisation. Microeconomic characteristics of the labour market, household consumption and income are modelled using a MS model based on household survey data. The parameters of the MS model are estimated econometrically by employing a method such as regression analysis. This procedure is known as a 'top-down' approach due to the sequential fashion in generating results from a CGE model to a MS model. This is illustrated in Figure 3.3 below.

Figure 3.3 The Top-Down Approach



Source: Adopted from Colombo (2008)

Colombo (2008) points out that the basic difficulty of this approach is to ensure consistency between the micro and macro levels of analysis and therefore, it is suggested that one could introduce a system of equations to ensure the achievement of consistency between the two models. On the other hand, one can observe that there is no mechanism to transfer feedback from the MS model to the CGE model.

Verikios and Zhang (2010) notice that there are only a few micro-macro modelling applications in Australia and the the earliest Australian example is provided by Meagher and Agrawal (1986) in which output from a CGE model was used to reweight the 1981–82 National Income and Housing Survey. Their approach was updated by Dixon et al. (1996), who undertook pioneering work in this area by linking a CGE model to either a static or a dynamic MS model. They are the original contributors to the MONASH dynamic model of the Australian economy, which is regarded as superior in comparison to other MS models since this model can be implemented in a dynamic mode (Naranpanawa, 2005). Polette and Robinson (1997) used the 'top-down' approach to link an aggregated version of the MONASH dynamic CGE model to a MS model of the Australian income support system. Filho and Horridge (2004) developed a CGE and MS model for Brazil with a feedback mechanism from the MS model to the CGE model to overcome the above-mentioned limitation. The CGE model is a static inter-regional model of Brazil and the MS model is based on the household survey data. In this case, the models are run sequentially, with consistency between the two models assured by constraining the micro simulation model to ensure consistency with the CGE model.

Another good example for this type of model is CGE-MS model for South Africa by Herault (2007). This is a static CGE-MS model used to ascertain the new labour market choices after changing individual characteristics, such as earnings as a result of changes in macroeconomic variables of policy shocks estimated by the SAM based CGE model. The South African MS model is based on two household surveys: the Income and Expenditure Survey (IES) of 2000 and the Labour Force Survey (LFS) of September 2000, which was comprised of micro data for 26,000 households. Herault used a regression model to predict earnings of each labour market category (inactive, unemployed, subsistence agricultural worker, informal worker and formal worker) and this regression model was used to compute change in real net income of the individual households due to policy shocks estimated from the CGE model. Since the CGE model contains macroeconomic data and the MS model contains micro data the two sets of numbers are not automatically consistent and in a 'top-down' approach, the macro outcomes are imposed on the micro model. Therefore, the coefficients of the MS model need to be modified to reproduce the macro numbers obtained from the CGE model, while allowing the price and factor returns to change according to individual behaviour. This can be achieved by applying micro-macro consistency equations, which also ensure better interaction between the two models. This procedure would also overcome the limitation discussed above, arising from the absence of feedback effects from the CGE model to the MS model.

Selim Raihan (2010) developed a 'top-down' dynamic CGE-MS model for the Bangladesh economy. The model has an investment demand function, which determines the pattern of reallocation of new investment among sectors after any policy shock according to the rate of return to capital and its user cost. Further, the labour supply increases at an exogenous rate, which is equal to the population growth rate and the labour force growth rate. The poverty and welfare effects of different policy shocks are estimated using the Bangladesh Income and Expenditure Survey

(HIES) 2005, which included a total of 10,047 households. The dynamic CGE model is shocked to obtain values for changes in consumption for each household group and then this new consumption vector is applied to the MS model, which contains individual households from the Bangladeshi household survey. The poverty effects were measured using FGT poverty index. The findings suggest that there are significant differences between the short-run and long-run impact of trade liberalisation on rural and urban poverty in Bangladesh. The short-run impacts indicate welfare reductions and increasing poverty whereas, in the long-run resources are allocated from less efficient sectors to more efficient sectors, hence generating positive outcomes in terms of welfare gains and poverty reduction. Other studies have developed CGE-MS models using multi-country or global models to address the impact of trade liberalisation on household income and poverty. These studies are briefly discussed in the Section 3.4.2.

3.4.2 Multi Country CGE Models

Multi-country or global CGE models are the most favoured approach to analyse the issue of trade liberalisation on household income distribution and poverty (Antoine Bouët, 2008). This is because these models offer a complete structure to simulate the general impact of trade liberalisation on a national economy in the short-run and long-run perspectives. In addition, these models are more suitable in analysing the impacts of multilateral trade liberalisation, e.g. forming a customs union on a particular country as the model can link major trading partners with the rest of the world. Hence, the impact of trade liberalisation is likely to be assessed more realistically in multi-country models than by using single country models.

Multi-country CGE models differ widely from single country CGE models in terms of country and commodity coverage, assumed market structures, policy details and specification of macroeconomic closure. Furthermore, in the case of multi-country CGE models, the assumption of exogenous trading partner effects, embodied in single country CGE models, are no longer maintained (Naranpanawa, 2005) and therefore, the effects which are coming from the trading partners and the rest of the world can be treated as endogenous in these models. The majority of multi-country CGE models have used well-known databases and modelling software for developing global multilateral general equilibrium trade models through the GTAP.

The GTAP was established in 1992 and is used by a global network of researchers and policy makers conducting quantitative analysis of international trade and development issues, poverty analysis, service liberalisation and foreign direct investments, climate change and the environment. The purpose of developing GTAP is to improve the quality of quantitative analysis of global economic issues within an economy-wide framework. However, in its present form, the GTAP database has only one representative household and, therefore, researchers are of the view that, without extending the database, this database is not suitable for analysing income distribution and poverty issues. Hence, the use of the GTAP database for poverty impact analysis is crucially dependent on the quality of the database extension for such analysis (Evans, 2001). Eventhough, the GTAP model is static in its original form, there have been attempts to develop dynamic versions of the GTAP model. As the main focus of the present research is to develop a multi-country CGE model for South Asia by extending the GTAP database, it is important to briefly examine the methodology of some poverty-focused multi-country or global CGE models based on the GTAP database.

Ianchovichina et al. (2002) used the GTAP (version 5) model to simulate the effects of trade liberalisation on Mexican households by using a two-step computational procedure. At first, the comparative-static multi-regional GTAP model was simulated to generate price changes in the commodities and these were subsequently applied to the household survey data in order to assess the effects of the policy simulation on poverty and income distribution. The simulation results show that, in general, the impacts of tariff reform on household welfare is positive for all the expenditure deciles with poor households benefiting more than richer households.

However, Ianchovichina et al. (2002) point out that there are certain limitations in this methodology namely:

- The analysis does not consider changes in occupational choices in response to change in prices, that is, price changes are uniform across all income groups.
- The results reflect only medium and long-run effects and do not indicate what would happen in the short-run.
- The GTAP does not account explicitly for the adjustments in the labour markets and therefore, the results might underestimate the increase in wages as result of trade reforms.
- The methodology employs a static CGE model and hence, it ignores dynamic impacts of the trade reforms.
- The GTAP model does not have a detailed treatment of the public sector and, therefore, the alternative fiscal policies could not be considered; instead the model determines changes in taxes on income and spending.

- In undertaking the research, the authors used income elasiticities from the GTAP database and, therefore, income elasiticities of average consumer across countries are assumed the same.

As discussed in Section 3.3, Hertel et al. (2003) used the GTAP model to analyse the impact of multilateral trade liberalisation on household earnings in developing countries by integrating household strata according to income categories. By stratifying households according to earnings specialisation, the authors were able to capture a great deal of the diversity relevant to trade policy impacts while maintaining the analytical flexibility and comparability across countries. Another important contribution of this research was the introduction of an econometrically estimated demand system (MS framework), capable of providing a unique poverty level of utility, that could be used as an benchmark for evaluating changes in poverty rates using different poverty measures, such as an FGT poverty index.

An alternative way of undertaking poverty studies using the GTAP database is extending the database according to the SAM framework. Evans (2001) used the SAM framework in designing the database for his multi-country model to identify the winners and losers in Southern Africa from global trade policy reforms. The database is designed in such a way that the dataset is relatively disaggregated for the seven Southern African countries and the dataset is highly aggregated to the rest of the world. In this case the household sector of the GTAP database is disaggregated especially for Zambia using SAM for four types of households for post-simulation calculations of the impact on the disaggregated net income paid to the disaggregated households. Evans points out that in this way, country models can be linked into a global model using the GTAP dataset by using a common sectoral classification to complete the bottom-up strategy for analysing trade and poverty impacts. Finally, household survey data for Zambia was used to link income changes to changes in poverty headcount index using the National poverty line for extremely poor households.

Other studies have also developed multi-country models to analyse the links between trade reforms and household income distribution. One example is the global model developed by Ezaki and Nguyen (2008) to investigate the impact of regional economic integration in East Asia on household income and poverty. The analysis of poverty and income distribution was mainly made for four developing countries in East Asia, namely; China, Indonesia, Thailand and Vietnam. The database and modelling framework of the static global CGE model is similar to GTAP database (Version 7) and modelling framework except the global CGE model incorporates household data of income and expenditures for the four above-mentioned countries, thereby extending the model according to a framework that combines different households groups and broad industries. The results indicate that East Asian FTAs have positive effects on growth, improve income distribution and poverty reduction, with the results for China being exceptional. Furthermore, the findings suggest that, although there are positive welfare effects due to trade liberalisation in the long run, the structural adjustments in the East-Asian economies could be a problem in the short run.

When reviewing empirical research on world trade policy issues, it is obvious that multi-country or global models are more appropriate for analysing the impact of multilateral trade reforms on a particular economy as such models are designed to understand the linkages between sectors, countries and factors on a global scale.

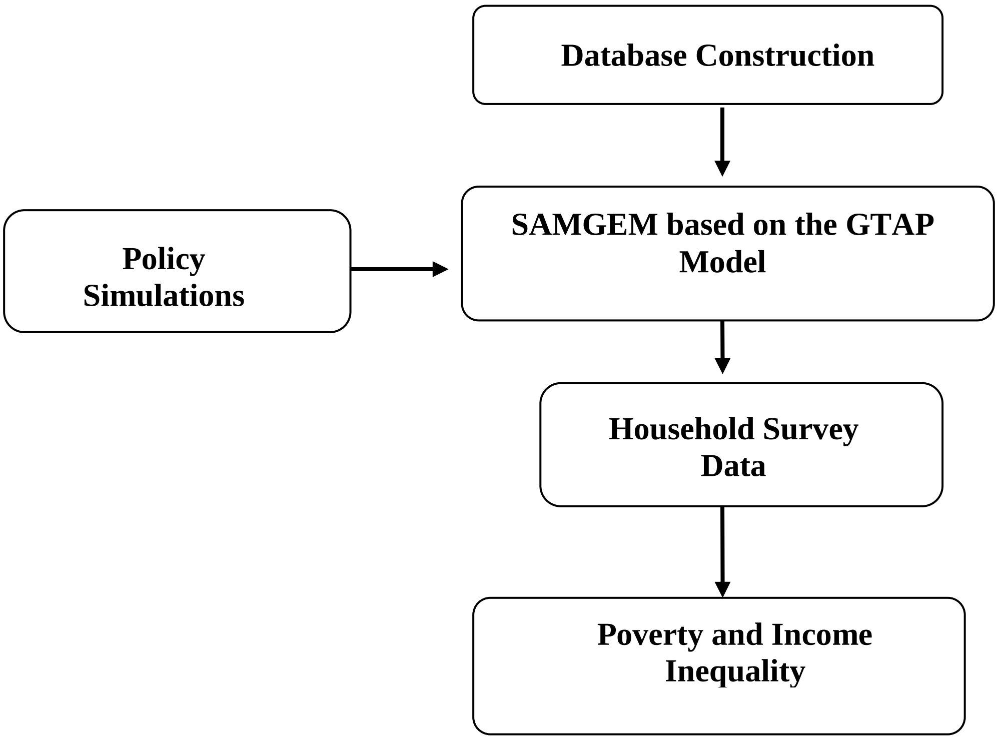
Therefore, it is evident that a well-designed multi-country CGE model is needed to analyse the impact of trade liberalisation in South Asia on household income and poverty.

Having understood the theoretical and empirical approaches it is important to design the conceptual framework for the present study. Section 3.5 illustrates the conceptual framework chosen to analyse the links between trade liberalisation in South Asia on household income distribution in a multi-country framework based on the GTAP model.

3.5 Conceptual Framework of the Present Study

It is clear from the empirical research based on the CGE approach that there are two steps to analysing the impact of trade liberalisation on household income and poverty: the first is to formulate the CGE model and the second is to undertake detailed analysis of household income distribution based on the simulation results obtained from the CGE model. As a first step, this study formulates a multi-country CGE model based on the GTAP model by dis-aggregating the household sector, and follows the ERH approach to poverty analysis. The multi-country CGE model is constructed in such a way that the model can capture both the consumption side and the factor market effects following trade liberalisation. In the second step, the results from the simulations are used to undertake a detail household income distribution analysis for Sri Lanka based on micro household survey data. Figure 3.4 presents the conceptual framework of the research.

Figure 3.4 Conceptual Framework of the Study



3.6 Concluding Remarks

One of the biggest challenges presently confronting the world community is how to eradicate poverty. In line with the MDGs, the international community is committed to halve poverty by late in 2015. From the poverty statistics presented in Chapter 2, it was noted that South Asia has the second largest level of poverty in the world after Sub-Saharan Africa. It is accepted that trade reforms have long been part of national economic policy packages aimed at promoting economic growth and efficiency and that economists believe that trade liberalisation creates many new opportunities to enhance economic growth in such countries. A review of the literature, indicates that both the theoretical and empirical research have well explained the short-term and long-term benefits from improved resource allocation and efficiency that follows from trade liberalisation.

However, trade reforms tend to create gains for the overall economy but those gains are unlikely to be distributed evenly among all the members in the society. In general, empirical research evidence continues to support the idea that although trade liberalisation is beneficial for the poor, it is likely to affect individual households differently. Nonetheless, it could be noted that the strength of the poverty reducing effects of trade reforms appears to be country-specific and will depend, to a large extent on the policies accompanying such reforms.

Because of its ability to consistently track the effect of policies across an entire economic system, at present, CGE analysis has become a mainstay of the trade policy literature (Scollay and Gilbert, 2000; Gilbert and Wahl, 2003; Robinson and Thierfelder, 2002; and Lloyd and MacLaren, 2004). Bandara (2009) however has a different view when he states that CGE models play with numbers, which can deviate from real economic outcomes in analysing the impact of trade policy simulations. Therefore, emphasis should be placed on the real economic situations rather than numbers in formulating a CGE model. This is particularly important in analysing the impact of trade reforms on different scoio economic groups in South Asia. To address this concern, the present study formulates a multi-country CGE model for South Asia (SAMGEM) to capture household effects at country level by incorporating both consumption and income side effects following trade liberalisation. Hence, SAMGEM moves beyond the representative household approach that is currently in the standard GTAP model and attempts to answer the question of income distribution by feeding the SAMGEM results to the Household Income and Expenditure Survey data of Sri Lanka, which is the focus of this study. Therefore, this research can make original and significant contribution to the CGE modelling literature by explicitly incoprtating multi-household framework into the standard GTAP model, which is useful to address important policy issues relating to the South Asian region. Chapter 4 presents the theoretical structure of the model, which will be used to simulate and analyse the implications of different trade reforms on South Asian economies and the rest of the world.

CHAPTER 4 A MULTI-COUNTRY CGE MODEL FOR SOUTH ASIA (SAMGEM): THEORETICAL FRAMEWORK

4.1 Introduction

This chapter presents the theoretical framework of the South Asia multi-country, multi-sector static Computable General Equilibrium Model (SAMGEM) which is used to examine the impact of different policy options on trade and income distribution of the economies in the region. Its framework and database are basically the same as the GTAP model. An important feature of the SAMGEM, which makes it different from the 'standard' GTAP model, is that it attempts to incorporate a multi-household[9] dimension into the model. Accordingly, the household sector is disaggregated based on different income groups in different geographical regions of four countries in South Asia (India, Sri Lanka, Bangladesh and Pakistan). It incorporates household survey data of the four countries by extending the model in a framework to combine household groups, different industries and factor endowments. The theoretical framework of SAMGEM is discussed in the present chapter and database construction and calibration of the model will be presented in Chapter 5.

[9] In the standard GTAP model each region has a single representative household (Hertel, 1997).

4.2 Model Description

4.2.1 General Outline

The data for SAMGEM are taken from the GTAP database version 7, which reflects the world economy in 2004. The data are aggregated into sixteen regions, thirty sectors and three primary factors[10]. The GTAP version 7 contains 113 countries/regions and, in designing the present model, 113 countries/regions have been aggregated into 16 countries/regions (Table B.1 in Appendix B). Therefore, SAMGEM consists of sixteen country models and these models are linked together through international trade and foreign direct investment. Generally, country models follow the standard neoclassical CGE model (Dervis et al., 1982). The sixteen regions are India, , Pakistan, , Rest of South Asia, America (USA), (CAN), European Union (EU), ASEAN-6, High Income Asia, Japan, China, , and , Russian Federation and Rest of Soviet Union, and Rest of the World.

In formulating the model, 57 GTAP sectors have been aggregated into 30 sectors (Table B.2 in Appendix B). The thirty sectors are rice (paddy and processed), wheat, cereal grains, vegetables and fruits, oil seeds and vegetable oil, plant based fibers and crops, sugar, dairy products and milk, fishing, meat, food products necessaries, beverages and tobacco products, textiles, wearing apparel, leather, wood products, paper products, chemical, rubber & plastic products, metal products, electronic equipment, machinery and equipment, manufacturing necessaries, motor

---

[10] The details of the data aggregation are provided in Table B.1 and Table B.3 in Appendix.

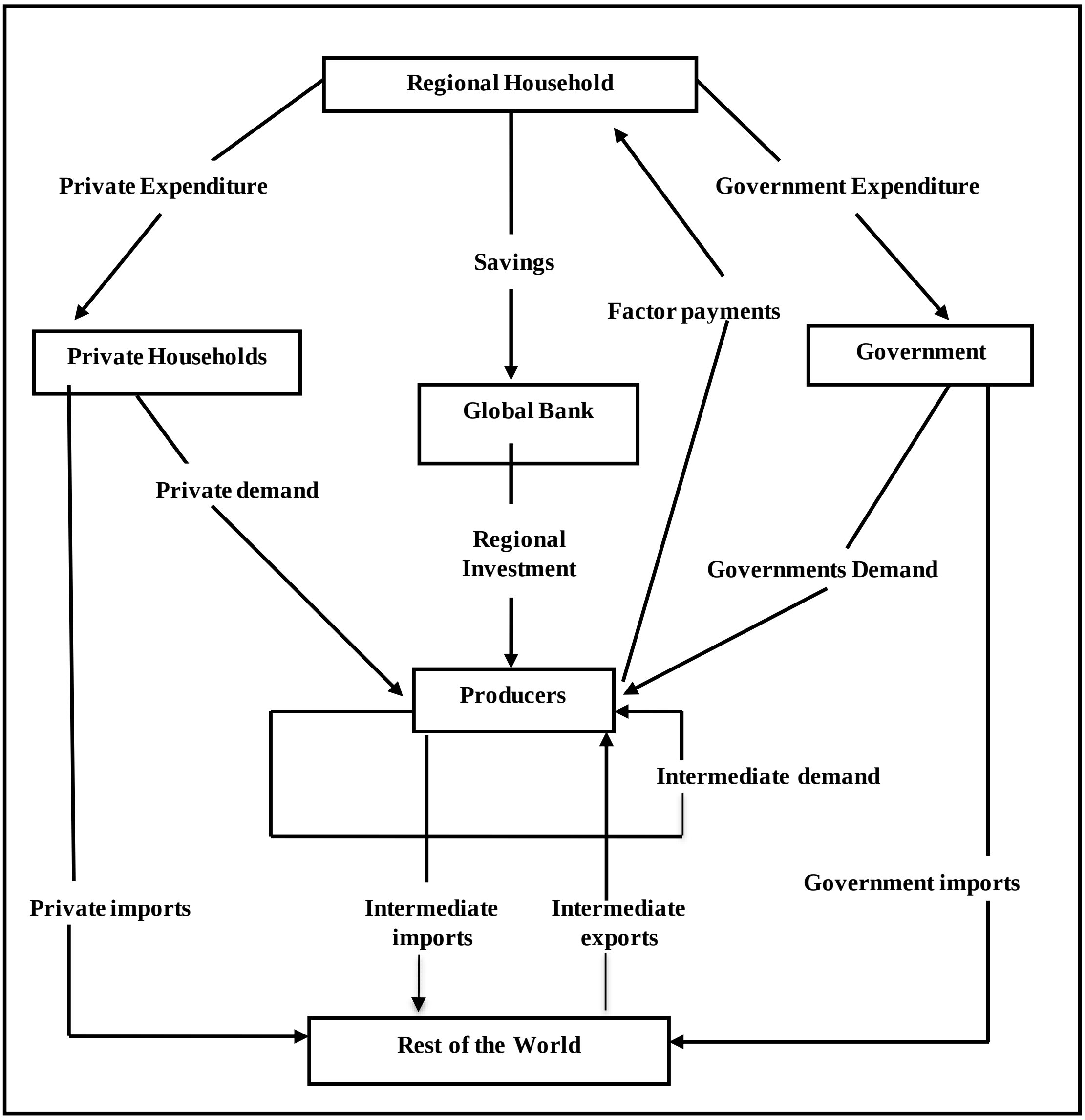
vehicles and transport equipment, petroleum and coal, gas manufactures and distributors, tradeable services, non tradeable services, other primary products, trade and construction, electricity, water and air transport, oil and natural resources.

The five factors in the GTAP model have been aggregated into the three factors, namely; skilled labour, unskilled labour and capital (including land and natural resources) with each group assumed to be homogeneous. The factor aggregation of the model is presented in Appendix B.3. In SAMGEM, capital and both types of labour are mobile across economic sectors and they are treated accordingly under short run and long run conditions as explained in section 4.3.9.

The policy instruments are classified by eight kinds of taxes and subsidies which were specified in each country model. They consist of tariffs, export duties, production taxes and output subsidies, taxes on capital goods, sales taxes imposed on consumer goods and public goods.

Given the complexity of the GTAP model, it is useful to provide a graphical overview of its basic structure before incorporating any changes to construct the SAMGEM. Figure 4.1 presents the basic value flows of the standard GTAP model. Each region in the global model is endowed with primary factors of production, land, capital, skilled and unskilled labour and natural resources. These non-labour primary factors are either used in producing goods in the same region where these factors are located or are permitted to move to other regions in response to factor price changes. Labour is mobile across sectors only at the regional level. The modelling of each region in GTAP based on the ORANI model and also based on the assumptions of constant returns to scale in production and perfect competition in commodity and factor markets.

Figure 4.1 Overview of the GTAP Model



Source: Adopted from Brockmeier (2001)

In the above diagram, it is assumed that there is no depreciation or government intervention in the form of taxes and subsidies. At the top of the Figure 4.1 one can identify regional households who have fixed endowment with primary factors of production (land, labour, capital and natural resources). Since, there is no government intervention, the only source of income for regional households is from sales of factor endowment to producers, which yields factor payment in return. In the GTAP model, regional households have an aggregate utility function, which allocates regional income across three broad categories, i.e. private household expenditure, government expenditure and savings. The formulation of regional households in an AGE (Applied General Equilibrium) model has an advantage as it could provide a useful indicator to measure overall regional welfare. This means, when regional income rises, the regional utility function takes into account not only the private household expenditure but also government purchases and savings (Hertel and Tsigas, 1997; Lotze, 1998). In the GTAP model, private households spend their income on domestic as well as imported goods, and the same is applied to government sector who demand domestic and imported goods in order to produce public goods and government services. On the other hand, producers combine primary and intermediate inputs to satisfy this final demand. They also demand intermediate inputs and supply export commodities to the rest of the world. The model allows the user to distinguish bilateral exports and imports by destination and source region. Furthermore, imports are distributed among specific domestic user groups, i.e. private households, government and firms, which is important in analysing trade policy issues.

Finally, there are two global sectors in the GTAP model. Firstly, the global bank collects savings from regional households and allocates these funds among regional investments and, therefore, this provides the macroeconomic closure of the model. In addition, the producers who produce final commodities also supply capital goods, which are formed as part of investments. The global bank collects these investment goods produced by the producers and distributes them to regional households in the form of shares from the global portfolio to satisfy their demand for savings. The second global sector is the global transportation sector, which acts as an intermediary between the supply of, and demand for, international transportation services. In the GTAP model the transportation cost is calculated from the value of exports at f.o.b (free on board) prices whereas imports are valued at c.i.f (cost, insurance and freight) prices. Moreover, the global transport sector supplies all the demand for (the import of) trade and transport margins, and then purchases all the supply of (the export of) trade and transport margins to balance the transport market (Hertel and Tsigas, 1997).

4.3 The Theoretical Foundation of the Model

The model equations, coefficients and parameters of the SAMGEM are presented in detail in Appendix B.4 while the theoretical foundation of the model is described in this section. The equations illustrated in Section C to Section M of Appendix B define the behaviour of the model agents as well as market clearing conditions based on the theoretical foundation of the model. While the accounting relationships in the model are more conveniently expressed in value terms, the behavioural equations of the model are written in percentage change in prices and quantities. The non-linear formulation of the model in value level terms can be transferred into percentage changes by differentiating the values in the following way (Hertel and Tsigas, 1997).

$$\frac{dV}{V} = \frac{d(PQ)}{PQ} = \frac{dP}{PQ} * Q + \frac{dQ}{PQ} * P = p + q$$

Where:

V =Value term

P = Price term

Q =Quantity level

p = Percentage change in price

q = Percentage change in quantity

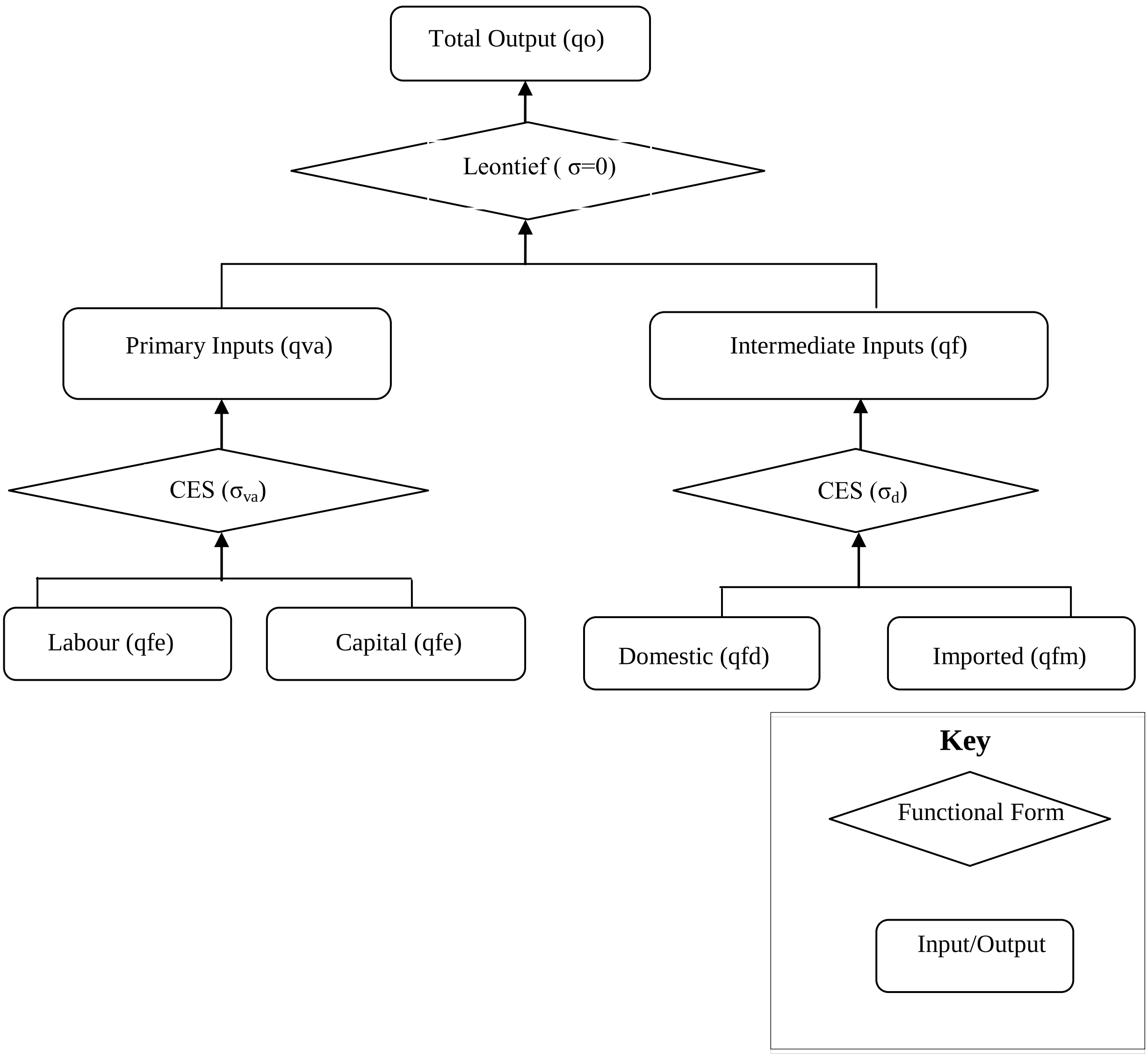
In a linearised form model, the initial values are taken from the database and are entered as constant coefficients to the model. In implementing the model, percentage change in the endogenous prices and the quantities are derived using the equations. Subsequently, the initial value terms are updated by using updated commands and these values are stored in a new data file which are used in interpreting the results of a given policy shock to the model.

The theoretical structure of the SAMGEM will be discussed in detail in later sections of the present chapter. There are several blocks of equations in the SAMGEM dealing with production, supply, household consumption and savings, government expenditure, investments, external sector, price relations, GDP identities, market clearing equations and zero profit conditions. The derivation of equations of the SAMGEM is based on the GTAP framework and the equations in the GTAP model are based on ORANI family (Dixon et al., 1982).

4.3.1 Production

As explained in the above section, the model contains 30 industries and 16 regions/countries and the output is produced under the 30 industries concerned. Each firm maximises its profit under perfect competition subject to constant returns to scale technology. This is equivalent to minimising production costs subject to production technology. The structure of the production in the model is explained using a composite production function, which is characterised by three level nests.

Figure 4.2 Structure of Production Activity



Source: Hertel, 1997

Figure 4.2, the top level of the nest, indicates that total inputs are combined according to fixed ratios of inputs such as intermediate inputs (commodity composites), and primary factors (labour and capital) based on Leontief production function. This further suggests that the proportion of each composite input demand remain unchanged as a result of changes in composite price of each input, for a given technology. Furthermore, the Leontief production function exhibits constant returns to scale, so the production structure does not depend on the level of production. The Leontief production function can be given by:

$$X_{ir}^{S} = \min A_j \left\{ \frac{INT_{ijr}}{iocf_{ijr}}, \frac{VA_{fjr}}{vacf_{fjr}} \right\} \qquad (1)$$

Where:

X_{ir}^{S} = Output of the sector *i* in region *r* from source *s*

INT_{ijr} = Composite intermediate input *i* demand by sector *j* of region *r*

VA_{fjr} =Value added composite of factor *f* in sector *j* in region *r*

$iocf_{ijr}$ = Input-output co-efficient for composite intermediate input in sector *j* commodity *i* of region *r* (technological co-efficient)

$vacf_{fir}$ =Value added co-efficient of factor *f* in sector *i* in region *r* (technological co-efficient)

A_j = Technological variable of sector *j*

The Leontief production function assumes zero substitution elasticity (σ=0) between intermediate inputs and primary inputs. Thus, it is assumed that no substitution is taking place between primary factors and intermediate inputs or between intermediate inputs of different input-output classes. The intermediate input composites (INT_{ijr}) and primary factors or value added composites (VA_{fjr}) are demanded in direct proportion to the industry activity level (X_{ir}^{S}) with given technology (A_j). All input-output coefficients for intermediate inputs and primary factors are assumed to remain constant and Hicks-neutral technical-change term that affects all inputs equally are illustrated in the above equation. Accordingly, equations for demand for composite value added and demand for composite intermediate inputs can be illustrated as:

$$VA_{fjr} = vacf_{fjr}\left(\frac{X_{ir}^{S}}{A_j}\right) \quad \text{.......(2)}$$

$$INT_{ijr} = iocf_{ijr}\left(\frac{X_{ir}^{S}}{A_j}\right) \quad \text{.......(3)}$$

a) Demand for Intermediate Inputs

The next level of the nest, which describes the demand for intermediate inputs from two sources, i.e. domestic and imported sources is assumed to be derived by adopting a cost minimising decision rule, subject to a Constant Elasticity of Substitution (CES) production function in which the substitution between imported and domestically produced inputs is allowed following the Armington (1969) assumption of imperfect substitutability. These intermediate goods from different regions combine at the second level of composite intermediate goods and enter the first level of production. The commodity composite from domestic and imported sources is aggregated using a CES production function and is given by:

Minimise

$$PNM_{ijr} = PID_{ijr} * ID_{ijr} + PIM_{ijr} * IM_{ijr}$$

s.t:

$$INT_{ijr} = \Phi_{jr}\left(\delta_{jr} IM_{ijr}^{\rho} + (1-\delta_{jr}) ID_{iijr}^{\rho}\right)^{\frac{1}{\rho}}$$

$$\sigma = \frac{1}{1+\rho}$$

Where:

$\Phi_{jr}>0$ = Intermediate input efficiency parameter of sector j in region r

$0<\delta_{jr}<1$ =The share parameter of sector j in region r

IM_{ijr} =Intermediate input i, imported by sector j from region r

ID_{ijr} =Domestically produced intermediate input i by sector j from region r

ρ = The substitution parameter

σ = The elasticity of substitution of inputs

PNM_{ijr} = Price of intermediate input i by sector j in region r

PID_{ijr} = Price of domestically produced intermediate good i by sector j in region r

PIM_{ijr} = Price of imported intermediate good i by sector j in region r

The above equation can be used to derive equations of demand for imported intermediate inputs and domestically produced intermediate inputs and the equations can be presented as follows:

$$IM_{ijr} = a_{IN}^{\frac{\rho}{(1+\rho)}}\left[\delta_{jr}\frac{PNM_{ijr}}{PIM_{ijr}}\right]^{\frac{1}{1+\rho}} * INT_{ijr} \text{ ....(4)}$$

$$ID_{ijr} = a_{IN}^{\frac{\rho}{(1+\rho)}}\left[\delta_{jr}\frac{PNM_{ijr}}{PID_{ijr}}\right]^{\frac{1}{1+\rho}} * INT_{ijr} \text{ ....,,,,,,,,,,,,,,,,,,,,.(5)}$$

Where:

a_{IN} = Scale parameter in intermediate input demand function

b) Demand for Primary Factors

The equation of demand for primary factors is the flows of value added (VA_{fjr}) components of costs that are described within a nest. The CES function of capital and labour types form the value added (VA_{fjr}) of the sectoral output and combine with the production nest. Three production factors are specified, consisting of capital, skilled labour and unskilled labour. The factor demand for capital and labour types based on the CES function and is illustrated as:

$$VA_{fjr} = a_{X_{jr}} \left[\varpi_{X_{jr}} L_{fjr}^{-\alpha_{jr}} + \left(1 - \varpi_{X_{jr}}\right) K_{fjr}^{-\varepsilon_{jr}} \right]^{\frac{-1}{\alpha_{jr}}} \quad \text{...(6)}$$

Where:

$a_{X_{jr}}$ = Scale parameter in production sector *j* in region *r*

$\varpi_{X_{ir}}$ = Share parameter in production sector *j* in region *r*

L_{fjr} = Composite labour (*f*) demand in sector *j* in region *r*

a_{ir} = CES parameter between primary factors

K_{fjr} = Capital (*f*) demand by sector *j* in region *r*

c) Supply of Output (Domestic market and exports)

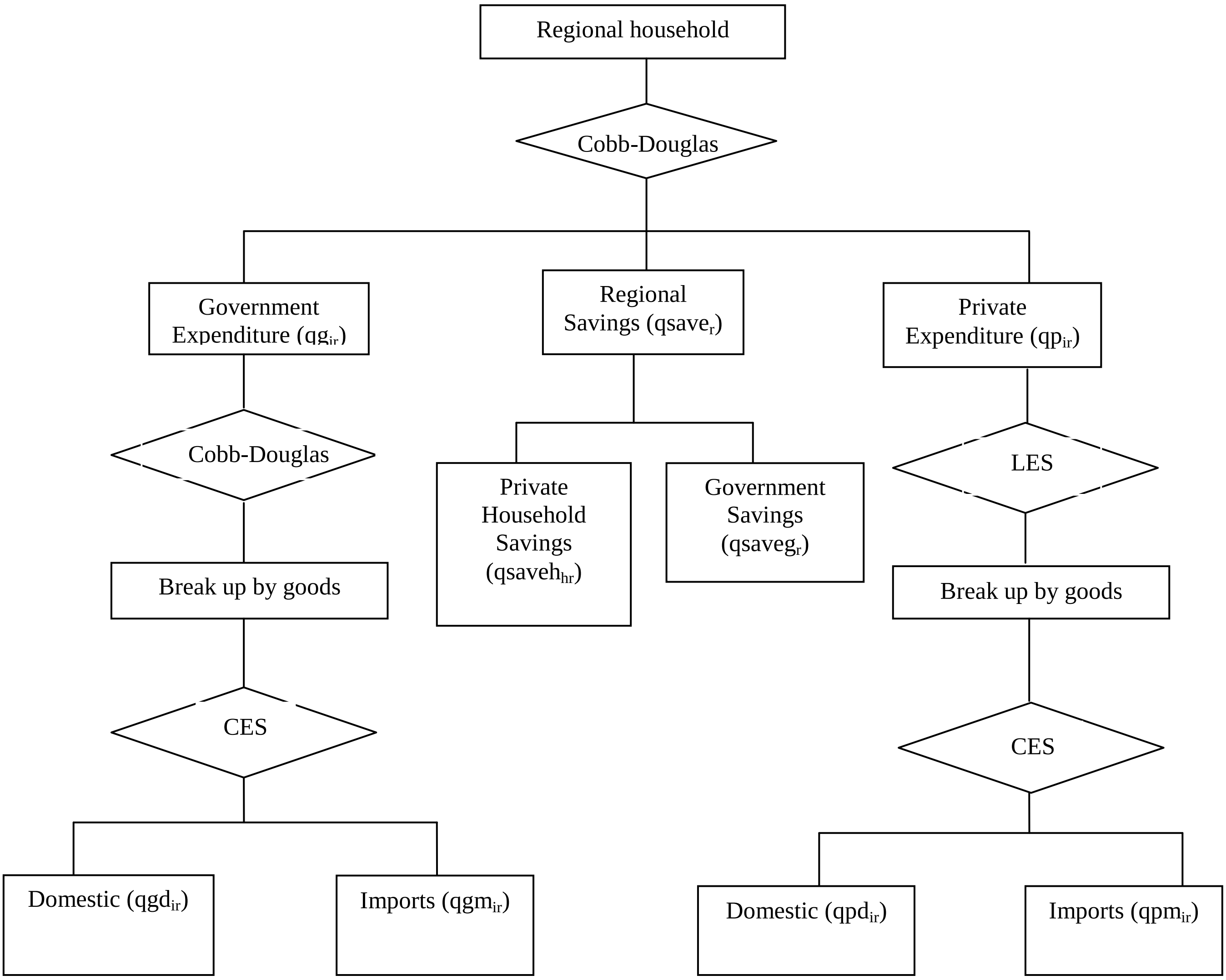
The output produced by the firm is supplied to the domestic market and consists of the supply of goods to households, government and firms, which is considered domestic consumption. Exports of goods by countries/regions is defined as the difference between total output and domestic consumption and that difference is directed to exports to meet the import demand of other countries.

In examining the production tree above, it could be identified that there are two types of equations for each nest. The first describes the substitution between inputs within the nest and the second describes the unit cost for the composite good produced by that branch. This composite price enters the next higher nest and determines the demand for that composite good (Hertel and Tsigas, 1997). Section C of Appendix B.4 presents the equations relating to production in percentage change form.

4.3.2 Regional Household Sector

In the GTAP model, overall regional household's behaviour is determined by an aggregate Cobb-Douglas utility function which is specified over three categories, namely, private consumption, government purchases and savings. Although the allocation of savings is an intertemporal maximisation problem, by using proper specification of utility function, it is possible to represent savings in a comparative static model (Hertel and Tsigas, 1997). In analysing from a macroeconomic point of view, the model is savings driven. This is because the share of regional income spent on savings is constant in the Cobb-Douglas utility function and the level of investment needs to be adjusted accordingly. The structure of the regional household activities in the SAMGEM is illustrated in Figure 4.3.

Figure 4.3 Structure of Consumer Behaviour



In the standard GTAP model there is a single representative household. However, the SAMGEM is designed to analyse the implications of trade liberalisation on private household income distribution. Therefore, in this model one representative private household is specified for the regions other than South Asia while the private household sector in the four South Asian countries; India, Sri Lanka, Pakistan and Bangladesh is disaggregated according to different income classes based on different geographical classification. For instance, in the case of Sri Lanka, the household sector is disaggregated into 30 household groups according to income deciles and the geographical region, consisting of 10 rural groups, 10 urban groups and 10 estate sector groups. In India, the household sector is disaggregated into 24 household groups according to monthly per capita consumer expenditure (MPCE) classes consisting of 12 rural groups and 12 urban groups. In Pakistan, the household sector is disaggregated into 10 household groups according to income quintiles consisting of five rural groups and five urban groups. In the case of Bangladesh, the household sector is disaggregated based on monthly household income groups. Accordingly, the household sector includes a total of 38 groups, consisting 19 rural and 19 urban groups. The data are allocated among the different household groups based on the shares calculated from the Household Survey data of the respective South Asian economies.

Each private household owns the factors of production and the household income consists of labour and capital income and the income is allocated to savings and consumption using exogenous shares. Households of the four South Asian countries receive fixed proportions of sectoral capital income based on their initial supply of capital services. Labour income is defined as wages and salaries, whereas capital income is profit from members of household's investment and income from land and natural resources. Labour income is determined based on the household supply of labour in each industry and the corresponding wage rates. The household composition of sectoral labour income would change as labour moves between industries during the trade liberalisation.

Household disposable income is the total income less income taxes and private household savings. The household consumption demand is determined using the Linear Expenditure System (LES) function. This is one of the key difference between GTAP and SAMGEM, as in the GTAP model household consumption is determined using Constant Difference Elasticity (CDE) function. In modelling household consumption equations, ORANI-G multi-household framework has been followed (Centre of Policy Studies, Monash University, 2004). The LES function is used in the SAMGEM because it can measure the effect of change in income on the structure of consumption. In the model, households make the optimal allocation between consumption of commodities by maximisation of the Stone Geary Utility function or LES function subject to its budget constraint, which is the disposable income spent on consumption. Accordingly, the optimisation problem can be illustrated as:

Max $UC_r(C_{1r}\ldots\ldots\ldots\ldots C_{ir})$

$UC_r = \prod_i (C_{ir} - Subs_{ir})^{bshr_{ir}}$ Where: $\sum_i bshr_{ir} = 1$

Subject to: $\sum_i PCM_{ir} * C_{ir} = YDH_{ir}$

Where:

UC_r	= Total utility from consumption in region *r*
C_{ir}	= Household consumption demand of comodity *i* in region *r*
PCM_{ir}	= Market prices of consumer's comodity *i* in region *r*
$Subs_{ir}$	= Substance consumption of comodity *i* in region *r*
$bshr_{ir}$	= Marginal budget shares for comodity *i* region *r*

Corresponding to Figure 4.3 the description of household total income, disposable income, consumption, savings and their respective equations in level form are specified below.

- **Household Income**

In the SAMGEM, private households receive income from skilled labour, unskilled labour and capital. In modelling household income, it is assumed that the factor market operates under the assumption of perfect competition

Further, government transfers are also considered as part of household income, which is not included under the income from factors. The way transfers need to be treated in CGE models is not obvious. Therefore, in most cases, transfers are treated as payments without any real counterpart, and they are not explicitly related to any specific form of economic behaviour (Decaluwé et al, 2010). In the standard GTAP model there is no mechanism to explain transfer payment. Hence in the SAMGEM, the nominal transfers are modelled in such a way that it depends on real transfers and transfer price. In which case the real household transfers are treated as exogenous and the transfer price is the share-weighted price of consumer price index and price of savings. This is because the government has a number of redistributive policies to help low income households to maintain their purchasing power through consumer price index (Verikios and Zhang, 2008). Since, transfers affect savings of both households and government, nominal transfers were indexed to share weight of CPI and price of savings. These equations are illustrated in Section D in Appendix B.4.

$$YH_{ir} = \sum_i ykcf_{ir} * K_{ir} + \sum_{lr} ylcf_{lr} * LK_{lr} * WK_{lr} \ldots\ldots(7)$$

for r ≠ India, Sri Lanka, Pakistan and Bangladesh

Where:

YH_{ir} = Household income from factor *i* in regions other than South Asia

K_{ir} = Capital (i) demand by region r

$ykch_{ir}$ = Share of capital (i) income in region r

R_{ir} = Capital (i) rents in region r

LK_{lr} = Labour demand by types of labour l in region r

WK_{lr} = Wage rates by by types of labour l in region r

$ylcf_{lr}$ = Share of labour income of labour type l in region r

$$YH_{ihr} = \left(\sum_i ykcf_{ihr} * R_{ir} * K_{ihr} + \sum_i ylcf_{lhr} * WK_{.lr} * LK_{lhr}\right) \text{.............................}(8)$$

for r = India, Sri Lanka, Pakistan and Bangladesh

Where:

YH_{ihr} = Household income of household group h in factor i of South Asia

$ykch_{ihr}$= Share of capital income accrued to household group h in factor i of South Asia

R_{ir} = Capital (i) rents in region r

K_{ihr} = Capital demand by household group h in South Asia

$ylcf_{lhr}$ = Share of labour income l accrued to household h in South Asia

WK_{lr} = Wage rates by types of labour l in region r

LK_{lhr} = Labour demand by types of labour l in household group h in South Asia

- **Household Disposable Income**

$$YDH_r = YH_r + GTRS_r - YTAX_r - SH_r \text{..}(9)$$

for r ≠ India, Sri Lanka, Pakistan and Bangladesh

Where:

YDH_r =Household disposable income in regions other than South Asia

YH_r = Household income in region r

$GTRS_r$ = Government transfers to/from to households in region r

$YTAX_r$ = Income tax in region r

SH_r = Household savings in region r

$$YDH_{hr} = YH_{hr} + GTRS_{hr} - YTAX_{hr} - SH_{hr} \text{ ....}(10)$$

for r = India, Sri Lanka, Pakistan and Bangladesh

YDH_{hr} =Household disposable income by household group h in South Asia

$YTAX_{hr}$ = Income taxes or direct taxes by household group h in South Asia

YH_{hr} = Household income by household group h in South Asia

SH_{hr} = Household savings by household group h in South Asia

- **Net Household Income**

$$NYH_r = YH_r - VDEP_r \text{ ....}(11)$$

Where:

NYH_r = Net household income in regions other than South Asia

$VDEP_r$ = Depreciation on capital in regions other than South Asia

$$NYH_{hr} = YH_{hr} - VDEP_{hr} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (12)$$

Where:

NYH_{hr} = Net household income in household *h* in South Asia

$VDEP_{hr}$ =Depreciation on capital by household *h* in South Asia

- **Household Consumption**

$$C_{ir} = Subs_{ir} + \frac{bshr_{ir}}{PCM_{ir}} \left[YDH_{ir} - PCM_{ir} * Subs_{ir} \right] \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (13)$$

for r ≠ India, Sri Lanka, Pakistan and Bangladesh

Where:

C_{ir} = Household consumption demand of comodity *i* in region *r*

PCM_{ir} = Market prices of consumer's comodity *i* in region *r*

$Subs_{ir}$ = Subsistence consumption of comodity *i* in region *r*

$bshr_{ir}$ = Marginal budget shares for comodity *i* region *r*

$$C_{ihr} = Subs_{ihe} + \frac{bshr_{ihr}}{PCM_{ir}} \left[YDH_{ihr} - \sum_i PCM_{ir} * Subs_{ihr} \right] \ldots\ldots\ldots\ldots\ldots\ldots (14)$$

for r = India, Sri Lanka, Pakistan and Bangladesh

Where:

C_{ihr} = Household consumption by commodity *i* in household *h* for South Asia

PCM_{ir} = Market prices of comodity *i* for South Asia

$Subs_{ihr}$ = Subsistence consumption of commodity *i* for household *h* for South Asia

$bshr_{ihr}$ = Marginal budget shares of commodity *i* for household *h* for South Asia

According to the LES function, it is required to obtain subsistence consumption data to calibrate the household consumption demand. Due to absence of subsistence consumption data in the GTAP database, the marginal budget shares can be obtained by making use of the income elasticity of demand. If the income elasticity of demand is known, the marginal budget share ($bshr_{ir}$) can be derived as follows:

$$\varepsilon_{ir} = \frac{\partial C_{ir}}{\partial YDH_{ir}} * \frac{YDH_{ir}}{C_{ir}}$$

$$\varepsilon_{ir} = \frac{bshr_{ir}}{PCM_{ir}} * \frac{YDH_{ir}}{C_{ir}}$$

$$bshr_{ir} = \frac{\varepsilon_{ir} * PCM_{ir} * C_{ir}}{YDH_{ir}}$$

Where: ε_{ir} = Income elasticity of demand

In addition, the subsistence consumption can be derived when the Frisch parameter (*frisch*$_r$) is known, which can be presented as:

$$Subs_{ir} = C_{ir} + \frac{bshr_{ir}}{PCM_{ir}} * \left[\frac{YDH_{ir}}{frisch_r} \right] \text{..} (15)$$

According to the above equations, the exogenous parameters required for calibrating the level of subsistence consumption data in the SAMGEM are expenditure elasticity of demand and the Frisch parameters. The calculation of Frisch parameters and data for expenditure elasticities will be presented in Chapter 5.

- **Endogenising Poverty Lines**

One of the main objectives of the present research is to analyse the impact of trade liberalisation on household income and poverty. In order to achieve this objective along with the income and the expenditure patterns, the poverty lines for South Asian economies need to be incorporated into the SAMGEM. Decaluwé et at. (1999) and Decaluwé, Savard and Thorbecke (2006) made a valuable contribution to poverty analysis by incorporating the poverty line into the CGE model. Based on their work, the monetary poverty line is derived from a basket of goods that reflects basic needs. This can be presented as:

$$\text{Monetary Poverty Line} = \sum W_{bcom}^{p} * P_{bcom}$$

Where:

W_{bcom}^{p} = Basic commodity basket of the household groups

P_{bcom} = Price of the basic commodities.

As commodity prices are endogenously determined within the model, it is possible to ascertain the nominal value of the basic commodities[11] in each household group of the respective economy. Hence, this will facilitate the determination of the poverty lines within the model. The prices of commodities can rise or fall after a policy shock, thereby these poverty lines will change accordingly. In addition, Naranpanawa (2005) endogenises the monetary poverty line into the CGE model by defining a price index that reflects changes in prices of the basic commodities. Hence, SAMGEM follows the method adopted by Naranpanawa (2005) to endogenise the monetary poverty line into the model. The poverty lines for urban and rural areas are estimated based on the Household Survey data of the respective South Asian economies by taking year 2004 as the base year. Further, in determining the poverty line for rural and urban areas, a new commodity set has been created known as basic commodities pertaining to rural and urban sectors. Once the simulations are performed the model determines the new poverty lines by adjusting the base period poverty lines by the percentage changes in the price index of the basic commodities.

All the equations relating to household activities are illustrated in Sections D and G of the Appendix B.4 in percentage change form.

---

[11] The basic commodity bundle in rural and estate sector households comprises of goods and services in 12 industries included in Appendix B.2, namely; PDR_PCR, WHT_GRO, V_F, OSD_VOL, C_B_SGR, RMK_MIL, FSH, CMT_OAP, OFD, TEX and WAP.

In the case of urban sector basic commodity bundle includes 15 industries. This means in addition to the above 12 industries, this commodity bundle consisted of GAS_GDT, ELY_WTR and OIL.

- **Regional Savings**

Regional demand for savings is generated from the aggregate Cobb-Douglas utility function and comprises private household savings and government savings. Total regional savings in the standard GTAP model has been divided between the private households and the government proportionate to household income and the government revenue of particular regions. Then, the private savings are disaggregated among the respective household groups in the South Asian economies. Section E of Appendix B.4 specifies all the equations relating to household savings and government savings in linear form.

- **The Government Sector**

The government in each region is an institutional sector and acts as a consumer. It receives revenue from taxes and tariffs. Eight kinds of taxes and subsidies were specified in each country model consisting of tariffs, export duties, production taxes and output subsidies, taxes on intermediate inputs, sales taxes imposed on consumer goods and public goods, factor taxes and income taxes. Government revenue consists of revenues from all taxes and transfers from households and allocated among consumption and government savings. The residual between the government expenditure, transfers and government revenue is treated as government savings.

$$GSAVE_r = TGREV_r - TGEX_r - GTRS_r \quad \text{......(16)}$$

Where:

$TGEX_r$ = Government expenditure in region *r*

$GSAVE_r$ = Government savings in region *r*

$GTRS_r$ = Transfers to/from households in region r

The total revenue of the government is also formed as a part of regional income. Government expenditure for the country as a whole is derived from the Cobb-Douglas function for demand by products and from a CES function for demand for domestic and imported goods. All these behavioural equations relating to government revenue and government consumption are presented in Section D and H of Appendix B.4 respectively in linear form.

4.3.3 Investment Demand and the Macroeconomic Closure

As mentioned in section 4.3.2, in the GTAP model, the amount of savings is determined as a certain share of regional income and investment needs to be adjusted accordingly. In the case of multi-country models, one possibility of achieving savings-investment equilibrium is on a regional basis. In this case, the current account balance of the region can be fixed and the difference between regional saving and investment always needs to be equal to the current account deficit or surplus (Chinn and Ito, 2006). The macroeconomic closure is a crucial area in any AGE model and therefore, in order to close all the flows of the economy, a link between savings and investment has to be established in the model (Hertel and Tsigas, 1997). The GTAP model allows for a global closure, which is facilitated by the global bank (see Figure 4.1). The global bank collects savings from private households and the government. Further it purchases shares in a portfolio of regional investment goods, thereby acting as an intermediary between regional savings and investment. The size of this portfolio needs to be adjusted to accommodate changes in global savings and hence, the global closure in the GTAP model is neoclassical. However, the model is permitted to do some adjustments to investments on a regional basis by adding another dimension to the determination of investments in the model.

In this model there is no ‘money or exchange rate’, as it is concerned with real resource flows and reallocation effects caused by trade policy intervention or any other exogenous shock. This means the GTAP model does not take into account any macroeconomic and monetary policies that are usually driving forces behind the aggregate investment. However, the GTAP model allocation of investments across regions has implications on production and trade through its final demand. The capital endowment is assumed to be fixed within a static framework[12] in the short run. The value of the capital depreciation is determined as a fixed proportion to the capital stock. Once the level of investment activity is determined in each region, it remains only to generate the mix of expenditure of domestic and imported inputs used in the production of fixed capital in the respective region.

Capital will flow into and out of regions until real returns are equalised among all regions and sectors (Hertel, 1997). Hence, the GTAP allows for international capital mobility and it is assumed that the investment decisions are made in such a way that the rates of return on capital are equalised across countries and regions in the long run. The structure of investment activities are presented in Figure 4.4 below.

[12] In the case of static framework, the capital stock is fixed in each region in the short run. On the contrary, in a dynamic framework, the capital stock is endogenously accumulated through time which would capture the capital accumulation effect due to higher savings and investment. Hence, it should be noted that the results from a static model may underestimate the actual impacts as the dynamic effects are not modelled.

- **Total Aggregate Investments**

$$RSAV_r = PRSAV_r + GSAV_r \quad \text{.......(17)}$$

Where:

$RSAV_r$ = Total regional savings

$PRSAV_r$ = Total private household savings

$GSAV_r$ = Government savings

$$INV_r = DEP_r + RSAV_r \quad \text{.......(18)}$$

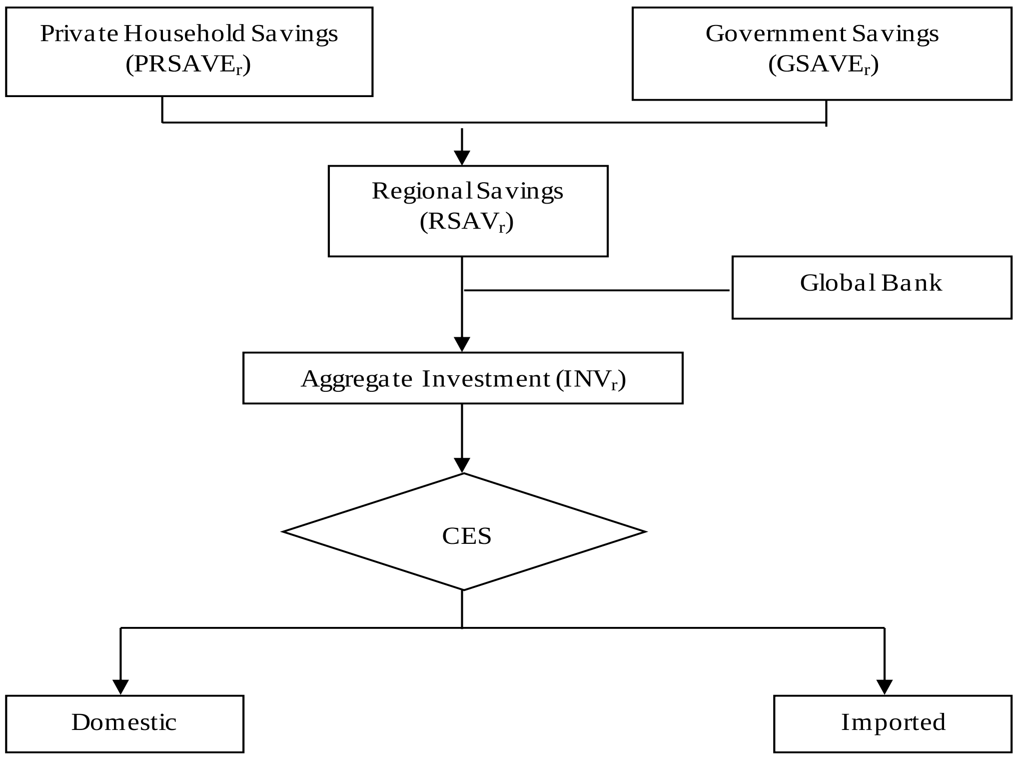
Where:

INV_r = Total gross aggregate investment in region *r*

DEP_r = Total depreciation expenditure in region *r*

$RSAV_r$ = Regional Savings

Figure 4.4 Structure of Investment



- **Net Aggregate Investments**

$$NINV_r = INV_r - DEP_r \qquad (19)$$

Where :

$NINV_r$ = Net aggregate investment in region r

- **Ending Capital Stock**

$$K_r^N = KLAG_r^N + INV_r \qquad (20)$$

Where:

K_r^N **=** Total supply of capital in region r

$KLAG_r^N$ = Total capital stock in the previous period in region r

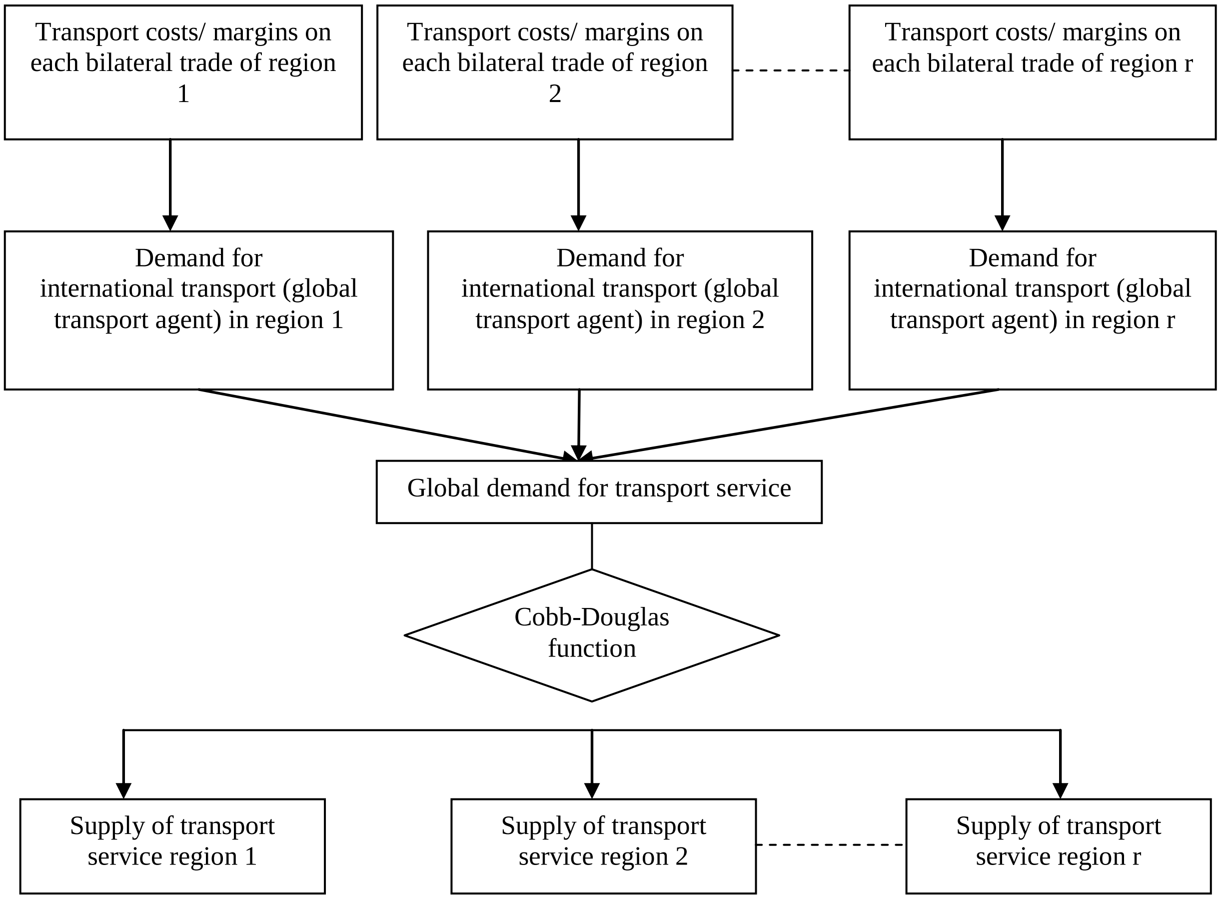
All the equations relating to savings and investment in SAMGEM are based on the standard GTAP model and they are illustrated in linear form in Section I of Appendix B.4.

4.3.4 Global Transportation Sector

In order to handle international transportation services, there must be an intermediary between the supply of and demand for international transportation services. In the GTAP model, transportation cost is calculated from the value of exports at f.o.b prices whereas imports are valued at c.i.f prices. Moreover, the global transport sector is the second global sector apart from the global bank and supplies all the demand for (the import of) trade and transport margins, and then purchases all the supply of (the export of) trade and transport margins to balance the transport market (Hertel, 1997). It is not necessary for the transport balance in each region to be zero. However, the global pool for transport balance must be cleared (McDonald and Thierfelder, 2004). The overall structure of the international transportation industry in

SAMGEM is modelled according to GTAP and its structure is presented in Figure 4.5. The corresponding equations are illustrated in Section J of Appendix B.4.

Figure 4.5   Structure of International Transport Industry



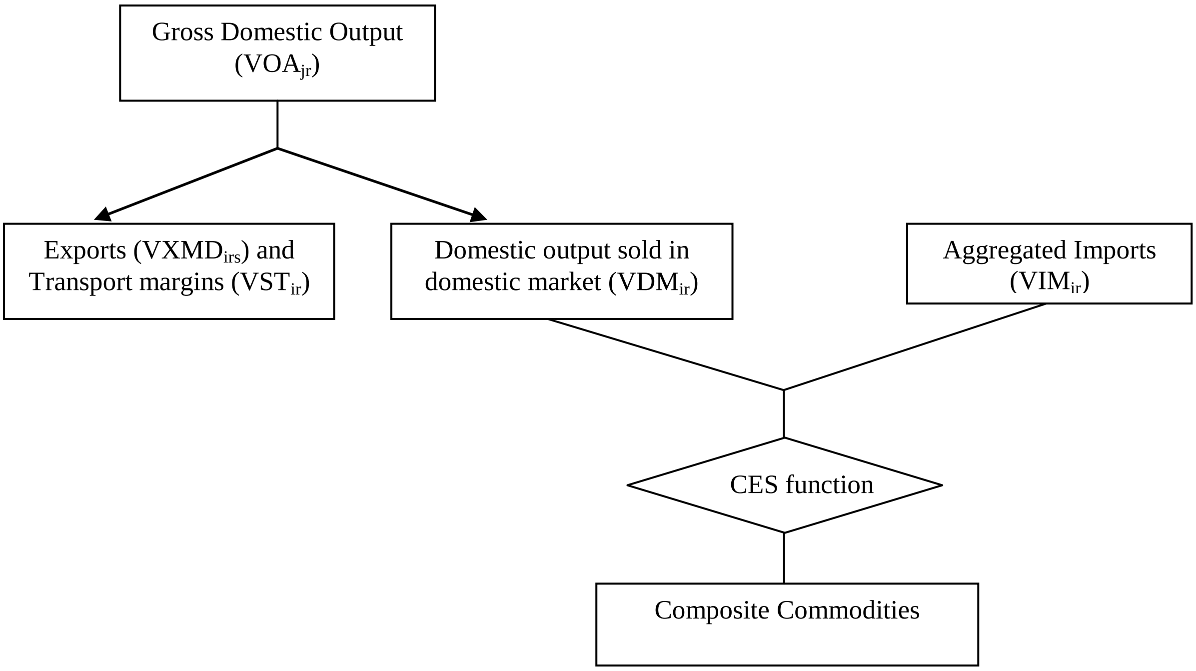
Transportation services provided by the global transport sector is modelled based on the Cobb-Douglas production function, which demands certain exports from all regions as inputs. These exports are simply combined into a composite international "transport good" with a common price. The transportation activity is also described by a price equation and quantity equation with respect to the production technology.

4.3.5 Foreign Trade

One key feature of modelling trade linkages in the standard CGE frameworks is the use of Armington specification (Armington, 1969), which assumes imperfect substitutability between domestic products and imports (and vice versa between foreign products and exports). One of the specific features of the GTAP model is the Armington structure, which sets the fixed elasticity of substitution between imported and domestic goods due to changes in the relative price of those two goods (Hertel, 1997). However, in general, with higher Armington elasticities, trade liberalisation will create more trade and accordingly higher incomes (Sánchez, 2008).

The modelling strategy for bilateral trade flows in SAMGEM also assumes an Armington type import demand, where domestically produced and imported commodities are imperfect substitutes with each other, sourced by their origin. This assumption is widely adopted because it accommodates 'two-way' trade, which better reflects the reality of most countries' trade patterns and it is still consistent with the perfect competition assumption. In the model, the composite commodities are produced by the use of domestically produced and imported goods via a CES production function, while the total output is allocated to the domestic market and export sales and also to the international transport sector. The structure of foreign trade is shown in Figure 4.6.

Figure 4.6 Structure of Foreign Trade



- **Demand for Composite Goods**

Demand for composite goods arise from demand for intermediate goods by firms, household consumption, demand for government consumption, demand for capital and investments goods and total demand for international transport goods. This can be illustrated in the following equation.

$$Q_{ir} = INT_{ijr} + C_{ir} + G_{ir} + ID_{ir} + TMQ_{ir} \quad \ldots\ldots(21)$$

Where:

Q_{ir} = Composite good demand of sector *i* in region *r*

INT_{ijr} = Demand for intermediate inputs *i* from sector *j* in region *r*

C_{ir} = Demand for household consumer goods *i* from region *r*

G_{ir} = Demand for public goods *i* from region *r*

ID_{ir} = Demand for investment and capital goods *i* from region *r*

TMQ_{ir} = Demand for international transport good *i* from region *r*

Demand for composite goods is also a function of domestically produced goods and imported goods. This is illustrated as the CES function in the equation below.

$$Q_{ir} = a_{M_{ir}} \left[\varpi_{M_{ir}} M_{ir}^{-\varphi_{ir}} + (1-\varpi_{M_{ir}}) D_{ir}^{-\varphi_{ir}} \right]^{-\frac{1}{\varphi_{ir}}} \text{......}(22)$$

Where:

Q_{ir} = Composite goods demand of commodity *i* in region *r*

$a_{M_{ir}}$ = Scale parameters in composite goods function

$\varpi_{M_{ir}}$ = Share parameters in composite goods function

φ_{ir} = Exponents in composite goods function (Armington elasticities)

M_{ir} = Demand for total imports *i* from region *r*

D_{ir} = Demand for domestic goods *i* from region *r*

- **Domestic Output Supply in Domestic Market**

$$D_{ir} = a_{M_{ir}}^{\frac{\varphi_{ir}}{(1+\varphi_{ir})}} \left[(1-\varpi_{M_{ir}}) \frac{P_{ir}}{PD_{ir}} \right]^{\frac{1}{(1+\varphi_{ir})}} * Q_{ir} \text{......}(23)$$

Where:

P_{ir} = Price of composite goods *i* from region *r*

PD_{ir} = Price of domestic goods *i* from region *r*

- **Demand for Imports**

$$M_{ir} = a_{M_{ir}}^{\frac{\varphi_{ir}}{(1+\varphi_{ir})}} \left[\frac{\varpi_{M_{ir}} P_{ir}}{PM_{ir}} \right]^{\frac{1}{(1+\varphi_{ir})}} * Q_{ir} \text{......}(24)$$

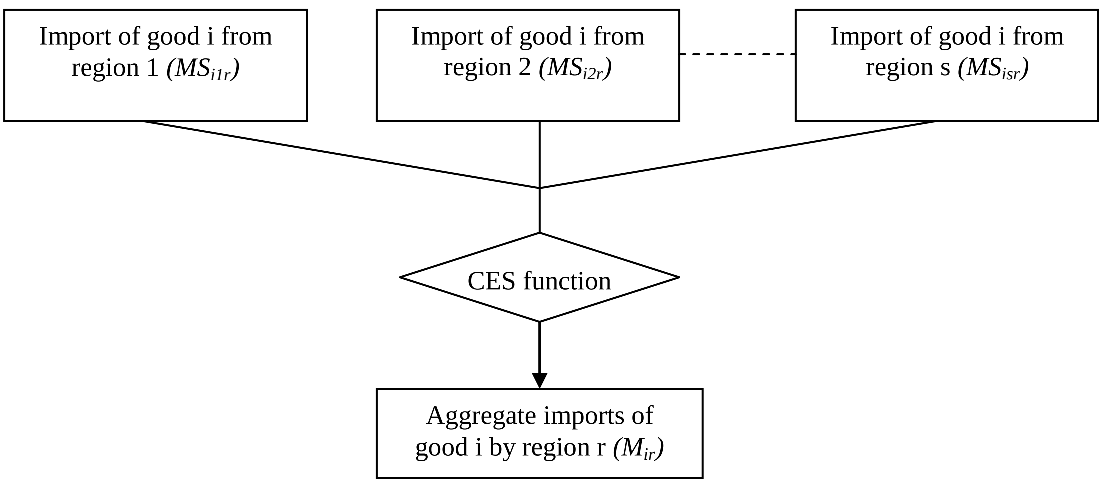
Where:

PM_{ir} = Price of import good *i* from region *r*

4.3.6 Linkage between Countries or Region and Bilateral Trade

In the SAMGEM, countries or regions are linked together through trade and investments flows. Domestic consumers and producers differentiate imports by source, which means imports coming from different countries or regions are considered as imperfect substitutes and modelled with the Armington structure. As mentioned in Section 4.3.5, total imports are modelled as a CES combination of imports from different sources, and then the demand for imports from each source is derived from the cost minimisation condition. On the other hand, exporters do not differentiate exports by countries of destination, that is, commodities supplied to foreign countries are assumed to be seen as perfectly homogeneous and are sold at the same price. The structure of aggregate bilateral exports and imports of countries or regions is illustrated in Figure 4.7. All the equations relating to total and bilateral trade of the SAMGEM are based on the standard GTAP model and are specified in linear form in Section K of Appendix B.4.

Figure 4.7 Strucutre of Bilateral Exports and Imports



In this model, the balance of trade in a particular region is the value of exports in commodity and trade margin minus the value of imports. The regional trade balance can be in deficit or surplus, depending upon the demand for imports and exports. However, the global balance must be zero to ensure that the values of bilateral trade flows are cleared.

The imports of good *i* from region *s* to *r* are represented in a CES functional form as:

$$MS_{isr} = a_{S\,ir}^{\frac{\theta_{ir}}{(1+\theta_{ir})}} \left(\varpi_{S_{ir}} \frac{PMS_{ir}}{PM_{ir}} \right)^{\frac{1}{(1+\theta_{ir})}} * M_{ir} \text{ ....(25)}$$

Here: $M_{ir} = a_{S_{ir}} \left(\sum \varpi_{S_{isr}} MS_{isr}^{-\theta_{ir}} \right)^{\frac{-1}{\theta_{ir}}}$

Where:

$a_{S_{ir}}$	= Scale parameters in import demand function
θ_{ir}	= Exponents in import demand function
$\varpi_{S_{ir}}$	= Share parameters in import demand function

The associated zero profit condition is that the total value of aggregated imports of good *i* in region *r* must be equal to the total value of imports of good *i* from region *s* to region *r*.

$$PM_{ir} * M_{ir} = \sum_S (1 + tm_{isr}) * PM\$_{isr} * MS_{isr} \text{ ....(26)}$$

Where:

tm_{isr}	= Import tariff rates of commodity *i* from region s to region r
$PM\$_{isr}$	= World price of imports of good *i* from region *s* to region *r*

Similarly, exports can be modelled as the total value of the aggregated exports of commodity *i* by region *r* to region *s* as follows:

$$E_{ir} = \frac{1}{PE_{ir}} * \sum_{S} \left[\frac{1}{(1+te_{irs})} * PE\$_{irs} * MS_{irs} \right] \quad (27)$$

Where:

te_{irs} = Export duty rates of good *i* from region r to region *s*

$PE\$_{irs}$ = World price of exports of good *i* from region r to region *s*

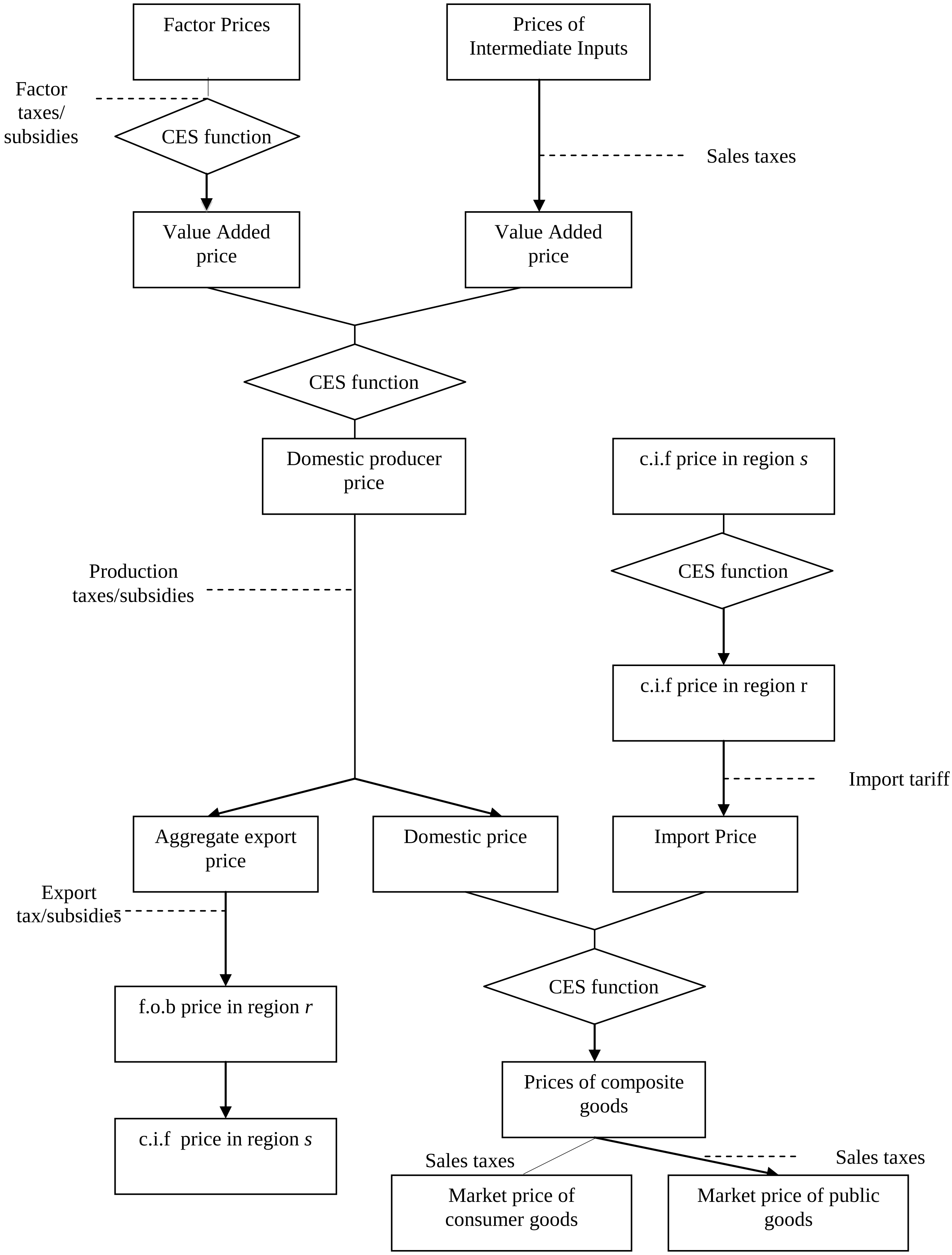
MS_{irs} = Export of good *i* from region *r* to region *s*

4.3.7 Price System

There are several prices associated with each good in the region, namely; output prices, prices of composite goods, value added price by sectors, market price of consumer goods, market price of public goods, market prices of intermediate inputs, market price of capital goods, export price, import price, f.o.b price and c.i.f price. The structure of the pricing system in the model is presented in Figure 4.8.

The average output price is a tax-inclusive aggregation of price of non-savings commodities. The composite good price is the tax-inclusive CES aggregation of domestic and import prices, which is an aggregation of tariff inclusive prices from different sources. The domestic consumer price is the composite good price inclusive of sales taxes and the market price of public goods is the price inclusive of sales taxes on public goods. Prices of mobile endowments comprise factor prices that include price of labour (wage rate) and price of capital (rental rate). The respective factor prices include the taxes/subsides on factor income.

Figure 4.8 Structure of the Price System



The market price of capital goods includes the sales taxes on capital goods. The f.o.b price of each Armington good is the export price plus any export taxes less any subsidies received by the domestic producer. The f.o.b price plus the appropriate international transportation margin gives the c.i.f price. All these pricing equations used in the SAMGEM are based on the standard GTAP model and presented in Section L of Appendix B.4.

4.3.8 GDP Identities

According to the GTAP model, GDP at current prices can be defined as:

$$GDPN_r = \sum_i C_{ir} PCM_{ir} + \sum_i G_{ir} PGM_{ir} + DI_{ir} PKM_{ir} - \sum_{ir} MS_{isr} PM\$_{isr} + \sum_{ir} PE\$_{irs} E_{irs} + \sum_i TMQ_{ir} * P_{ir} \quad \text{....................................(28)}$$

Where:

$GDPN_r$ = Nominal Gross Domestic Product in region *r*

C_{ir} = Total private household consumption in sector *i* in region *r*

PCM_{ir} = Price of composite consumer goods in sector *i* in region *r*

G_{ir} = Total government consumption in sector *i* in region *r*

PGM_{ir} = Price of composite public goods in sector *i* in region *r*

DI_{ir} = Total investment goods in sector *i* in region *r*

PKM_{ir} = Price of investment goods in sector *i* in region *r*

MS_{isr} = Imports of good *i* from region *r* to region *s*

$PM\$_{irs}$ = World price (c.i.f price) of imported good *i* from region *r* to region *s*

E_{irs} = Exports of good *i* from region *r* to region *s*

$PE\$_{irs}$ = World price of exports (f.o.b price) good *i* from region *r* to region *s*

TMQ_{ir} = Total quantity of transport goods *i* from region *r*

P_{ir} = Price of transport goods *i* from region *r*

The real GDP is calculated by eliminating price impacts from the above-calculated nominal GDP. The equations relating to GDP are presented in Section O of Appendix B.4.

4.3.9 Market Clearing Conditions

In the GTAP model, in each region both factor and commodity markets are assumed to be perfectly competitive. A competitive equilibrium in this global economy is such that, given the prices of commodities and factors, demand for goods and supply of goods are equal at the regional as well as at the global level and factor markets clear for each region and at the world level**.** There are mainly three equilibrium conditions in the model; commodity, factor and foreign (global) markets.

- **Commodity Markets**

In the commodity market clearing condition, the demand for each type of commodity must be equal to the commodity supply at the specified prices. In this case, domestic prices serve as equilibrating variables. The commodity market clearing equation is given by:

$$D_{ir} = D_{ir}^{X} \qquad (29)$$

Where:

D_{ir}^{X} = Supply of domestically produced products by sector i in region r

D_{ir} = Demand for domestically produced goods i by private households, government and firms in region r.

- **Factor Markets**

In the GTAP, factor markets clear on the assumption that factors are fully employed and the factor prices serve as equilibrating variables. However, in the SAMGEM, factor markets clear based on short-run and long-run closure. Accordingly, it is assumed that in the short run there exists unemployment in the labour market. However, in the long run it is assumed that the labour is fully employed.

$$\sum_l L_{lr} = L_r \quad \text{......(30)}$$

Where:

L_r = Supply of labour in region r

L_{lr} = Demand for l type of labour in region r

Similarly, capital markets clear when demand for capital is equal to the supply of capital goods produced by the firms and in the short run it is assumed that the capital is fixed and in the long run capital stock can be adjusted until the rate of returns are equalised across countries.

$$\sum_i K_{ir} = K_r^N \quad \text{......(31)}$$

- **Trade and External Balance**

The external balance includes the trade balance in the current account, transport margin accounts, global savings and investments. The trade balance in each region can be positive, negative or zero. Conversely, the global trade balance in the current account and the global external balance must be equal to zero. In the SAMGEM the trade balance in each region is fixed in the short run. Trade balance and the external balance can be presented by the following equations.

$$TB\$_r = \sum_{ir} MS_{isr} * PM\$_{isr} - \sum_i E_{ir} * PE\$_{irs} \text{...}(32)$$

Where:

$TB\$_r$ = Trade Balance in region r

- **The Global Current Account Balance**

$$\sum_{ik} MS_{isr} * PM\$_{isr} - \sum_i E_{ir} * PE\$_{irs} - \sum_i TMQ_{ir} * P_{ir} = 0 \text{..............................}(33)$$

The equations relating to market clearing conditions and trade balance are illustrated in Sections M in Appendix B.4.

4.3.10 Walrasian Law and Numéraire

The global external balance is set to ensure that the sum of regional trade balances must be zero, i.e. the value of global exports must equal the value of global imports. According to the Walras' law, if (n-1) markets are cleared then the nth market will also be cleared; hence, the zero global external balance is guaranteed through the system of equations. The GTAP model offers a separate computation of savings and investment and, therefore, provides a consistency check on the accounting relationships and verifies that Walras' law is satisfied. Since the model can only be solved for (n-1) prices, the one price is set exogenously, and all other prices are evaluated relative to this numéraire (Brockmeier, 2001). In the original GTAP model, the price of savings was chosen as the numéraire. However, in the version 7.0 of the GTAP model, the price of savings varies by region and, therefore, the global average return to primary factors is used as the numéraire in the model. Equations explaining the Walras condition are included in Section N of Appendix B.4

4.3.11 Welfare Evaluation

The Equivalent Variation (EV) is an absolute monetary measure of welfare improvement in terms of income that results from the fall in import prices when tariffs are reduced or eliminated, and is expressed in terms of millions of US dollars. The regional household equivalent variation, resulting from a policy shock, is equal to the difference between the expenditure required to obtain the new level of utility at initial prices and the initial expenditure (McDougall, 2001).

As already explained in section 4.3.2, the consumption demand of the representative household in the SAMGEM is derived by maximising a LES utility function subject to budget constraint, i.e. household disposable income (YDHr). This can be presented as:

Minimise: $\sum_i PCM_{ir} * C_{ir}$

Subject to: $YDH_r = \prod_i \left(C_{ir} - Subs_{ir}\right)^{bshr_{ir}}$ and $\sum_i bshr_{ir} = 1$

The equivalent variation is based on the money metric indirect utility function, which measures how much income the consumer would need at the price in the counterfactual scenario relative to the initial prices and disposable income (YDH_r) (Huff K.M and Hertel, 2000).

The total household consumption expenditure plays an important role in calculating total regional income which affects the determination of regional utility. The overall change in welfare is calculated as the Hicksian measure of Equivalent Variation for a region and for the world as a whole. The well-defined regional utility function of regional households allows a calculation of EV by multiplying the percentage change in overall regional utility by the initial level of regional income. The change in the world welfare is simply the sum of regional welfare changes. All equations relating to welfare[13] in the SAMGEM summarised in Section O of Appendix B.4.

4.4 Concluding Remarks

The objective of this chapter is to present the theoretical framework of a static 16-region, 30-sector multi-country CGE model based on the GTAP model to assess and compare the impact of different trade policy options on trade and income distribution of the South Asian economies. The distinctive feature of the model is the disaggregation of the household sector based on different income groups under different geographical areas. The household sector has been disaggregated based on household consumption survey data of the respective South Asian countries. Disaggregating the single household sector in the GTAP model yields an advantage as it helps to analyse the change in household consumption of different income groups under different trade policy options, so that the implications of trade liberalisation on household income distribution and poverty in the South Asian economies can be

[13] As these equations are based on the standard GTAP model they are not explained in detail. (See Global Trade Analysis Project, the GTAP Modeling Framework, GTAP Version 6.2, September 2003).

determined. The model is calibrated using the GTAP database version 7, which reflects the global economy in 2004. The details of the model calibration and database construction are presented in Chapter 5. The analysis of the results derived from the the model simulations are provided in Chapter 6.

CHAPTER 5 DATABASE CONSTRUCTION AND CALIBRATION OF THE MULTI-COUNTRY CGE MODEL FOR SOUTH ASIA (SAMGEM)

5.1 Introduction

This chapter presents the database construction, sources of data, description of sets, parameters, variables and calibration of the South Asia Multi-Country Computable Equilibrium Model (SAMGEM). The benchmark data used in the SAMGEM are taken mainly from the GTAP database version 7, which represents the global economy in 2004. In calibrating the model it was assumed that the world economy and the regions presented by the benchmark data are in equilibrium and the calibrated parameters therefore reproduce the initial equilibrium in each policy simulation considered in the research.

5.2 Database Construction and the Sources of Data

The GTAP database was used in developing the multi-country model for South Asia. GTAP is a multi-country, multi-sector AGE (Applied General Equilibrium) model (Hertel, 1997) which is widely employed by the researchers and policy makers in conducting quantitative analysis of international trade policy issues. The database used in SAMGEM is based on the GTAP database (Version 7)[14], which was released in 2008. The database corresponds to the global economy in 2004 and

[14] GTAP Version 7 was the latest database available at the time of constructing the database for SAMGEM. At present GTAP Version 8 is the latest which was realesed in June 2012.

covers data for 113 countries/regions, 57 industries and 5 factors of production (Narayanan and Walmsley, 2008). As mentioned in Chapter 4 in constructing SAMGEM, the database of the GTAP model has been aggregated into 16 countries/regions, 30 industries and 3 factors of production.[15]

5.2.1 Household Survey Data

SAMGEM is developed through modification of the standard GTAP model by incorporating a multi-household framework into the model. To evaluate the economic impacts of trade liberalisation in South Asia on household income distribution, additional data on household income and expenditure are used for India, Sri Lanka, Pakistan and Bangladesh. These data were compiled by the following surveys: Consumer Finances and Socio Economic Survey conducted by the Central Bank of Sri Lanka in 2003/2004, the Household Expenditure Survey conducted by the National Sample Survey Organisation (NSSO) of India in 2004, the Household Income and Expenditure Survey conducted by the Federal Bureau of Statistics of Pakistan (FBSP) in 2004/2005 and the Household Income and Expenditure Survey conducted by the Bangladesh Bureau of Statistics (BBS) in 2004/2005. The household data for 2003/2004 and 2004/2005 for South Asian countries are used as they are consistent with the 2004 base year in version 7 of GTAP database. The commodity groups in household survey data of each South Asian country are matched and categorised under the 30 industries aggregated from the GTAP database. Households have been grouped based on the income deciles and under different geographical areas of each of the South Asian countries as explained in Section 4.2.3 in Chapter 4.

[15] See Table B.1, Table B.2 and Table B.3 in Appendix B

Household survey data of each of the South Asian countries are matched with the GTAP household consumption data by calculating the proportions of household consumption data compiled from the respective household surveys mentioned above. The household consumption proportions calculated from the household survey data for the four South Asian countries are presented in Table C.1 in Appendix C. The household incomes are proportionally allocated among different factors of the GTAP based on the proportions calculated from the household survey data of the respective South Asian economies and these proportions are illustrated in Table C.2 in Appendix C.

5.3 Software and Computer Codes

The equations in SAMGEM are written using the TABLO language in the GEMPACK (General Equilibrium Modelling Package) software. The principal programming language for GTAP data and modelling work is based on GEMPACK and it is popular and powerful software in handling complex linear, nonlinear and mixed integer optimisation problems (Codsi G. and Pearson K.R., 1988). Moreover, GEMPACK is appropriate computer software for applied general equilibrium modeling, as the model specifications always relate to make the optimal choice under specified constraints.

The TABLO language, in which the equation file of SAMGEM is written, essentially follows conventional algebra with names for variables and coefficients chosen to be suggestive of their economic interpretations. This equation file is important in creating the interface between the computer and the software used to implement the model. The complete text of the TABLO Input file is presented in Appendix B.4.

In order to analyse the impact of trade liberalisation in South Asia on poverty and income inequality in Sri Lanka, the Distributive Analysis/Analyse Distributive (DAD) software is used. DAD is designed to facilitate the analysis and the comparisons of social welfare, inequality, poverty and equity across distributions of living standards (Abdelkrim and Duclos, 2009). Its features include the estimation of a large number of poverty indices such as Foster-Greer-Thorbecke (FGT), Gini co-efficient and Atkinson indices and also curves, such as the Lorenz curve, that are useful for distributive comparisons as well as the provision of asymptotic standard errors to enable statistical inference.

5.4 The Database and Multi-Country CGE Model for South Asia (SAMGEM)

The GTAP database is organised in an input-output framework. In formulating the database for SAMGEM, the version 7 of the GTAP database has been extended and organised according to Social Accounting Matrix (SAM) framework. The method used to generate SAM representation is according to the Global SAM framework presented by McDonald and Thierfelder (2004). This Global SAM is formulated as a series of single region input-output tables that are linked through the trade accounts. Therefore, this framework is particularly valid in the context of the GTAP, because the regions in the GTAP database are directly linked through commodity trade transactions, although there are certain indirect relationships that exist as a result of demand and supply of trade and transport services (McDonald et al., 2007). The SAM model presented by McDonald et al. contains only a unique regional private household. However, the SAMGEM is extended by splitting the regional private household sector of South Asian countries into household categories as explained in section 4.3.2 in Chapter 4.

In the Global model, exports are valued at fob (free on board) prices to destination y from source x and this must be equal to the value of imports valued at cif (cost-freight-insurance) to destination y from source x. Since this holds for all commodity trade transactions the sum of the differences in the value of imports and exports by each region must be equal to zero. McDonald et al. (2007) noted that, even though the sum of the differences in exports and imports in each region is equal to zero, the resultant trade balances do not fully accord with national accounting as there are other inter-regional transactions which are not recorded in the database.

McDonald et al. (2007) explained that since the SAM is a transaction matrix, each cell in the SAM records the values of the transactions between two agents identified by the row and column accounts. This means that the selling agents are identified by the row entries and therefore record the incomes received by the identified agent. Whereas the purchasing agents are identified by the column entries and they record the expenditures made by such agents. As McDonald et al. (2007) noted the SAM is a relatively compact form of double entry book keeping which is complete and consistent, and can be used to present National Accounts of a particular country. Further, they explained that SAM is complete because it should record all the transactions within the production boundary of the National Accounts, and the SAM is consistent as such income transactions by each and every agent are exactly matched with expenditure transactions by the other agent. Therefore, the fundamental condition should be satisfied in the SAM is that the sum row totals is equal to the sum of column totals. Once this condition is fulfilled the SAM provides a complete framework of the transactions of an economy as a circular flow system. Table 5.1 illustrates transactions recorded in a representative SAM for a typical region and once all these regions are summed the Global SAM can be obtained.

Therefore, in the context of Global SAM, each and every import transaction by a region is matched with an export transaction by another region. The row entries in Table 5.1 represent the values of commodity sales to the representative agents identified in the columns i.e, intermediate inputs are provided by the activities or industries, final consumption is supplied to household, government, investors and exporters. Further, margin services are provided by all other regions in the global SAM. In the above SAM framework, the commodity column entries deal with the supply side, which means they identify the accounts from which commodities to be purchased, in order to satisfy demand. Moreover, the commodities can be either purchased from domestic markets or they can be imported. The domestic supply matrix includes the value of domestic trade and transport margins whereas imports are valued as international trade and transport margins. In addition, payments to producing agents, whether they are domestic or foreign, must be made covering transaction cost, transportation costs and any commodity specific taxes (McDonald et al., 2007).

The GTAP database is more appropriate for constructing the Global SAM as it provides complete coverage of bilateral transactions in commodities, which are valued at free on board prices (fob). The costs of imports of trade and transport margins for each region are associated with the imports of specific commodities and therefore, it would enable identification of each commodity valued at fob with respect to their source and destination regions.

An important feature of the construction of SAM can be identified from the nature of the entries in the commodity account columns. By definition the column totals are equal to the row totals, this can be expressed as ‘price times quantity’. The expenditures incurred in supplying the goods are represented from the column totals and, therefore, the implicit price must be exactly equal to the average cost incurred to supply the commodity (McDonald et al., 2007). In addition since the column totals identify the components that enter into the formation of the explicit prices in the rows, it enables the each price in the pricing system to be identified. McDonald et al. noted that, generally, a SAM is defined in a way that the commodities in the rows are homogeneous and therefore all agents purchase a commodity at the same price.

Total income to the activity accounts are represented from the row entries. In the case of the GTAP database, each activity makes a single commodity and each commodity makes a single activity. Therefore, the domestic supply matrix is a square matrix. The expenditures incurred in the production of such commodities are presented in the activity columns. The intermediate inputs which are used by these activities will be recorded as composites of domestically produced and imported intermediate inputs. In each region, the sum of payments to primary inputs, which were used in production of goods and taxes paid on them, are equal to the activities’ contribution or GDP according to the value added.

Table 5.1 Social Accounting Matrix for a Region in the Global Social Accounting Matrix

	Commodities	Activities	Factors	Households	Government	Capital	Margins	Rest of the World	
Commodities	0	Combined Intermediate Use Matrix	0	Private Consumption	Government Consumption	Investment Consumption	Exports of Margins *(fob)*	Exports of Commodities *(fob)*	Total Demand for Commodities
Activities	Domestic Supply Matrix	0	0	0	0	0	0	0	Total Domestic Supply by Activities
Factors	0	Expenditure on Primary Inputs	0	0	0	0	0	0	Total Factor Income
Households	0	0	Distribution of Factor Incomes	0	Transfers to/from households	0	0	0	Total Household Income
Government	Taxes on Commodities	Taxes on Production Taxes on Factor Use	Direct/Income Taxes	Direct/Income Taxes	0	0	0	0	Total Government Income
Capital	0	0	Depreciation Allowances	Household Savings	Government Savings	0	Balance on Margins Trade	Foreign Savings	Total Savings
Margins	Imports of Trade and Transport Margins	0	0	0	0	0	0	0	Total Income from Margin Imports
Rest of the World	Imports of Commodities*(fob)*	0	0	0	0	0	0	0	Total Income from Imports
	Total Supply of Commodities	Total Expenditure on Inputs by Activities	Total Factor Expenditure	Total Household Expenditure	Total Government Expenditure	Total Investment	Total Expenditure on Margin Exports	Total Expenditure on Exports	

Source: Adapted from McDonald, Thierfelder and Robinson (2007)

The other accounts in the SAM relate to the institutions. All income from factors are distributed to private households in each region after making allowance for depreciation of physical capital and payment of direct (income) taxes. In the standard GTAP model, regional households consist of private household and government while three categories of expenditures are identified relating to the regional household sector, namely: consumption expenditure, savings and taxes. The government receives income from direct and indirect taxes and uses that income to pay for consumption, savings and transfers to households. Section 5.5 describes the structure of SAMGEM and the organisation of the model.

5.5 The Structure of the SAMGEM

This section discusses the basic notations, equations and intuition behind the use of GTAP database, which are used to construct SAMGEM. This helps to develop the TABLO programme, which provides complete documentation of the theory underlying the model. In implementing the model, it is important to understand the basic accounting relationships underpinning the database and the model. The basic accounting relationships in the model can be understood in the context of a flow chart. Figure 5.1 depicts the structure of SAMGEM. Following is a description of the sets and data requirements of each sector of SAMGEM and how it links with the GTAP database. The coefficients/variables of the model in Figure 5.1 are labeled according to the GTAP notations and Section B of Appendix B.4 lists the variables used in the model and their description.

5.5.1 Sets of the SAMGEM

The model consists of different sets and these sets and their elements are presented in TABLO input file, which is illustrated in Section A of the Appendix B.4.

- **Sectors**

According to the GTAP commodity classification, the description of the produced commodities (PROD_COMM) and the traded commodities (TRAD_COMM) are presented in Table B.2 in Appendix B. Produced goods and the traded goods have the same set elements except capital goods (CGDS) are included under the produced commodities.

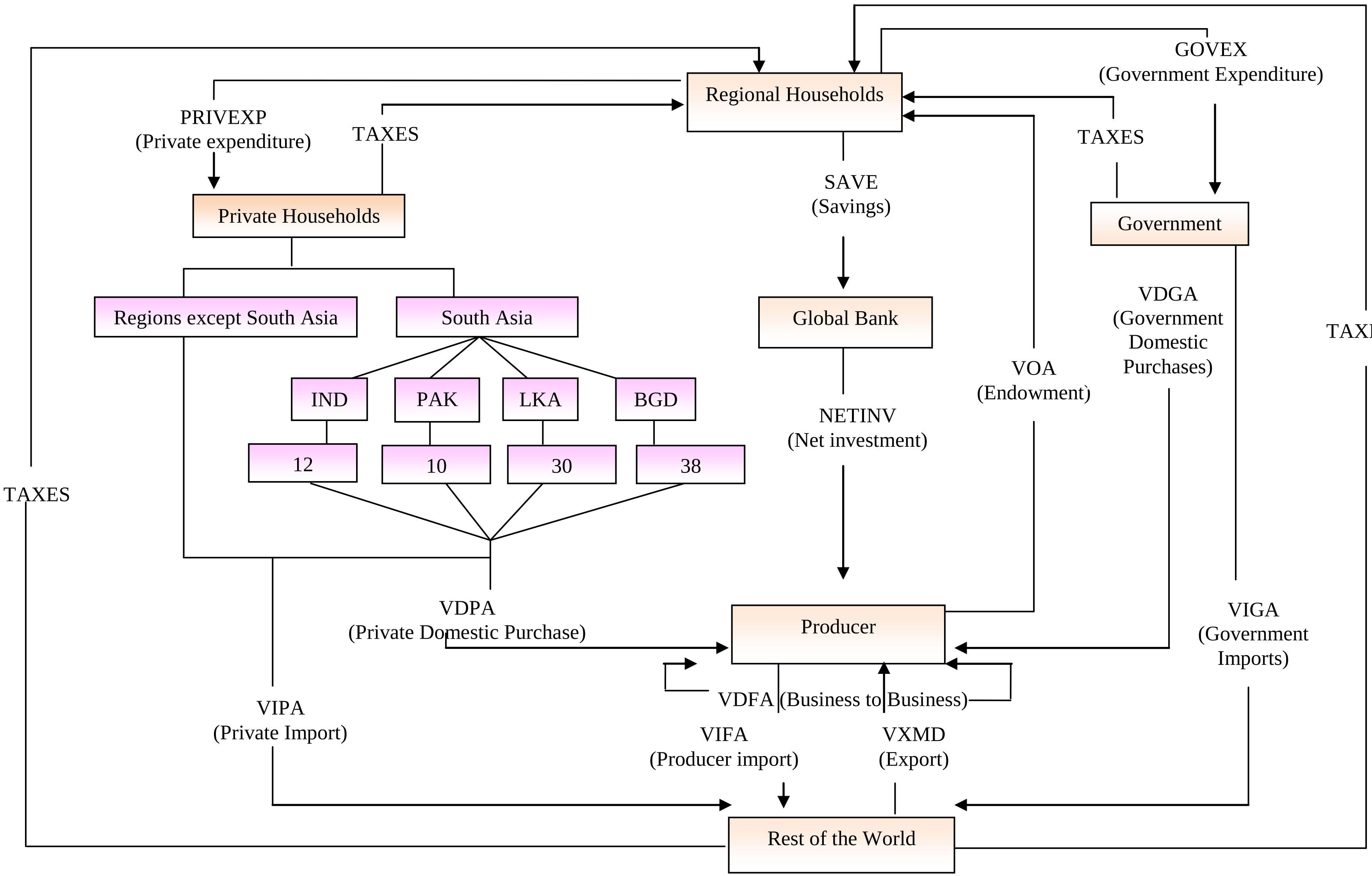
- **Factors**

Factors of production are included under the set of endowment commodities (ENDW_COMM). Further, this is also divided into two sets: capital (Capital) and labour types (COML). The set, Capital, consists of capital, natural resources and land whereas COML includes skilled and unskilled labour. The description of the factor categories are illustrated in Table B.3 in Appendix B.4.

- **Regions**

The regions in the SAMGEM are categorised mainly according to three sets. They are, all regions (REG), which consists of 16 regions, South Asia set (SOUA) which includes Sri Lanka (LKA), India (IND), Pakistan (PAK) and Bangladesh (BGD) and the third one is the rest of the world set (ROW) consisting of all regions except regions in SOUA. The descriptions of regions are presented in Table B.1 in Appendix B.4.

Figure 5.1 Structure of the Multi–Country CGE Model for South Asia (SAMGEM)



Note: The arrows show the flow of money
Source: Adapted from Hertal, (1997)

- **Households**

A set of household groups in India, Sri Lanka, Pakistan and Bangladesh are listed according to different geographical area. India has 24 household groups (HI), which are categorised into 12 rural and 12 urban groups. Sri Lanka consists of 30 household groups (HS): 10 rural, 10 urban and 10 estate groups. Pakistan has 10 household groups (HP): 5 rural groups and 5 urban groups. Finally, Bangladesh has 38 household groups (HB) which consists of 19 rural groups and 19 urban groups.

Once, the sets and the set elements are properly defined the next task is to develop the structure of the SAMGEM according to economic theory. Thee next section onwards explains the different sections of the model by briefly describing the data requirements.

5.5.2 Production and Sales to Regional Markets

In Figure 4.1, Chapter 4, VOA_{jr} refers to the value of the output at agent's prices and represents the payments received by the firms in industry *j* of region *r*. Further, these payments must be precisely exhausted on costs, under the zero profit condition. Accordingly, VOA_{jr} comprises cost of total intermediate inputs ($VPIA_{ijr}$) and total value added (TVA_{jr}) which is presented as:

VOA_{jr} Total production cost of industry *j* in region *r* at agents' prices:

$$VOA_{jr} = \sum_i VPIA_{ijr} + \sum_f TVA_{fjr}$$

$VPIA_{ijr}$ Producer cost of intermediate inputs *i* by industry *j* in region *r* at agents' prices:

$$VPIA_{ijr} = VDFA_{ijr} + VIFA_{ijr}$$

In the production tree the total value added (TVA_{fjr}) of the industry *j* in region *r* at agent's prices is calculated from GTAP header $EVFA_{fjr}$ i.e. endowments output at agents' prices. Once the producer tax (or deduct the subsidy) is added to VOA_{jr}, the value of output at market prices, (VOM_{jr}) is obtained. This is the sum of the value of domestic sales at market prices $VDSM_{ir,}$ the value of exports of good *i* from region *r* valued at domestic market prices and destined for source *s* denoted by $VXMD_{irs}$ and, also includes the possible sales to the international transport sector denoted by $VTWR_{ir.}$ This can be presented as follows:

VOM_{jr} Value of output of *j* in region *r* at market prices

$$VOM_{ir} = VDSM_{ir} + \sum_{s} VXMD_{irs} + VTWR_{ir}$$

$$VOM_{CGDS,r} = VOA_{CGDS,r}$$

The value of the domestic sales at market prices ($VDSM_{ir}$) is calculated as: the sum of household purchases at market prices ($VDPM_{ir}$), government purchases at market prices ($VDGM_{ir}$) and firm's domestic purchases at market prices ($VDFM_{ijr}$).

$VDSM_{ir}$ Domestic sales of commodity *i* in region *r* at market prices

$$VDSM_{ir} = VDPM_{ir} + VDGM_{ir} + \sum_{j} VDFM_{ijr}$$

5.5.3 Household Sector

The coefficients and parameters of the household sector of the SAMGEM are categorised under two parts, i.e, South Asian region and regions other than South Asia. Accordingly, the household sector consists of four South Asian regions (India, Sri

Lanka, Pakistan and Bangladesh) and another 12 regions (11 major trading partners of the South Asia and the rest of the world). All the coefficients and parameters of the South Asian region are disaggregated into different household groups as illustrated in section 5.5.1. The purpose of this disaggregation is to examine the impact of trade liberalisation in South Asia on household income, disposable income, savings and consumption by household groups in rural and urban areas based on the data collected from household surveys of particular South Asian economy. It could be noted that in Sri Lanka there are three sectors: urban, rural and estate (as explained in Section 1.1.2 in Chapter 1, estate sector is also considered as a part of rural sector) and in India, Pakistan and Bangladesh there are only urban and rural sectors. The data in the GTAP database is disaggregated into different household groups in each South Asian country according to the proportions calculated from the household consumption and income data from the household surveys of the above-mentioned South Asian economies. The purpose of this calculation is to match the GTAP data with the household survey data of respective South Asian countries, so that GTAP data are consistent with the household survey data.

a) Household Income

Total household income of SAMGEM consists of factor income from skilled labour ($THSL_{fr}$) unskilled labour ($THUSL_{fr}$) rental income on capital ($THCA_{fr}$). The household income from factors in each South Asian economy is allocated proportionately across household groups based on sources of income of households in each country. These proportions were calculated from the household survey data, illustrated in Table C.2 in Appendix C. Consequently, the total household income from factor *f* in region *r* (THI_{fr}) is:

$$THI_{fr} = THSL_{fr} + THUSL_{fr} + THCA_{fr}$$

All the income earned from lending factors within the region accrues to the households in the same region and this is represented by endowments-output at agents' prices ($EVOA_{fr}$). In order to obtain the net factor income ($NTHI_r$) from factor *f* in region *r*, it is necessary to deduct depreciation expenses ($VDEP_r$) in that region to maintain the integrity of initial capital stock (Hertel, 1997). In calculating the net factor income of each household in South Asia, the total depreciation expenses are disaggregated based on the same shares used to disaggregate income from capital.

$$NTHI_r = \sum_f THI_{fr} - VDEP_r$$

b) Disposable Income

Household disposable income (YDH_r) is calculated by incorporating government transfers ($GTRS_r$) and deducting income taxes ($YTAX_r$) and private household savings ($PRSAVE_r$) from the net household income ($NTHI_r$).

$$YDH_r = NTHI_r + GTRS_r - YTAX_r - PRSAVE_r$$

$GTRS_r$ in region r *(*transfers to/from government) is considered as a part of payment from/to the households by the government. Accordingly, net household income ($NTHI_r$) should be equal to the sum of private consumption ($VHPA_r$), private savings ($PRSAVE_r$) and government transfers ($GTRS_r$).

$$NTHI_r = VHPA_r + PRSAVE_r + GTRS_r$$

Transfers to each household ($GTRS_r$) in region r are calculated as the residual between the net household income and the private household consumption and private savings.

c) Household Savings

Household savings ($PRSAVE_r$) in the GTAP database is disaggregated into different household groups according to the proportions of household income.

d) Household Consumption

Since, the prime objective of the research is to analyse the impact of trade liberalisation in South Asia on household income distribution and poverty, it is important to understand the meaning of poverty. '*Economic poverty*' refers to a deficiency in the amount of financial resources a household has to meet its basic needs, which can be defined in either absolute or relative terms. '*Absolute poverty*' refers to the set of resources a person must acquire to maintain a minimum standard of living for survival. '*Relative poverty*' is concerned with how worse off an individual or household is with respect to others in the same society (Kawaka, 2005). The impact on household consumption and its distribution is central to welfare analysis in any economic research of trade liberalisation. Furthermore, the analysis of urban-rural distribution of consumption expenditure across different household groups can provide valuable insights into policy making. Tables 5.2 to 5.5 depict the consumption expenditures of household groups as a percentage of total consumption expenditure within the same sector and between different sectors, and are based on household survey data. The purpose of this analysis is to identify the consumption disparities in rural and urban sectors of South Asian economies.

According to the figures in Table 5.2, consumption expenditure of lower household income groups is significantly lower compared to higher income groups in the same sector in Sri Lanka. However, there is no significant difference in consumption expenditure of the same household groups among different sectors (urban, rural and estate) in Sri Lanka.

Table 5.2 Percentage of Household Consumption Expenditure: Sri Lanka

Sector	Income Deciles										Total (%)
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
	Consumption expenditure of a household group as a % of total consumption expenditure (Inter-group comparison: across rows)										
Urban	8.2	8.0	7.4	8.6	8.9	9.2	10.6	11.0	12.4	15.7	100.0
Rural	7.6	7.8	8.3	8.6	9.2	10.0	10.6	11.3	11.9	14.7	100.0
Estate	7.5	8.4	8.5	9.4	9.7	10.4	10.3	10.5	13.1	12.2	100.0
Consumption expenditure of a household group based on geographical area as a % of total consumption expenditure (Intra-group comparison: along a column)											
Urban	37.9	35.8	32.9	34.9	34.5	33.4	36.2	36.1	35.7	39.5	35.9
Rural	31.8	31.4	33.7	31.7	32.5	33.2	33.0	33.6	31.3	33.4	32.6
Estate	30.3	32.8	33.4	33.4	33.0	33.4	30.8	30.2	33.0	27.0	31.5
Total(%)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Author's calculations from Consumer finances and Socio Economic Survey Conducted by the Central Bankd of Sri Lanka 2003/2004

Table 5.3 Percentange of Household Consumption Expenditure: Pakistan

Sector	Income Quintiles					Total (%)
	1	**2**	**3**	**4**	**5**	
	Consumption expenditure of a household group as a % of total consumption expenditure (Inter-group comparison: across rows)					
Urban	8.5	12.1	15.1	20.2	44.2	100.0
Rural	9.4	13.4	16.9	22.1	38.1	100.0
Consumption expenditure of a household group based on geographical area as a % of total consumption expenditure (Intra-group comparison: along a column)						
Urban	50.6	50.5	50.4	50.9	56.9	53.2
Rural	49.4	49.5	49.6	49.1	43.1	46.8
Total (%)	100.0	100.0	100.0	100.0	100.0	100.0

Source: Author's calculations from the Household Expenditure Survey conducted by Federal Bureau of Statistics of Pakistan in 2004

According to Table 5.3 Pakistan also experiences that the consumption of lower income household groups is significantly lower than the higher income groups (inter group comparison). Table 5.3 indicates that in Pakistan the consumption of lower income household groups is significantly lower than the higher income groups (inter group comparison). However, there is not a considerable variation in consumption in the same household group in urban and rural sectors (intra group comparison). Table 5.4 demonstrate that in India, there is substantial difference in consumption expenditure among different groups (inter group) in the same sector and also this difference is also high in the same group among rural and urban sectors in India. Table 5.5 for Bangladesh presents a similar pattern of consumption among different household groups as in India, the consumption expenditure of low income groups is significantly lower in rural sector compared to the urban sector in Bangladesh.

Based on the above analysis it is evident that there are differences in consumption expenditure among inter-household groups as well as intra-household groups. Therefore, it is important to undertake a detailed analysis to investigate the impact of trade liberalisation on consumption pattern of different household groups in different geographical areas to make appropriate policy recommendations to minimise the income distribution gaps in South Asian economies. Hence, it is important to select a suitable functional form to analyse household consumption demand to capture the implications of trade liberalisation on income distribution and poverty.

Table 5.4 Percentage of Household Consumption Expenditure: India

Sector	Monthly per capital expenditure groups in Indian Rs.												
	1	2	3	4	5	6	7	8	9	10	11	12	
	0-225	225-255	255-300	300-340	340-380	380-420	420-470	470-525	525-615	615-775	775-950	950-above	Total (%)
	Consumption expenditure of a household group as a % of total consumption expenditure (Inter-group comparison: across rows)												
Urban	2.2	3.0	3.5	4.2	4.8	5.6	6.5	7.6	9.2	11.6	15.3	26.6	100.0
Rural	3.1	3.9	4.5	5.1	5.8	6.4	7.1	8.0	9.0	10.9	13.5	22.6	100.0
Consumption expenditure of a household group based on geographical area as a % of total consumption expenditure (Intra-group comparison: along a column)													
Urban	55.5	57.3	58.2	58.9	59.7	60.7	61.7	62.8	64.2	65.3	66.8	67.5	63.9
Rural	44.5	42.7	41.8	41.1	40.3	39.3	38.3	37.2	35.8	34.7	33.2	32.5	36.1
Total(%)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Author's calculations from the household expenditure survey conducted by National Sample Survey Organisation (NSSO) of India 2004

Table 5.5 Percentage of Household Consumption Expenditure: Bangladesh

Sector	**Monthly per capital expenditure groups in Taka**																			**Total**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	
	<750	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3999	4000-4999	5000-5999	6000-6999	7000-7999	8000-8999	9000-9999	10000-12499	12500-14999	15000-17499	17500-19999	20000+	
	Consumption expenditure of a household group as a % of total consumption expenditure (Inter-group comparison: across rows)																			
Urban	2.5	1.9	1.8	2.1	2.5	2.5	2.7	2.9	3.5	3.9	4.6	5.4	5.3	5.5	6.8	9.2	10.0	11.4	15.5	100.0
Rural	1.7	1.9	2.1	2.2	2.6	4.5	4.7	3.3	3.9	4.4	4.9	5.2	6.1	5.8	7.1	8.2	8.9	8.9	13.6	100.0
Consumption expenditure of a household group based on geographical area as a % of total consumption expenditure (Intra-group comparison: along a column)																				
Urban	64.0	55.0	51.6	53.8	54.1	39.9	40.8	51.8	52.9	51.9	53.5	55.8	51.8	53.4	54.0	57.7	57.9	61.0	58.2	55.0
Rural	36.0	45.0	48.4	46.2	45.9	60.1	59.2	48.2	47.1	48.1	46.5	44.2	48.2	46.6	46.0	42.3	42.1	39.0	41.8	45.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Author's calculations from the Household Expenditure Survey Conducted by Bangladesh Bureau of Statistics in 2004/2005

As explained in Section 4.3.2 in Chapter 4, the standard GTAP model uses the Constant Difference Elasticities (CDE) functional form to analyse the private household consumption behaviour. However, in SAMGEM the Linear Expenditure System (LES), which was introduced by Stone (1954), is used to estimate the household consumption demand in contrast to the CDE function because it incorporates subsistence consumption. Hence, the LES function is more appropriate to use in this situation as it has the ability to capture issues relating to income distribution and poverty. The LES function in the model is:

$$VHPA_{ir} = SUBS_{ir} + \frac{bshr_{ir}}{PCM_{ir}} \left[YDH_{ir} - PCM_{ir} * SUBS_{ir} \right]$$

Where: $VHPA_{ir}$ is the total household consumption of good *i* in region *r*, $SUBS_{ir}$ is the subsistence consumption of good *i* in region *r*, PCM_{ir} is the price of composite good *i* in region *r*, YDH_{ir} is the disposable income of factor *i* in region *r* and $bshr_{ir}$ is the marginal budget share of good *i* in region *r*.

In the above equation, the total demand for household consumption expenditure ($VHPA_{ir}$) is calculated by summing household domestic purchases of good *i* in region *r* at agent's prices ($VDPA_{ir}$) and household's imports good *i* in region *r* at agent's prices ($VIPA_{ir}$), which can be illustrated as:

$$VHPA_{ir} = VDPA_{ir} + VIPA_{ir}$$

It is important to design the SAMGEM in such a way to capture both absolute poverty and relative poverty impacts of trade liberalisation. As previously mentioned, in South Asia household consumption is disaggregated in each member country based on different geographical areas (urban/rural) and income deciles. This distinction is very important when analysing the impact of trade reforms on rural poverty, urban poverty and rural-urban inequality. Since, the model facilitates an analysis of changes in consumption among different household groups, it enables examination of relative poverty aspects of trade reforms. In addition, a useful feature of the LES is the estimation of subsistence quantities which is represented by $PCM_{ir} * SUBS_{ir}$. If any household group does not have access to means at a minimum requirement, the respective household group is said to fall under absolute poverty. The difference between the household disposable income and the level of subsistence consumption $(YDH_{ir} - PCM_{it} * SUBS_{ir})$ is known as '*supernumerary income' or 'discretionary income'*.

To calibrate the household consumption function, it is necessary to estimate the level of subsistence consumption. The parameter estimates that have been used to obtain subsistence expenditure are marginal budget shares and Frisch parameters. As explained in Chapter 4 in section 4.2.3, the level of subsistence consumption is:

$$SUBS_{ir} = VHPA_{ir} + \frac{bshr_{ir}}{PCM_{ir}} * \left[\frac{YDH_{i,r}}{frisch_r} \right]$$

The level of subsistence consumption in sector *i* in region *r*, marginal budget shares ($bshr_{ir}$) and Frisch parameters ($frisch_r$) can be calculated using the formulas explained below.

- **Marginal Budget Shares**

$$bshr_{ir} = \frac{\varepsilon_{ir} * PCM_{ir} * VHPA_{ir}}{YDH_{ir}}$$

Where: ε_{ir} = Income elasticity of demand

The values for marginal budget shares are also estimated under two categories: South Asia and regions other than South Asia. Income elasticities of demand or expenditure elasticities are imposed exogeneously and been taken into account in calculating marginal budget shares (exogenous parameter) of respective countries. Since these elasticities are based on the income (or the expenditure), one could not expect the same values of elasticities to exist across the household groups in South Asian countries. For instance, the pattern of household consumption with respect to change in income could vary in urban and rural household groups. Therefore, these elasticity values for different household groups have been obtained from the previous research undertaken for South Asian countries. A study undertaken by Rajapakse (2011) to estimate non-linear Engel curves for Sri Lanka, calculated expenditure elasticities for rural, urban and estate sector under broad commodity categories. Similarly, Majumder (1986) researched the consumer expenditure pattern in India, estimating expenditure elasticities for urban and rural household groups under different commodity groups. Furthermore, a study undertaken by Yen and Roe (1986) to identify the determinants of urban and rural household demand in India, calculated expenditure elasticities for urban and rural household groups under different commodity groups. Likewise, Burney and Khan (1991) investigated household consumption patterns in Pakistan, estimating expenditure elasticities for six urban and rural household groups under various commodity categories.

All the aforementioned studies have calculated expenditure elasticities for broad commodity categories and therefore, in the present research, these values have been mapped with the GTAP commodity categories in estimating marginal budget shares for South Asian countries. These estimated expenditure elasticity values are presented in Table C.3 in Appendix C. However, in calculating marginal budget shares for rest of the world, income elasticities from the GTAP database have been used as there is only one representative household for these 12 regions.

Furthermore, the calculated marginal budget shares are presented in Table C.4 and Table C.5 in Appendix C for rest of the world and South Asia respectively. According to the theoretical definition of Engel aggregation, the sum of marginal budget shares for sector *i* in region *r* should be equal to one (Brown et al., 1972). The marginal budget shares which are calculated using the above formula may not exactly equal one, (rather the values are very close to one) since the income elasiticities are taken from different sources. Therefore, the marginal budget shares have to be readjusted, so that the sum of budget shares is equal to one.

- **Frisch Parameters**

It was decided to estimate the values of Frisch parameters for India, Sri Lanka, Pakistan and Bangladesh, as the main focus of the research is on the South Asian region.

The estimation of the Frisch parameters are based on the study undertaken by Lluch et al. (1977, pp.248-50), which approximated the relationship between the per capita income in 1970 in US dollars (X) and the Frisch parameter (*frisch*) in the following formula.

$$frisch \approx 36X^{-0.36}$$

According to the above formula, the Frisch parameter has an inverse relationship with the per capita income of the country. To estimate the Frisch parameter, the per capita income of the respective South Asian countries were obtained from World Bank database and existing literature, and these values can be presented in Table 5.6 below.

Table 5.6 Estimated Frisch Parameters for South Asian Countries

Country	Per Capita Income in 1970 in US$ (a)	Frisch Parameters (b)
India	110	-6.86
Sri Lanka	160	-5.79
Pakistan	160	-5.61
Bangladesh	81	-7.40

Source: (a) Per capita income for India, Sri Lanka and Pakistan were obtained from world bank database and per capita income of Bangladesh was obtained from the exiting literature (Olau, 1989). b)Author's calculations based on the formula presented by Lluch et al. (1977, pp.248-50)

The estimated values of the Frisch parameters using the above formula are broadly in line with the values adopted in other CGE studies on developing countries ranging from -2.94 for Mexico to -7.57 for India (Hertel,1997). Furthermore, from existing literature[16] the Frisch parameter for the urban sector is generally low compared with the rural sector and, accordingly, the value of the Frisch parameter in developing

[16] Frisch parameter values are estimated as -4.57, -5.45 and -6.43 for the urban, rural and estate sectors respectively for Sri Lanka (Bandara, 1989).

countries' urban sector is -3.34, whereas the same in the rural sector -5.85 (Hertel, McDougall and Dimaranan, 1997).Therefore, subsistence consumption levels of urban and rural sectors are calibrated using estimates for different household groups based on the above calculated Frisch parameters of South Asian countries

The Frisch parameter values for other regions in SAMGEM are reported in Table 5.7.

Table 5.7 Frisch Parameters for Other Regions

Region	Frisch Parameters
XSA	-7.18
USA	-1.53
CAN	-1.62
EU	-2.00
ASE	-4.25
HIA	-2.05
JPN	-1.41
CHN	-6.88
XME	-3.54
AUS_NZL	-1.83
RUS_XSU	-3.54
ROW	-4.45

Source: Dimaranan B., McDougall R. and Hertel T, 1997

5.5.4 Government Sector

According to Figure 5.1, TAXES flow from private households, firms and government to the regional household sector. Since these value flows include both taxes and subsidies, they denote net tax revenues (Hertel, 1997). Private households and the government not only spend their available income on consumption goods, but also pay TAXES to the regional household. In the case of the government, TAXES consist of consumption taxes on commodities and in contrast to that, TAXES paid by the private household cover consumption taxes and income tax net of subsidies. In GTAP, tax revenues and subsidy expenditures are computed by comparing the value of a given transaction, evaluated at agents' and market prices (Hertel, 1997). In the SAMGEM taxes and subsidies are computed in the same manner. As mentioned in section 4.3.2 in Chapter 4, there are eight kinds of taxes/subsidies, which consist of total government revenue in region *r* ($GREV_r$). The formulas used to calculate each of the above mentioned taxes are explained in detail in the TABLO input file illustrated in Section D of Appendix B.4.

Total Government expenditure is evaluated at Agents' prices ($NVGA_{ir}$). This includes domestic purchase ($VDGA_{ir}$) and government imports ($VIGA_{ir}$).

$$NVGA_{ir} = VDGA_{ir} + VIGA_{ir}$$

In order to model the behaviour of demand for government consumption (domestic and imports), the CES function is used in SAMGEM, as in the case of the standard GTAP model. The demand for public goods ($GOVD_{ir}$) is evaluated at the market prices and this includes domestic purchases ($VDGM_{ir}$) and government imports ($VIGM_{ir}$) as follow:

$$GOVD_{ir} = VDGM_{ir} + VIGM_{ir}$$

Total government revenue in region r ($GREV_r$) should be equal to the sum of government expenditure ($NVGA_r$), government savings ($GSVE_r$) minus government transfers to households.

$$GREV_r = NVGA_r + GSVE_r - GTRS_r$$

Accordingly, total expenditure in region r should be equal to total income. This is satisfied as follows.

$$NTHI_r = VHPA_r + PRSAVE_r + GTRS_r$$

Where: $NTHI_r$ is the net household income, $VHPA_r$ is the total private consumption expenditure, $PRSAVE_r$ is the private savings and $GTRS_r$ is the transfers to/from households.

Total income ($INCOME_r$) in region r is the sum of net household income ($NTHI_r$) and the total government revenue ($GREV_r$).

$$INCOME_r = NTHI_r + GREV_r$$

Total expenditure in region *r* ($TEXREG_r$) equals the sum of total savings ($SAVE_r$), private consumption expenditure in region *r* ($VHPA_r$) and government expenditure in region *r* ($NVGA_r$).

$$TEXREG_r = VHPA_r + NVGA_r + SAVE_r$$

5.5.5 Investment Sector

The standard GTAP model assumes that the 'global bank' allocates international capital flows in response to changes in regional rates of return (Hertel, 1997). This bank collects regional savings and foreign savings and uses these for international investments as follows:

$$INV_r = VDEP_r + SAVE_r$$

The total gross investment (INV_r) in the region comprises of regional savings ($SAVE_r$), and total depreciation ($VDEP_r$). Investment demand is modelled according to the Cobb-Douglas function and Investment demand ($DIVS_{ir}$) in sector *i* in the region *r* in turn is determined by the regional investment (INV_r). The total capital stock ($CAPS_r$) in the region during a given period is computed by adding beginning stock of capital ($KLAG_r$) and investment during the period (INV_r) as follows:

$$CAPS_r = KLAG_r + INV_r$$

Capital accumulates as a result of net investment (Hertel, 1997). It is assumed in the SAMGEM capital is mobile across sectors; it moves in response to a higher reward. This implies that the equilibrium rental rates on capital are equalised across all sectors of each region in the model.

5.5.6 Global Transportation Sector

The global transport sector in the GTAP model provides the services that account for the difference between fob (free on board) and cif (cost, insurance and freight) for a particular commodity shipped along a specific route (Hertel, 1997). In other words, the transport cost margin ($VTWR_{isr}$) is the difference between bilateral imports ($VIWS_{isr}$) and exports at world market prices ($VXWD_{irs}$) can be determined as:

$$VTWR_{isr} = VIWS_{isr} - VXWD_{irs}$$

The international transport rates (tr_{isr}) can be calculated as:

$$tr_{isr} = \frac{VIWS_{isr}}{VXWD_{irs}} - 1$$

Moreover, the total cost associated with the international transportation services (ITC) would be:

$$ITC = \sum_{r}\sum_{i}\sum_{s} VTWR_{isr}$$

The total demand for international transport services ($VTWR_{isr}$) is calculated by adding all routes and commodities and is illustrated in Figure 4.5 in Chapter 4. The supply of these services is provided to individual regional economies, which export them to global transport sector (VST_{ir}). However, in GTAP, we do not have information that would permit the determination of regional transportation services, exports associated with particular commodities and routes. Therefore, it is assumed that all demand is met from the same pool of services, the price of which is a blend of the price of all transport services exports (Hertel, 1997). Accordingly, in the GTAP model, transport margins are derived from equating supply and demand in the global transport sector (Hertel, 1997) and, therefore, at equilibrium the total demand of international shipping industry in every region must be equal to its global supply. This can be illustrated as:

$$\sum_{r}\sum_{i} VST_{ir} = \sum_{r}\sum_{i}\sum_{s} VTWR_{isr}$$

Version 7 of the GTAP database includes international transportation margins for air, water and other transportation. Efficient transportation is one aspect of trade facilitation which is important in enhancing international trade in a country. It is evident that countries with inadequate trade infrastructure are less capable of benefiting from the opportunities of expanding global trade (Weerahewa, 2009).

5.5.7 Foreign Sector

The GTAP model/database links countries through bilateral trade. According to Figure 4.1 in Chapter 4, considering the production side of the open economy, firms obtain additional revenues for selling commodities to the rest of the world. The value of exports of commodity i from region r to region s ($VXMD_{irs}$), is valued at the exporter's domestic market. Once the exports taxes or subsidies are adjusted to this value one can obtain the value of exports of commodity i from region r to region s ($VXWD_{irs}$) valued at the world prices. In other words the difference between the market price and the world price is known as the exports taxes/ (subsidies), which can be represented by:

$$ETAX_{irs} = VXMD_{irs} - VXWD_{irs}$$

On the other hand, total imports of commodity *i* from region *r* (TMS_{ir}) comprises total imports of firms ($VIFM_{ijr}$), total imports of household ($VIPM_{ir}$) and the total imports by the government ($VIGM_{ir}$) at market prices;

$$TMS_{ir} = \sum_j VIFM_{ijr} + VIPM_{ir} + VIGM_{ir}$$

Similarly, the value of imports of a commodity i from region s to region r is determined at market prices by source ($VIMS_{isr}$) and the value of imports of commodity *i* from region *r* to region *s* at world market prices ($VIWS_{isr}$) is determined by adjusting import taxes ($MTAX_{isr}$);

$$MTAX_{isr} = VIMS_{isr} - VIWS_{isr}$$

The GTAP model employs the so-called Armington assumption in the trading sector which enable the determination of imports by their origin and explains intra-indusrty trade of similar products (Hertel, 1997). Thus, imported commodities are assumed to be separable from domestically produced goods and combined in an additional nest in the production tree as illustrated in Figure 4.1 in Chapter 4. The elasticity of substitution in this input nest is equal across all uses and it is known as

Armington elasticities and is denoted by ESUBD (Table C.6 in Appendix C). Under these circumstances, the firms decide first on the sourcing of their imports and, based on the resulting composite import price, they then determine the optimal mix of imported ($VIMS_{isr}$) and domestic goods ($DOMSALE_{ir}$) which formed the composite goods ($COMG_{ir}$) in the production nest. Then the bilateral imports from source *s* to region *r* are allocated based on Armington CES for regional allocation of imports (ESUBM).

5.5.8 Equilibrium Conditions and Checking the Benchmark Data for Consistency

As mentioned before in Section 5.1, the SAMGEM is based on the GTAP version 7 database featuring 2004 as the benchmark year. The behaviour of economic agents in CGE models is determined explicitly through utility and profit maximizing assumptions. The neoclassical paradigm implies that at equilibrium firms realise zero profits (Dixon and Parmenter, 1996). This condition can be illustrated by indicating that profit of sector i in region r ($PROFIT_{jr}$) should be zero:

$$PROFIT_{jr} = VOA_{jr} - \sum_{i} VIDA_{ijr} - \sum_{f} FVFA_{fjr}$$

Where: VOA_{jr} is the value of output j in region r at agents' price, VFA_{ijr} is the value of the traded commodties i in sector j in region r at agent price and $EVFA_{fjr}$ is the value of endowment commodties f in sector j in region r at agents' price.

The following conditions should also be met at the equilibrium (Kitwiwattanachai A, 2008):

- The economic surplus ($ESUPR_r$) in the region r must be equal to zero.

$$ESUPR_r = \sum_f \sum_j TVA_{fjr} - VDEP_r + GREV_r - \left(\sum_i NVPA_{ir} + NVGA_{ir} \right) - SAVE_r$$

Where: TVA_{fjr} is the total value added of factor *f* in sector *j* in region *r* at agents' price, $VDEP_r$ is the depreciation in region *r*, $GREV_r$ is the total government revenue in region *r*, $NVPA_{ir}$ is the total private consumption expenditure of commodity *i* at agents' price in region *r*, $NVGA_{ir}$ is the total government expenditure of commodity *i* at agent's price in region *r* and $SAVE_r$ is the total regional savings.

- The residual of production of commodity i in region r ($RPROD_{ir}$) must be equal zero.

$$RPROD_{ir} = VOM_{ir} - VDSM_{ir} - \sum_s VXMD_{irs} - VST_{ir}$$

Where: VOM_{ir} is the value of the output of commodity *i* at market price in region *r*, $VDSM_{ir}$ is the total domestic sales of commodity *i* at market price in region *r*, $VXMD_{irs}$ is the exports of commodity *i* at market price from region *r* to region *s* and VST_{ir} is the margin commodity *i* at market price in region *r*.

- The residual of the international transportation industry (*RTR)* must be equal to zero.

$$RTR = \sum_i \sum_r VST_{ir} - ITC$$

Where: VST_{ir} is the market price of transport services and ITC is the cost of transport services.

- The current account in region r (BOT_r):

$$BOT_r = \sum_i \sum_s \left(VXWD_{irs} - VIWS_{isr} \right) + \sum_i VST_{ir}$$

Where: $VXWD_{irs}$ is the value of exports of good *i* from region *r* to region *s* at world market price, $VIWS_{isr}$ is the value of imports of good *i* from region *s* to region *r* at world market price and VST_{ir} is the value of margin commodity *i* in region *r* at market price.

- The residual of the global current account balance (GBOT) must be equal to zero:

$$GBOT = \sum_r BOT_r$$

Where: BOT_r is the current account balances in region *r*.

5.5.9 Price initialisation in the Model

A common assumption for CGE models, which has been adopted in calibrating the SAMGEM, is that the economy is initially in equilibrium with the quantities normalised in such a way that all prices are equal to unity (Bayar, 2009). All nominal values are represented in dollar values (US$ in millions) and in testing nominal homogeneity, similar to the standard GTAP, the global average return to primary factors (pfactwld) has been used as the numéraire and the real values are given by the dollar values divided by the respective price indices.

5.6 Calibration of the Multi-Country CGE Model for South Asia (SAMGEM)

Having designing the theoretical structure of the model and construction of the database, this section explains the procedure that follows to solve the model. In CGE modelling a single base year is often used as an observation year and it is assumed that the selected year provides a 'benchmark' equilibrium. Profit and utility maximising conditions are then assumed to hold in the base year, allowing the remaining parameters to be determined from the base data, a process called calibration. In calibrating the parameters in CGE models it is assumed that there are no stochastic disturbances in the equation sets and CGE modelling follows a non-stochastic approach assuming there is no error term in the equations (Kitwiwattanachai A, 2008). The solution of a CGE model entails finding parameters and elasticities to feed the model equations (Dixon and Parmenter, 1996). The parameters and elasticity values that are used to calibrate the model are very important to assess the impact of change in any policy reforms on the respective economies.

5.6.1 Calibration of the parameters

The SAMGEM is calibrated in such a way that the model produces the parameter values which guarantee that the benchmark data set provides an equilibrium solution to the model. Parameters such as elasticitity values could not be obtained by calibration and these values need to be econometrically estimated, gathered from the existing literature or extracted from a reliable database. The calibrated values of the parameters of the SAMGEM are illustrated in the TABLO input file in Appendix B.4.

5.6.2 Elasticities from the GTAP Database

Most of the elasticity values used in the model are directly taken from version 7 of the GTAP database. It should be noted that the choice of elasticity values critically affects the results of policy simulations generated by the model and therefore it is important to select appropriate values for elasticities.

The GTAP database contains two sets of source substitution elasticities. One relates to the substitution between domestic products and imports (ESUBD)[17], and the other relates to substitution between imports from different regions (ESUBM)[18]. In the GTAP model, the source substitution elasticities are defined separately for each of the representative agents within each region rather than referring to single economy- wide demand behaviour, as in the other models (Hertel, 1997). Therefore, it is clear that for each commodity within each region, the domestic-import mix is determined separately for each industry and for each final demand category: household consumption, government consumption and investment.

The sourcing of imports is also determined separately for intermediate usage (for all industries together) and for each of the final demand category. Finally, for cross

---

[17] See Table C.6 in Appendix C

[18] See Table C.9 in Appendix C

regional behaviour, the GTAP model assumes that for each commodity, all agents in all regions display the same substitution elasticity (McDougall et al., 2006). Table 5.8 presents the elasticities extracted from GTAP version 7 database in calibrating the SAMGEM.

In SAMGEM, primary factors of production are assumed to be substitutable according to CES denoted by $ESUBVA_j$[19], while composite value added and intermediates are used in fixed proportions. The overall elasticity of substitution among primary factors determines the ability of the economy to alter its output mix in response to changes in relative prices, or changes in the endowments of these factors. These parameters also play an important role in determining the sectoral supply response in the presence of sector-specific and sluggish factors of production (Hanslow et al., 1997).

Investment flexibility parameters refer to the degree of flexibility of regional investment (*RORFLEX*). The smaller the value of $RORFLEX_r$, the greater responsiveness of international investment to change in the rate of return in region *r*. Because, $RORFLEX_r$ is indexed over regions, it is possible to have some regions where investment is quite sensitive to changing rates of returns, and others where this is not the case (Dirmaranan, McDougall and Hertel, 2006).

[19] See Table C.7 in Appendix C

Table 5.8 Elasticities Extracted from the GTAP Database

Elasticities/ Parameters	Description
$ESUBD_i$	Elasticity of substitution between domestic and imported goods *i* in the Armington aggregation structure for all agents in region *r*.
$ESUBM_i$	Elasticity of substitution among imports of good *i* from different destinations in the Armington aggregation structure of all agents in region *r*.
$ESUBVA_j$	Elasticity of substitution between primary factors in the production of commodity *j* in region *r*.
EY_{ir}	Income elasticities of private household demand for good *i* in regions other than South Asia.
$EXPELAST_{irs}$	Exports supply elasticity for good *i* from region *r* to *s*
$IMPELAST_{isr}$	Import demand elasticity of good *i* from region *r* to *s*
$RORFLEX_r$	Expected rate of return flexibility parameter of region *r*

Source: The GTAP Version 7 Database (Purdue University: Centre for Global Trading Ananlysis, 2008)

Income elasticities (EY_{ir}) for rest of the world (12 regions in the model) were obtained from the GTAP version 7 database and these elasticity values were used to calculate marginal budget shares presented in Table C.4 and Table C.5 in Appendix C. As explained in section 5.5.3 income elasticities for South Asian countries were obtained from the existing literature.

In the SAMGEM supply of exports and demand for imports are modelled in the same way as in the standard GTAP. Hence, in calibrating the model the export elasiticities ($EXPELAST_{irs}$) and import elasiticities ($IMPELAST_{isr}$) were obtained from the GTAP database.

5.7 Concluding Remarks

This chapter presented the construction of the database for the multi-country CGE model for South Asia (SAMGEM). The GTAP version 7 database, which reflects the world economy 2004, has been used in conjunction with the household survey data of the respective South Asian economies in constructing the database of the SAMGEM. The main contribution to the GTAP database in this research is disaggregation of the household sector based on different income groups in different geographical areas of respective South Asian countries. Developing a CGE model, whether single country or multi-country, requires substantial data and, therefore, all unavailable data in constructing the SAMGEM were obtained through a process known as 'calibration', and all elasticity values have been extracted from the GTAP version 7 database other than income/expenditure elasticities of different household groups in the South Asian region.

Finally, in implementing the SAMGEM, a TABLO programme has been developed using GEMPACK software, which is vital in creating the interface between the computer and the software used in executing the model. This model can be used to analyse implications of different trade liberalisation scenarios on trade, household income distribution and poverty in South Asia and the rest of the world.

CHAPTER 6 THE MACROECONOMIC AND HOUSEHOLD EFFECTS OF TRADE LIBERALISATION IN SOUTH ASIA: SIMULATION RESULTS

6.1 Introduction

The SAMGEM developed in Chapter 4 and the database outlined in Chapter 5 is used to simulate the effects of different trade policies. These simulations aim to identify and quantify the effects of trade liberalisation in South Asia on a number of some key macroeconomic variables: trade, government revenue, household income distribution and welfare in such economies to determine the best trade policy options. The results of the simulations are reported in the chapter.

The results of the simulations are analysed in both short-run and long-run frameworks in order to decide the best trade policy options for South Asia[20]. Section 6.2 presents the details of the policy experiments. The model closure is described in Section 6.3 and the results of the policy simulations are given in Section 6.4. The sensitivity of the model results with respect to different parameter values under the Systematic

[20] The preliminary results of the policy simulations outlined in this Chapter were presented at the Postgraduate Research Conference of the UNE in July 2011 and PhD Conference in Economics and Business (Brisbane, November 2011). The feedback received at the PhD conference, from Professor Xin Meng from the Australian National University and the comments from the participants of the two conferences are gratefully acknowledged.

Sensitivity Analysis (SSA) are explored in Section 6.5 and the final section provides the chapter's concluding comments.

6.2 Trade Policy Options for South Asia

As described in Chapter 2, almost all the South Asian economies initiated trade reforms during the last two decades with a view to integrating themselves into the world economy and thereby improving their growth prospects and reducing poverty in the region. Bangladesh, in the 1980s, proposed the idea of a "regional forum" in South Asia, drawing attention to the success of similar arrangements elsewhere in the world, thereby enabling the South Asian economies to benefit from such cooperation by strengthening their competitive position both individually and as a group (Ratna and Sidhu, 2007). Consequently, South Asian economies commenced regional integration initiatives with the formation of the SAARC in 1985.

Chapter 1 stated the grounds for the trade liberalisation in SAARC as the means to establish SAFTA as well as probe beneath the deeper integration levels such as customs union through the elimination of tariffs and NTBs, and structural impediments to free trade. Many studies[21] have shed light on SAPTA and SAFTA but only a few

---

[21] Pigato et al., (1997), Panagariya (2003), Pitigala (2005), Srinivasan and Canonero (1995), Bandara and Yu (2003) and Bouët et al., (2010)

quantify[22] the possible economic impacts on member countries. Among these studies, there is a disagreement about economic outcome

(Perera M.S.S, 2009). Bandara and Yu (2003) examined the early studies of impact of potential benefits of SAFTA on the member countries and classified those findings into three views: optimistic, pessimistic and moderate.

Pigato et al., (1997) viewed SAFTA as optimistic, because the results of their global CGE model predict that the SAFTA would have positive welfare effects on all the economies in the region, particularly the small economies. Additionally, a study undertaken by UNCTAD and ADB (2008) used general equilibrium analysis to estimate the impact of SAFTA on the welfare of member nations. It concluded that SAFTA will be trade creating, with India serving as the growth pole for the region, and also found that all the participating countries will gain while gains will be greater for smaller, least-developed countries. Furthermore, Research and Information System for Developing countries-RIS (2005) used partial equilibrium framework to analyse the economic impacts of SAFTA on the member countries, indicating that smaller and least developed

---

[22] Quatitative estimates of gains from SAFTA can either be made by using gravity models or CGE models (Das D.K, 2007). Hassan (2001) quantified the impact of SAFTA using 1997 statistical series in gravity model and found that the seven SAARC economies not only reduced trade among themselves but also with the rest of the world (ROW). Neverthess, Hirantha (2004) used both panel and cross sectional data for the 1996-2002 period to estimate trade creation and trade diversion effects under the present SAFTA regime and found the evidence of trade creation among the SAARC member countries, without any trade diversion with the ROW.

economies like Bangladesh, Nepal and Sri Lanka gain more than relatively bigger economies such as India and Pakistan.

On the contrary, Panagriya (2003) expressed a pessimistic view and pointed out that SAFTA has large trade diversion effects and therefore the agreement would result in a reduction in efficiency given that it is doubtful whether the SAFTA members are the most efficient suppliers for the member countries. The same pessimistic view was shared by Baysan, Panagriya and Pitigala (2006). They identified three characteristics of the South Asian economies that make the SAFTA economically unattractive. Those characteristics indicate that most of the economies in the region are small in terms of their contribution to world GDP and trade flows. All SAFTA members except Sri Lanka would suffer from trade diversion because of higher levels of protection against members. The inclusion of long sensitive-item lists and imposing restrictive rules of origin were likely to lead to sectoral bias that could be exploited by strong domestic lobbies to resist outside competition.

Nevertheless, Srinivansan and Canonero (1995) held a more moderate view. They believed that, although the SAFTA would ensure potential benefits to the members, it would be less than those from unilateral trade liberalisation in South Asia. DeRosa and Govinda (1996) also focused on the impact of trade liberalisation in South Asia on the food and the agricultural sector. They used the Armington system of bilateral trade demands in a partial equilibrium framework to analyse alternative approaches to trade liberalisation in South Asia. The findings suggest that although the SAFTA leads to expansion of intra-regional food and agricultural trade among the members, moving into deeper integration levels and trade liberalisation with the other parts of the world economy may enhance welfare for South Asia.

Furthermore, Bandara and Yu (2003) examined the welfare implications of the SAFTA in comparing with the effects of unilateral trade liberalisation and and other policy options on member countries using the GTAP model. Contrary to the studies above, they found that the potential benefits of full trade liberalisation in South Asia are marginal for most of the countries except for India, which stands to gain significantly from the agreement. Hence, their study supported the pessimistic view and indicates that South Asian countries may gain more from the unilateral and multilateral trade liberalisation than under the SAFTA.

Antoine Bouët et al. (2010) used the 2004 MAcMapHS6-v2 database and the MIRAGE (Modelling International Relationships in Applied General Equilibrium) model to examine the effects of SAFTA on trade and net income in South Asia (the 2004 MAcMapHS6-v2 database computes the equivalent measure of applied protection at the six-digit level of the Harmonized Commodity Description and Coding System and the MIRAGE model relies on the GTAP 6.2 database). The research suggests that the SAFTA members experience, on average, small gains from the agreement. However, exempting sensitive products from the agreement may limit the gains from trade for the lower-middle-income countries in SAFTA, but it may be welfare-enhancing for the least developed countries.

In Chapter 3, it was noted that several single country CGE models were used for poverty and income distribution analysis in South Asian economies (e.g. Cockburn, 2001 for Nepal, Naranpanawa, 2005 for Sri Lanka and Annabi et al. 2006, for Bangladesh). However, none of these studies attempted to formulate a regional model of South Asia except Gilbert (2008), who used GTAP version 6, which reflects the world economy in 2001.

In reference to the previous studies undertaken to assess the welfare implications of the SAFTA, it can be seen that most omitted addressing the question of how SAFTA may affect broader socio-economic variables in the region, particularly with regard to income distribution and poverty in a multi country CGE framework. This is a major trade policy concern mentioned in Chapter 2 with reference to South Asia as the second largest region in the world experiencing poverty next to Sub Saharan Africa.

Amongst the few policy instruments available in shaping up trade policies, tariff reforms can be considered as one of the most widely used policy instruments in many countries (Naranpanawa, 2005). For this reason, the focus of the present study has been limited to tariff reforms and their impacts on trade, income distribution and welfare of the South Asian economies. It is well-known from the discussion in Chapter 2 that, tackling NTBs and trade facilitation in South Asia are important issues to be addressed to boost the intra-regional trade in the region. However, incorporating these issues within a single model poses many challenges for the modeller because of their diverse and complex nature, and the lack of available evidence particulary on NTBs. Therefore, these issues are considered as priority areas for future research.

The following section outlines the simulations designed to indentify the short-run and long-run impacts of trade liberalisation in South Asia with the objective of deciding the best trade policy outcome for South Asia in promoting regional economic integration and thereby reducing poverty in the region.

a) Simulation 1: South Asian Free Trade Area –SAFTA

This simulation considers full implementation of the SAFTA in its originally proposed form where all SAARC countries reduce their existing tariff rates to zero per cent while import protection between the rest of the world and the SAARC is maintained.

b) Simulation 2: South Asian Customs Union

From the preceding studies on trade reforms in South Asia, it was evident that attempts have been made to quantify the gains from customs union scenario in South Asia. Jayaraman (1978) estimated the static effects of a hypothetical customs union in South Asia, with the post-union common external tariff rate equal to the lowest pre-union tariff rate. On the other hand, Rahman et al. (1981) analysed the static welfare effects of forming a customs union in South Asia with the common external tariff equal to the weighted average tariff rates of all country averages. Furthermore, Siriwardana (2003) used the GTAP model (version 5 database) to scrutinise the effects of forming a customs union in South Asia with a 10 per cent (hypothetical) common external tariff targeting non members of the proposed South Asian customs union.

This simulation considers SAFTA plus a 13 per cent uniform external tariff rate to non-members. In selecting a common external tariff rate of 13 per cent for non-members, the weighted average import tariff rate (see Figure 2.11) has been taken as in the case of Rahman et al. (1981). In applying the common external tariff, 30 sectors have been divided into two groups, traded commodities and non-traded commodities[23]. Thus, the common external tariff rate is applied only to traded commodities.

c) Simulation 3: Unilateral Trade Liberalisation in South Asia

The prior discussion raises the question as to whether SAFTA creates welfare gains to its members or not? This is because nearly two decades after regional initiatives took place in South Asia, the region's intra-regional trade as a share of total trade has not increased from the 5 per cent level witnessed in the 1980s and 1990s (Ratna and Sidhu, 2007). This implies that South Asia trades heavily with the countries outside the region. Furthermore, Dash (2009) pointed out that, SAARC countries export the bulk of their primary commodities and manufactured goods to the same world markets. Hence, they tend to compete in the same industrial sectors with each other. Additionally, most of SAARC members' trade is with the United States and Europe rather than with their regional trading partners. Given the small size of markets of South Asian countries, with India as an exception, there is limited scope for mutually beneficial market exchange

[23] Non traded commodities include the industries in the services sector such as CMN_ROS, OSG_DWE, TRD_CNS and ELY_WTR

among South Asian countries. Hence, most South Asian economies lack incentives to seek regional trade liberalisation.

The empirical evidence suggests that, some (Panagariya, 2003; Bandara and Yu, 2003; Bhagawati, 2008) embrace a pessimistic view about the SAFTA and alternatively argue that unilateral or multilateral trade liberalisation would be the best trade policy option for South Asia. Conversely, the supporters of SAFTA point out that despite the potential for trade diversion, SAFTA would bring significant benefits to small countries in the region and would facilitate unilateral trade liberalisation in South Asia[24] .

Answers to these questions require an extensive examination of impacts of SAFTA and unilateral trade liberalisation on the member countries of South Asia. Like in the case of Bandara and Yu (2003), this simulation considers the possibility of all South Asian countries unilaterally removing all their tariffs against all countries in the world, while the rest of the world retains tariffs against South Asia. Since SAMGEM has been formulated based on the GTAP version 7 database, it is important to note that its baseline reflects the world economy in 2004. Yet, creating a new baseline by updating 2004 baseline with new tariff data would be a useful modelling exercise to be considered in future research.

---

[24] Srinivasan and Canonero (1995), Srinivasan (1998), Pigato et al. (1997), Kemal (2004), Mukherji, (2004), Newfarmer (2004)

6.3 Model Closure

This section describes the main aspects of the model's closure. It was discernible in Chapter 4 that the theoretical description of SAMGEM has more variables than equations. Therefore, it is necessary to select which variables will be endogenously determined within the model and which are to be treated as exogenous. The exogenous variables of the model must be selected based on the economic environment in which the policy is tested which best reflects the true economic environment in which the policy is applied. The list of exogenous variables of the SAMGEM is illustrated in Section B7 of Appendix B.4.

In Section 4.3.9 it was noted that the simulations will be performed in two different economic environments or closures: short-run and long-run. These closure rules define the equilibrium conditions in the included markets in the model and also determine the expected time period of the solution. The SAMGEM is based on the standard static GTAP model and the model closure rules of the GTAP model are widely available (Hertel and Tsigas (1997). Hence, this section focuses on the model closure rules, relating to SAMGEM which depart from those in the standard GTAP model. The standard closure rules for the GTAP model were adjusted to provide a better reflection of the economies in South Asia. The short-run and long-run closures for the SAMGEM are based on the short-run and long-run closures developed by Dixon, Parmenter and Rimmer (1981) and Horridge and Powell (1984) for the ORANI model. The set of assumptions used in the short-run and long-run economic environments are given below.

- **Short-Run Closure**

The assumptions of this closure are made to retain the realities of the South Asian countries' labour markets and other macro constraints in the short-run. Three fundamental changes were made to the closure of the standard GTAP model: the first was related to fixing the trade balance, the second to employment of labour and the real wage rate and the third to the physical capital stock and real rental rate of capital.

In the short-run it is assumed that trade balance is fixed with real consumption, investment and government spending moving together to accommodate it (Horridge et al., 2006). South Asian countries are endowed with excess supply of especially unskilled labour which can be drawn on by industries in the event of increased production of export-oriented industries due to trade liberalisation. Hence, in South Asia and the rest of the world, employment is allowed to change in the short-run as firms can employ more labour while the real price of labour is fixed. On the other hand, in the capital market the capital stock in each sector is held fixed, with real rates of returns to capital adjusting endogenously. The same applies for land and natural resources, which are included under capital in the model. In line with many other CGE simulations the short-run is considered as a period between 1-2 years.

- **Long-Run Closure**

The assumptions of this closure are made to retain the realities of the macroeconomic environment of the South Asian economies and the rest of the world in the long-run. Accordingly, under this closure, capital stock is allowed to vary while labour supply is assumed to be fixed. This reflects that capital can adjust over time with the natural rate of unemployment. Under this scenario the real price of labour is allowed to vary while the real price of capital remains fixed. In addition, the trade balance, real consumption, government consumption and investments become endogenous in the model.

Furthermore, both in the short-run and long-run, production technologies, the number of households, all policy variables (taxes and subsidies) and shift variables in household consumption are assumed to be exogenous. Since the model can only be solved for (n-1) prices, one price is set exogenously, and all other prices are evaluated relative to this numéraire (Brockmeier, 2001). Accordingly, as in the standard GTAP model the global average rate of return to primary factors is used as the numéraire in the model.

6.4 Analysis of Modelling Results

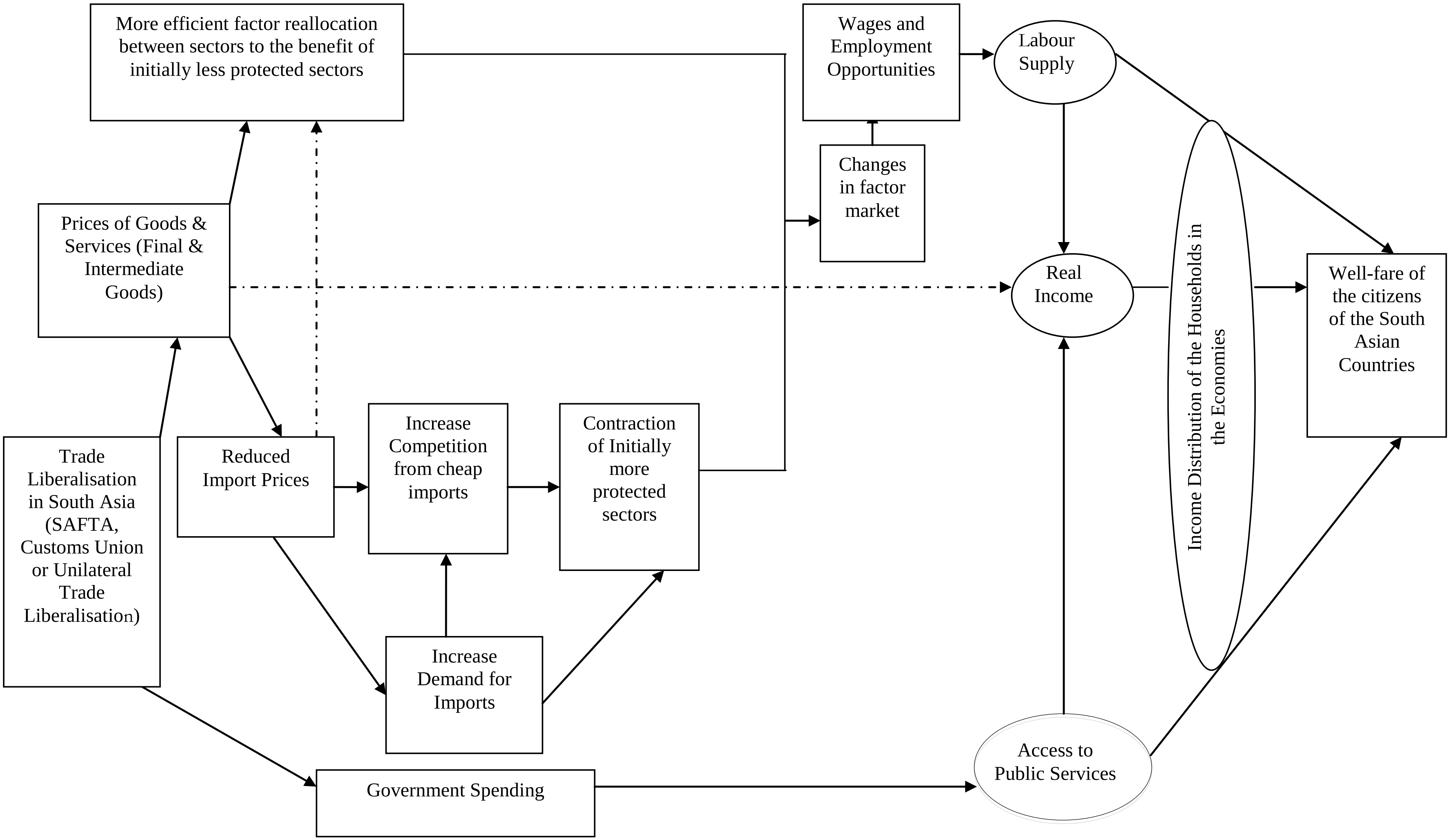
The modelling assessment and results of SAMGEM require careful explanation. The chronological interpretation of results no doubt demand meticulous and discreet application of economic theory. Little wonder Adams in his article mentioned that 'the interpretation of results of a CGE model in terms of a logical sequence of connections is a challenging task in itself' (Adams, 2005, p.1). In interpreting modelling results, two tasks need to be accomplished. The first deals with the complexity of the modelling results and the second to proof that the result produced are in fact reliable and defendable. This is especially important since the present study considers three trade policy options and each policy needs to be analysed in short-run and long-run frameworks.

As tariff reform affects all sectors in the economy, to keep the analysis concise, it is imperative to select the most significant sectors and variables to be examined under each policy option. The other essential issue to deal with in any CGE modelling is the reliability of parameter values in the model. In addressing this concern, the sensitivity test for key constraint values are performed and discussed in Section 6.5.

Given the complexity of interpreting the model results, it is important to devise a framework to explain the modelling results in a coherent manner, in the context of South Asian trade liberalisation. Figure 6.1 assists in indentifying the principal theoretical mechanisms that underly the projections from the SAMGEM.

Figure 6.1 is a classic theoretical framework that explains the impact of a given tariff shock on different sectors in the economy. The first noticeable effect of tariff shocks is the reduction of prices of imported (final and intermediate) goods relative to the domestic substitutes. The result of this trend is the increasing demand for final imported goods in comparison to domestic substitutes. As noted by Aredo et al. (2011), the attitude of domestic competition depends on a) the depth of the initial protection of a given sector, b) the degree of openness of a sector whether it is export-oriented or not and finally c) the capacity of a given sector to compete against imports.

Figure 6.1 The Effects of Trade Liberalisation in the South Asian Economies: A Conceptual Framework



Source: Adapted from Annabi et al. (2005) and extended by the author

The decreased prices for imported intermediate goods benefit domestic export-oriented industries (due to low-cost of production) and the import-dependent industries (as a result of low-priced imported intermediate goods). Apart from cost-saving advantage, trade liberalisation leads to expansion of a given sector due to low initial tariff rate, growing prospects for export expansion and intensifying domestic demand (Annabi et al., 2005, Chitiga et al., 2005 and Cororaton and Corong, 2006). Therefore, it is reasonable to conclude that, trade liberalisation is likely to lead to improve performance of domestic industries under the above circumstances through efficiency improvements and cost reductions.

Another important effect of tariff reform is its impact on factor markets. As illustrated above, the expansion in the export-oriented industries leads to increased demand in abundant factors such as labour in the South Asian economies, as suggested by the H-O theorem. The consequence is an increase in the relative price of labour and the reverse is the case for capital in labour abundant economies.

Classic comparative-static closures have either, labour or capital fixed, but not both. Hence, in interpreting model results, the closure rules described in Section 6.3 need to be carefully taken into account, particularly in the short-run and the long-run. Another effect that needs to be examined is the impact of tariff shocks on the government budget. As shown in the above diagram, tariff cuts curtail government revenue thereby reducing the provision of public services which may in turn affect the welfare of the citizens of the economy. However, it is worth noting that the net effect on the total fiscal revenue depends on how indirect taxes such as exercise duties or value added taxes change following tariff shocks.

The above cause and effects depicted in Figure 6.1 assists in indentifying the principal theoretical mechanisms that underlie the projections from SAMGEM. The best policy outcomes are determined on the basis of the equivalent variation (EV) that arises under each of the simulated policy outcomes.

6.4.1 Macroeconomic Effects

The sound knowledge on the impact of macroeconomic variables of a given policy shock is essential as it affects all sectors in the economy. When analysing the macroeconomic results it is important to identify the implications on key variables such as real GDP, aggregate employment, real factor prices, consumer price index, and terms of trade, trade volumes and per capita household utility in the economy. Table 6.1 illustrates the projected macroeconomic results under different policy simulations. Interpretation of macroeconomic results begins with short-run effects.

First, the overall impact on the macro economy is indicated by change in real GDP and the employment. The results indicate that under all three policy options there are positive impacts on real GDP in all South Asian economies in the short-run.

Table 6.1 Projected Macroeconomic Results Under Different Policy Experiments

Macroeconomic Variable	Change in real GDP(%)		Change in Terms of Trade (TOT) (%)		Change in volume of Exports (%)		Change in volume of Imports (%)		Change in Trade Balance (US Million)		Change in per capita utility (%)		Change real wages (unskilled) (%)		Change real wage rate (skilled) (%)		Change real rental rate (%)	
Region	**SR**	**LR**	**SR**	**LR**	**SR**	**LR**	**SR**	**LR**	**SR**	**LR**	**SR**	**LR**	**SR**	**LR**	**SR**	**LR**	**SR**	**LR**
SAFTA																		
India	0.13	0.18	0.26	0.28	1.04	0.95	1.07	1.18	0.00	-215.97	0.20	0.23	0.00	0.27	0.00	0.18	0.19	0.00
Pakistan	0.19	0.29	0.18	0.19	1.71	1.68	1.16	1.45	0.00	-83.62	0.26	0.35	0.00	0.46	0.00	0.36	0.33	0.00
Sri Lanka	0.76	1.58	0.06	-0.21	6.42	8.01	4.97	6.70	0.00	-71.12	0.85	1.39	0.00	1.83	0.00	1.91	1.37	0.00
Bangladesh	0.86	0.71	-1.10	-0.91	8.07	6.85	5.68	5.56	0.00	-94.93	0.68	0.48	0.00	0.98	0.00	0.92	0.87	0.00
Rest of South Asia	2.93	2.46	-0.70	-0.94	10.85	13.72	5.18	3.74	0.00	154.74	3.03	2.05	0.00	3.48	0.00	2.63	3.47	0.00
Customs Union																		
India	1.02	1.06	-0.29	-0.55	3.92	4.93	3.21	2.52	0.00	1923.69	1.06	0.97	0.00	0.80	0.00	1.05	0.82	0.00
Pakistan	0.58	0.93	-0.22	-0.36	3.55	4.26	2.17	2.68	0.00	-21.51	0.56	0.83	0.00	0.84	0.00	0.83	0.72	0.00
Sri Lanka	0.14	-1.44	1.19	1.11	-2.80	-2.40	-2.15	-6.20	0.00	431.24	0.71	-0.79	0.00	-2.45	0.00	-2.05	-1.37	0.00
Bangladesh	2.46	2.49	-2.46	-2.31	14.97	14.20	12.22	12.18	0.00	-77.91	2.14	1.92	0.00	2.61	0.00	2.35	2.54	0.00
Rest of South Asia	3.16	2.74	-1.11	-1.38	9.02	11.98	4.63	3.11	0.00	168.26	3.05	2.10	0.00	3.55	0.00	2.84	3.60	0.00
Unilateral Trade Liberalisation																		
India	3.11	3.99	-4.28	-3.18	24.76	19.11	16.76	20.21	0.00	-9120.21	2.47	3.18	0.00	5.41	0.00	4.75	3.72	0.00
Pakistan	2.77	4.59	-3.84	-3.08	22.24	18.88	11.26	17.87	0.00	-2226.96	1.44	3.29	0.00	6.16	0.00	6.09	4.19	0.00
Sri Lanka	1.99	4.07	-1.75	-2.12	15.17	17.43	10.47	15.37	0.00	-342.75	1.12	2.65	0.00	4.95	0.00	5.46	3.41	0.00
Bangladesh	5.17	5.23	-6.04	-4.94	41.76	34.48	29.25	30.00	0.00	-766.49	4.22	3.88	0.00	6.57	0.00	5.82	5.90	0.00
Rest of South Asia	6.18	6.12	-3.78	-4.27	21.83	27.99	9.87	8.16	0.00	252.72	4.88	3.72	0.00	7.98	0.00	6.95	8.12	0.00

Source: Simulation results derived from the SAMGEM Note: SR= Short-run effects LR=Long-run effects

It is noted that the gains in GDP are higher with the unilateral trade liberalisation followed by the customs union and SAFTA zero tariff agreement with the exception in Sri Lanka where GDP increases only marginally under the customs union. Moreover, the short-run gains in GDP are higher for least economies economies in the region (Bangladesh and Rest of South Asia). For instance, under the SAFTA, real GDP in India increases by 0.13 per cent whereas in the Rest of South Asia the same will increase by 2.93 per cent. On the other hand, under the unilateral trade liberalisation gain in GDP for India is 3.11 per cent where as for the Rest of the South Asia GDP increases by 6.18 per cent. This is because apart from the least developed countries in the region, these economies have high pre-liberalisation levels of protection against imports in comparison to India, Pakistan and Sri Lanka (see Figure 2.12 in Chapter 2). Hence, the findings of the present research is consistent with those who hold the moderate view about SAFTA that PTA would bring benefits to all countries in the region, and moving to unilateral trade liberalisation would bring significant gains to South Asia.

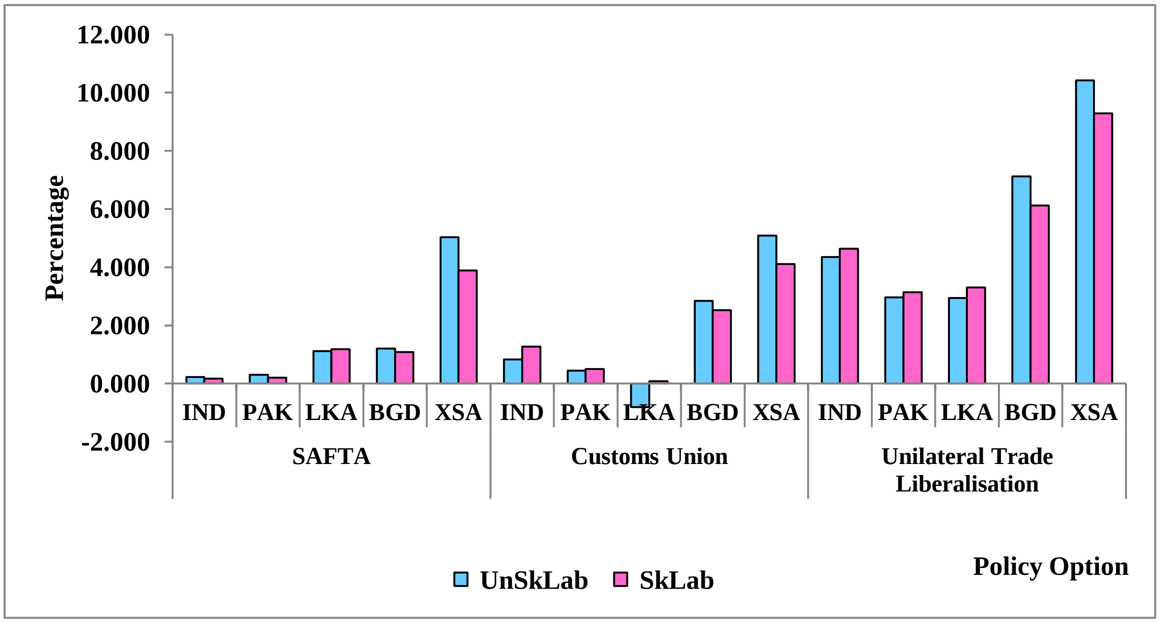
The long-run projections in real GDP stipulate that the gains for all South Asian economies are generally higher in comparison to the short-run under all three policies except for Sri Lanka under the customs union, in which case the real GDP declines by 1.44 per cent. Hence, these results demonstrate the widely held notion of growth stimulation effects of trade liberalisation as established in the literature (Davis, 1996).

It is important to investigate possible reasons for change in real GDP in such economies. Change in real GDP can be analysed either from expenditure (demand) side or from income (supply) side. Real GDP from expenditure side is made up of real household consumption, real investment, real government expenditure and net trade volume, while from the income side it consists of tax payments and total payments to factors of production.

In considering the change in real GDP from supply side, in the short-run, the components, such as capital stock, technology and real wages, are unaffected due to policy shocks. However, aggregate employment is expected to change as it is determined within the model. Figure 6.2 presents the outlook of new jobs created as a result of the different policies in the short-run.

The results suggest that employment will increase in all South Asian countries under the three trade policy options, with the exception of Sri Lanka where unskilled labour employment will decline under the customs union scenario. Given the marginal increase in GDP, it may lead to increase in unemployment, particularly in unskilled labour in Sri Lanka during the short-run period after implementing this trade policy option. In addition, it is noted that employment will increase substantially under the unilateral trade liberalisation in all South Asian countries and this result is consistent with changes in real GDP in respective economies.

Figure 6.2 Changes in Employment Under Different Policy Experiments in the Short-Run



Source: Simulation results derived from the SAMGEM

Furthermore, it is obvious that more employment opportunities will be created for the least developed economies in the region (Bangladesh and Rest of South Asia) under all three trade policy options due to expansion of labour intensive industries in the short-run. As explained in Chapter 3, the removal of quantitative restrictions through trade liberalisation will encourage a shift of resources from production of imports substitutes to the production of export-oriented goods. So, it is possible that the industries which are selling their products to the export market will benefit due to trade liberalisation. Since, South Asian countries specialise in labour intensive manufacturing products such as textiles, garments, footwear and leather products, it could be expected that an increase in demand for labour will occur in such industries.

The economic interpretation of increase in employment compared to real GDP lies in the assumption of fixed usage of capital and land in the short-run. When the capital and land are fixed, an increased use of labour causes the marginal product of labour to decline. It is important to note that, with perfect competition, real wage rate is equivalent to marginal product of labour and the real rental rate is equivalent to the marginal product of capital (Adams, 2005). Since real wages are fixed in the short-run, to achieve a certain percentage increase in output, industries must increase labour inputs by a higher percentage than output increase. For instance, in India under the SAFTA, although the real GDP increases by 0.13 per cent, unskilled and skilled labour employment is increased by 0.22 per cent and 0.17 respectively. The same tendency will follow in all South Asian countries under all trade policy options in the short-run.

Another important income-side factor that affects change in real GDP is return on capital in the short-run. From Table 6.1, one can see that all South Asian economies under different trade policy options except Sri Lanka under the customs union have a positive impact on the real rental rate. For Sri Lanka the negative result occurred due to contraction in the manufacturing sector. The positive impacts on the others arise in the short-run, when a given capital stock is co-operating with more labour inputs leading to an increase in rental rate of capital (Baxter et al., 1993). Since there is decline in Consumer Price Index (CPI) under this trade policy option, it will eventually result in rise in the real rental rate. Table 6.2 illustrates the percentage change in capital stock in the long-run under the different trade policy scenarios.

Table 6.2 Percentage Change in Capital Stock in the Long-Run

Country/ Region	Trade Policy Options		
	SAFTA	Customs Union	Unilateral Trade Liberalisation
India	0.26	0.89	5.14
Pakistan	0.41	1.03	5.56
Sri Lanka	2.15	-2.77	5.43
Bangladesh	0.87	2.85	6.84
Rest of South Asia	4.12	4.35	10.56

Source: Simulation results derived from the SAMGEM

In analysing the causes for change in real GDP in the long-run, it is important to note that, the economic activity in all South Asian economies (apart from Sri Lanka, under the customs union) become significantly higher as a result of greater reduction in overall prices due to tariff cuts under different trade policy options (see Table 6.3). This is because, lower prices of imports lead to a fall in CPI largely in the long-run (expect in India and Pakistan under the SAFTA) which causes to change the pattern of domestic production and consequently these effects can influence the income and expenditure sides components of the real GDP.

Table 6.3 Percentage Change in Consumer Price Index

Country/Region	SAFTA		Customs Union		Unilateral Trade Liberalisation	
	SR	LR	SR	LR	SR	LR
India	0.26	0.29	-0.74	-1.01	-4.16	-2.94
Pakistan	0.17	0.20	-0.45	-0.55	-4.08	-3.19
Sri Lanka	-0.35	-0.56	-1.43	-1.67	-3.36	-3.44
Bangladesh	-0.89	-0.74	-1.89	-1.93	-4.93	-4.02
Rest of South Asia	-1.22	-1.35	-1.69	-1.90	-6.12	-6.18

Source: Simulation results derived from SAMGEM

Note: SR-Short-run effects LR- Long-run effects

On the income side, the aggregate employment remains fixed while real wages vary in the long-run. The results suggest that, there is an increase in real wages of both skilled and unskilled labour in all South Asian economies, except for Sri Lanka under the customs union, where such economies are operating at the natural rate of unemployment. This is because the combination of labour with more capital increases labour productivity in the long-run. When aggregate employment is fixed, the substitution of capital for labour is possible with the expansion of capital while keeping the real return on capital fixed in the long-run.

Table 6.2 points to more rapid expansion in the capital stock under unilateral trade liberalisation compared with the other two trade policy options. The results indicate a decline in capital stock in Sri Lanka under the customs union. The reduction in the overall price index raises the real rental rate, hence, the nominal rental rate needs to shrink proportionately to keep the real rental rate fixed in the long-run. Therefore, the cost of using capital is cheaper compared to that of labour, which induces substitution of capital for labour in the long-run. Other things being constant, tariff cuts can have more favourable impacts on capital intensive industries in the long-run, by allowing real cost of labour to rise while real cost of capital remains fixed.

Figure 6.1 shows that tariff reforms directly affect relative prices (import/domestic) which in turn change CPI. Understanding the change in relative prices will help to explain the impact on demand for imports relative to demand for domestically produced goods. Table 6.3 illustrates there is a reduction in the CPI under different trade policy options in all regional partners except in India and Pakistan under the SAFTA. India and Pakistan are the two largest economies in the region and an increase in CPI in these economies may be due to an increase in demand for domestically produced goods by their domestic counterparts and other South Asian economies.

This trend is changed under the customs union and unilateral trade liberalisation in these two countries (India and Pakistan) where there is a decline in CPI. From Figure 2.12 in Chapter 2, it is seen that, the average tariff in the agricultural sector is higher in all South Asian economies. As Sri Lanka, Bangladesh and the Rest of South Asia import most of the agricultural goods and other food products from their regional trading partners, the CPI tend to decline under the SAFTA. In Sri Lanka, it is worth noting that the CPI declines under the customs union as a result of improvement in TOT (see Table 6.1). Generally, rising terms of trade reflect import prices decline relative to export prices putting downward pressure on inflation (Australia Treasury, 2008). However, Sri Lanka's TOT improves under this policy option as a result of a rise in export prices relative to import prices (see Table 6.4) and this will be explained later.

Also, there is a greater reduction in CPI in all countries under the customs union and unilateral trade liberalisation as these economies import significant amounts of intermediate goods, electronic and machinery and equipment from other countries outside the region. It is worthwhile to note that, especially under unilateral trade liberalisation, the large amounts of imports cause a substantial decline in CPI in comparison to other two trade policy options.

Next, it is important to examine the impact of the three trade policy options on TOT in South Asian economies. The TOT effect also provides an important measurement as to how well each country could play its role in the international market due to trade reforms. It is also considered as an important component in welfare gains. Percentage changes in TOT reflect changes in export and import prices due to change in trade in each country. Table 6.4 illustrates the decomposition of the TOT effects in each South Asian country under different trade policy options (the total TOT effect is illustrated in Table 6.1).

Table 6.4 Decomposition of Terms of Trade Effects

Region	% change in export price		% change in import price		% change in export price		% change in import price		% change in export price		% change in import price	
	SR	LR	SR	LR	SR	LR	SR	LR	SR	LR	SR	LR
	SAFTA				Customs Union				Unilateral Trade Liberalisation			
India	0.25	0.27	-0.01	-0.01	-0.29	-0.55	0.01	0.02	-4.24	-3.22	0.04	-0.04
Pakistan	0.18	0.19	0.01	0.03	-0.22	-0.37	0.03	-0.01	-3.87	-3.16	-0.03	-0.08
Sri Lanka	0.09	-0.19	0.03	0.03	1.21	1.09	0.02	-0.02	-2.45	-2.74	-0.70	-0.62
Bangladesh	-1.08	-0.89	0.03	0.03	-2.48	-2.36	-0.02	-0.05	-6.52	-5.34	-0.49	-0.40
Rest of South Asia	-0.65	-0.90	0.05	0.05	-1.04	-1.38	0.06	0.01	-5.02	-5.37	-1.25	-1.11

Source: Simulation results derived from SAMGEM

Note: SR-Short-run effects LR-Long-run effects

The results demonstrate that, under the unilateral trade liberalisation scenario, TOT deteriorates in all countries in South Asia. Jomini et al. (2009) pointed out that, due to trade liberalisation, the relative price of exports to imports can decrease more in small countries than in large countries, resulting in a large deterioration in the terms of trade. Since, South Asia is a small player in the world economy, TOT deteriorates largely under the unilateral trade liberalisation. Bandara and Yu (2003) noted that when countries in the region liberalise their trade regimes, imports into the region, especially manufacturing goods from their trading partners, will increase. Consequently, these countries need to export more of their own products to finance their import bills. Accordingly, this would result in a reduction in their export prices and deterioration in TOT in South Asian countries under the unilateral trade liberalisation.

The TOT improves slightly in India, Pakistan and Sri Lanka under the SAFTA in the short run and is also positive for India and Pakistan in the long run under this policy option. The improvement in TOT reflects the benefits of export expansion in these markets, in which case consumers pay less money for imported products. This means that these economies need to give up fewer exports for the imports they receive under the SAFTA. However, the TOT deteriorates for smaller economies in the region under the SAFTA because they have limited capacity to expand their production eventhough demand increases due to tariff reduction.

In the case of a customs union, the TOT deteriorates in South Asian countries, with the exception of Sri Lanka, due to the higher initial tariff levels in these regions against the rest of the world. As Sri Lanka is a low tariff country, enforcing a 13 per cent common external tariff would result in a larger decrease in imports in comparison to exports and, therefore, would have a smaller import bill to finance from export revenue. This would result in an increase in export prices relative to the import prices under the customs union in Sri Lanka.

Another important macroeconomic effect is change in volume of trade due to trade reforms, which is known as trade enhancing effects. From the simulation results it is noted that percentage change in volume of exports and imports are substantially higher under the unilateral trade liberalisation in South Asian economies. This is due to the fact that South Asian countries are more involved in trading with other countries such as USA and EU than with their regional trading partners (see Table 6.9).

The results demonstrate that the SAFTA would not significantly increase total trade in South Asian countries. However, unilateral trade liberalisation would enhance trade in each individual economy in South Asia than under the regional trading agreement. There is a negative impact on trade under the customs union scenario in Sri Lanka due to higher tariffs against the rest of the world.

As discussed in Section 6.3, the trade balance is set to be endogenous in the long-run. Paulino and Thirlwall (2004) explained that although trade liberalisation will raise the growth of exports and imports, the implications for the trade balance and the balance of payments are uncertain. This is because it depends on the relative impact of liberalisation on export and import growth and also its impact on the prices of traded goods. It is important to note that the elasticities of supply of exports and demand for imports also play a significant role in determining growth of exports and imports in each country under the trade reforms. The long-run results (see Table 6.1) indicate that under the SAFTA, all South Asian countries experience a negative trade balance with the exception of the Rest of South Asia. This is because smaller economies experience the largest deterioration in TOT as a result of a fall in export prices relative to import prices causing an increase in exports relative to imports resulting into a positive trade balance.

Moreover, under the customs union scenario, India, Sri Lanka and rest of South Asia experience a positive trade balance. Sri Lanka experiences a positive trade balance as a result of higher reduction in the volume of imports due to an increase in tariffs in manufacturing and intermediate goods. Additionally, under the unilateral trade liberalisation all economies, except the Rest of South Asia, experience a higher negative trade balance in comparison to other two trade policy options. As previously noted, larger economies in the region are trading more with the rest of the world causing more rapid expansion in imports than exports in these countries under the unilateral trade liberalisation. Hence, the net effect on the trade balance in each South Asian economy depends on the magnitude of the trade creation and trade diversion effects due to tariff reductions under each trade policy option.

In examining the other macroeconomic variables, it is observed that the per-capita household utility is positive for South Asian economies under different trade policy experiments apart from Sri Lanka under the customs union in which case the household utility will decline in the long run by 0.79 percent. This is consistent with the change in real GDP in Sri Lanka under this policy option. Moreover, per-capita household utility increases substantially under the unilateral trade liberalisation scenario in all South Asian countries, which is again consistent with change in real GDP in the respective countries.

The above results suggest that the customs union scenario with a common external tariff of 13 percent is not favourable for Sri Lanka. This is because the average tariff rate in Sri Lanka is the lowest in South Asia and particularly so in the manufacturing sector where the average tariff rate is around 10% (Figures 2.11 and 2.12). Hence, if Sri Lanka were to maintain a 13 per cent common external tariff, it would certainly be lifting protection from the existing level, mainly in the manufacturing sector. As the sector is heavily dependent on imported intermediate inputs (e.g imported textiles and accessories in manufacturing garments) this may have a marginal impact on its GDP and employment in the short-run and Sri Lanka may lose in the long-run under this policy option.

6.4.2 The Industry Level Effects and Intra-Regional Trade

a) The Impact on Sectoral Trade

This section relates to the projections on trade both at sectoral and intra-regional level for South Asian economies under different trade policy scenarios. The description of regions and the commodities included under each industry are illustrated in Table B.3–B.4 in Appendix B. The bilateral tariff rates for each South Asian economy are listed in Table D.1–D.5 in Appendix D.

The bilateral tariffs under Table D.1–D.5 indicate higher agricultural tariffs in contrast to manufacturing tariff in India, Sri Lanka and Bangladesh, while in Pakistan and Rest of South Asia both the agricultural and manufacturing sectors are highly protected. Essentailly, South Asian economies do not use tariffs to protect services sector. Rather they use other regulatory measures and rules (see Table A.2 in Appendix A) to lock out foreign competition in the services sector.

We turn now to an examination of the impact of the three trade policy options on exports and imports in different industries at the national level in both the short-run and long-run. As previously pointed out in Figure 6.1, the most obvious and immediate impact of the tariff cuts is to stimulate the demand for imports by reducing the prices of imported goods. These tariff cuts therefore can intensify the competition for the protected domestic industries. Additionally, the tariff cuts also can directly reduce the cost of intermediate inputs for the domestic industries and the prices paid by the househols. Hence, it is important to take into account the causes for short-run and long-run implications of tariff cuts to shed light on the industry analysis for policy making purposes.

Apart from the direct effect on input cost in industries, in the short-run closure, the real wage rate is fixed and therefore the nominal wages in all industries need to fall in line with CPI in order to keep real wages fixed. This process will continue until the general equilibrium effect is reproduced in the short-run. If the effect of tariff cut is considerably higher on the CPI, it would cause a significant reduction in nominal wages to keep real wages fixed. Thus, impact on tariff cuts on CPI and nominal wages play an important role in reducing industry cost in the short-run. This implies that labour intensive industries are likely to benefit more in the short-run due to trade liberalisation.

Similar to the short run, tariff cuts intensify competition for domestic industries in the long-run by lowering the prices of imports. Unlike the short run, real wages can be adjusted in response to demand for labour, where supply is assumed to be determined exogenously in the long-run. Conversely, capital is assumed to be flexible, while the real rental rate is fixed in the long-run. Hence, the nominal rental rate needs to fall in line with the reduction in CPI to maintain the fixed real rental rate in the long-run. Reductions in cost of intermediate inputs due to tariff cuts coupled with the labour/capital intensity contribute to determining the production cost in the long-run. Everything being the same, tariff cuts can have more favourable impacts on capital intensive industries in the long-run by allowing the price of fixed factors (labour) to rise relative to price of variable factors (capital).

Tables 6.5 and 6.6 illustrate the percentage change in sectoral exports and imports under different policy options in South Asian economies in the short-run. The results indicate that, Indian exports of agricultural goods such as paddy rice, wheat and cereal products, oil seeds and vegetable oil, sugar, plant based fibres, dairy and milk products and beverage and tobacco are expected to increase substantially under the SAFTA and customs union in comparison to manufacturing goods. India is a net exporter of most agricultural goods and is one of the main suppliers of agricultural goods to its regional trading partners.

Although there is an increase in exports of the textile industry, the exports of the wearing apparel sector in India are expected to reduce under the SAFTA. As all South Asian economies specialise in the production of wearing apparel there is not much intra-industry trade in wearing apparel among these economies under the SAFTA. Moreover, exports of agricultural goods and labour intensive manufacturing goods are substantially higher under the unilateral trade liberalisation in comparison to the other two trade policy options as a result of greater reduction in the cost of intermediate goods and labour. This is because, India trades more intensely with rest of the world than with regional trading partners, and thus experiences a greater reduction in the cost of inputs under unilateral trade liberalisation.

Table 6.5 Projections of Percentage Change in Exports in Short-Run under Different Trade Policy Options

	SAFTA					Customs Union					Unilateral Trade Liberalisation				
	IND	PAK	LKA	BGD	XSA	IND	PAK	LKA	BGD	XSA	IND	PAK	LKA	BGD	XSA
1 pdr_pcr	11.7	1.5	-1.5	3.4	1.2	13.0	2.3	9.2	4.6	3.9	22.9	9.5	7.8	13.6	20.2
2 wht_gro	1.9	9.4	-0.9	116.3	7.3	10.6	21.8	3.7	87.4	4.8	16.1	19.5	12.3	61.5	5.1
3 v_f	5.2	18.3	20.5	5.5	68.1	6.8	13.5	23.0	5.2	52.0	11.1	13.9	17.1	8.9	44.4
4 osd_vol	2.6	-0.2	117.3	120.2	100.4	5.1	7.2	34.1	125.2	16.9	14.1	4.2	5.9	117.6	20.5
5 pfb_ocr	6.1	4.4	6.3	27.3	44.2	10.9	9.1	16.4	27.1	44.2	17.3	18.2	14.8	20.3	34.3
6 c_b_sgr	25.2	11.4	1.6	4.9	15.8	22.0	-9.6	2.1	3.8	9.1	21.2	-6.2	-6.3	22.5	34.1
7 rmk_mil	24.2	35.4	23.1	33.8	9.3	22.7	44.7	50.2	39.8	-10.5	32.4	31.5	17.9	47.3	-1.7
8 fsh	0.2	-0.5	-0.5	1.1	-0.1	1.4	0.1	5.2	1.1	0.9	4.9	5.4	2.7	4.2	5.9
9 cmt_oap	-1.5	5.7	39.8	10.3	9.3	2.2	7.7	52.4	14.8	14.5	14.6	19.6	23.9	29.2	30.7
10 ofd	-0.1	8.7	1.0	3.1	17.1	2.2	9.2	9.8	3.3	12.7	10.1	13.6	15.6	13.9	19.1
11 b_t	7.6	-2.5	3.1	3.6	57.5	8.8	-4.2	7.7	1.8	-0.9	13.4	-1.0	3.7	6.9	10.9
12 tex	1.3	2.6	6.6	7.6	12.5	5.9	5.4	-5.1	11.9	8.6	26.6	27.0	12.7	38.6	19.2
13 wap	-1.1	-1.3	-1.2	9.4	12.5	3.8	3.2	-28.4	26.8	12.2	25.3	24.7	8.3	57.1	43.1
14 lea_lum	-1.5	1.1	25.2	6.0	23.8	2.5	4.1	33.3	11.8	38.5	22.9	22.9	37.2	35.8	57.7
15 ppp	11.1	5.4	33.4	6.2	10.4	13.8	8.4	27.6	10.9	14.6	25.6	26.4	45.2	32.1	28.4
16 crp	2.4	6.4	10.1	20.4	34.6	5.0	7.6	8.5	20.8	34.2	32.9	21.7	24.2	27.8	14.4
17 i_s_nfm_fmp	1.4	0.3	87.1	31.7	49.2	6.4	1.5	61.2	38.7	43.6	36.2	23.5	54.2	49.9	18.1
18 ele	1.8	-0.6	7.5	6.0	10.4	-0.3	3.8	-14.6	7.6	14.6	45.8	43.4	36.6	32.6	58.7
19 ome	2.1	9.4	27.4	14.1	11.1	9.8	11.9	5.7	14.1	16.8	45.1	49.1	42.7	32.1	21.2
20 omf	-1.2	1.1	4.5	8.1	20.1	3.6	3.5	-10.7	13.6	25.7	32.2	27.3	34.0	32.1	46.5
21 mvh_otn_otp	3.6	-0.1	0.5	4.6	6.6	6.2	0.4	3.4	10.4	8.5	24.9	32.8	12.3	27.5	39.4
22 p_c_coa	7.7	-2.2	1.9	29.6	2.8	-0.7	-19.5	-24.7	52.4	3.6	31.0	-7.5	7.7	78.4	9.8
23 gas_gdt	7.0	-7.3	-19.9	13.5	5.7	36.9	14.3	71.5	7.5	21.7	76.6	134.5	39.9	78.8	135.9
24 cmn_ros	-1.2	-1.3	-0.4	2.8	2.8	1.1	0.7	5.3	5.7	4.5	10.5	6.9	8.5	16.1	19.0
25 osg_dwe	-1.2	-0.9	0.7	1.8	0.5	1.4	0.8	4.5	2.3	2.2	10.2	12.8	11.5	8.2	13.6
26 wol_omn_nmm	0.3	7.8	3.6	2.9	5.9	1.6	8.3	11.9	5.8	8.1	13.3	13.6	6.5	13.5	8.1
27 trd_cns	-1.2	-0.8	-1.3	2.3	2.5	1.1	1.3	6.4	3.9	4.4	11.9	13.9	6.5	12.6	17.1
28 ely_wtr	-0.4	-0.8	-0.4	2.2	2.4	0.4	-0.3	-2.8	5.6	3.2	7.6	12.9	6.3	15.1	17.9
29 oil	-2.2	-3.5	41.1	6.7	-17.3	65.9	-0.2	61.4	6.9	-13.3	21.9	26.2	47.7	47.3	-6.5
30 frs	4.1	-0.2	37.3	58.1	35.9	7.4	2.5	48.9	54.3	44.6	15.0	6.8	39.6	51.9	38.5

Source: Simulation results derived from SAMGEM

Table 6.6 Projections of Percentage Change in Imports in Short-Run under Different Trade Policy Options

	SAFTA					Customs Union					Unilateral Trade Liberalisation				
	IND	PAK	LKA	BGD	XSA	IND	PAK	LKA	BGD	XSA	IND	PAK	LKA	BGD	XSA
1 pdr_pcr	1.6	21.5	73.0	56.7	0.1	38.7	11.1	70.0	57.6	0.0	62.9	24.5	77.8	61.3	-0.1
2 wht_gro	1.1	0.9	3.6	3.5	3.3	0.8	17.3	-1.7	-0.4	-19.1	24.0	33.5	9.6	10.6	-4.5
3 v_f	4.3	3.8	17.4	11.7	2.0	29.1	1.1	15.8	12.1	1.7	41.8	15.4	27.4	20.3	2.2
4 osd_vol	2.7	2.2	7.4	4.0	4.4	85.6	17.9	4.7	12.1	0.6	99.3	35.0	20.6	28.9	2.7
5 pfb_ocr	8.3	4.5	18.3	4.5	5.4	25.5	-2.9	44.5	-19.2	2.8	51.4	23.1	58.0	14.8	9.0
6 c_b_sgr	7.9	2.8	0.7	0.1	0.0	90.9	25.3	4.7	26.1	-1.0	103.1	46.3	8.0	42.9	-1.5
7 rmk_mil	1.6	2.3	1.0	14.7	5.3	53.0	30.4	-9.1	45.8	2.6	82.3	58.9	13.8	67.6	9.9
8 fsh	2.1	1.1	2.0	22.3	1.9	6.9	-6.2	-6.6	23.5	0.7	18.2	10.0	8.2	26.2	3.4
9 cmt_oap	1.6	1.1	0.4	-0.7	3.3	-10.0	-9.4	0.4	-0.6	4.5	20.9	16.3	29.0	24.4	8.6
10 ofd	4.5	4.4	1.4	4.6	3.6	36.7	15.5	-1.7	9.9	3.9	51.1	58.4	7.2	25.6	6.4
11 b_t	4.0	0.7	1.7	6.1	-2.9	53.8	36.0	21.4	27.8	-3.3	71.6	43.9	32.2	51.9	-2.7
12 tex	2.6	1.9	-0.1	10.7	6.6	12.9	17.1	-20.5	38.6	3.3	43.0	50.7	6.4	67.2	15.6
13 wap	5.0	1.0	6.1	16.8	-0.2	14.0	29.4	7.8	43.8	-4.4	65.5	59.2	19.9	60.0	-2.2
14 lea_lum	2.9	2.2	4.6	3.2	4.8	4.4	12.2	-2.0	15.5	5.8	35.8	38.2	11.8	42.3	11.8
15 ppp	1.9	0.9	4.8	4.0	7.2	4.5	5.3	1.5	14.9	6.6	34.4	20.8	9.4	33.0	14.6
16 crp	1.2	2.0	1.8	3.8	6.6	3.8	2.4	-2.4	4.4	7.3	22.6	20.1	6.0	23.5	10.3
17 i_s_nfm_fmp	0.9	1.0	13.7	4.2	11.1	6.5	0.7	9.0	7.3	11.1	23.0	9.4	13.8	20.7	19.0
18 ele	1.0	0.6	1.7	3.8	5.9	-15.4	4.5	-1.7	10.0	4.5	4.3	19.6	1.8	28.5	11.9
19 ome	0.7	1.0	1.5	1.3	6.7	3.4	2.0	3.3	-0.1	7.0	15.9	9.0	0.7	9.7	14.2
20 omf	0.8	2.0	3.8	5.0	8.0	4.4	9.2	-7.1	41.0	14.1	26.6	40.0	14.9	66.7	24.8
21 mvh_otn_otp	0.7	0.2	3.5	0.9	6.2	0.7	0.5	5.7	0.3	6.3	13.8	0.1	7.6	12.6	17.0
22 p_c_coa	0.8	1.0	24.3	5.4	2.2	12.0	13.3	-11.1	16.0	0.5	20.7	17.5	56.8	31.8	4.1
23 gas_gdt	4.9	2.2	5.6	-4.5	18.4	-36.2	-143.1	-123.2	-141.0	-100.9	75.4	-44.6	-6.9	-27.8	-16.7
24 cmn_ros	0.5	0.6	0.3	-0.7	0.5	0.5	0.3	-1.8	-1.4	0.2	-1.4	-1.7	-2.7	-4.4	-1.3
25 osg_dwe	0.3	0.6	-0.2	-0.4	-0.9	1.2	-0.2	-2.0	0.0	-1.6	1.0	-5.5	-4.9	-1.7	-7.6
26 wol_omn_nmm	0.5	1.3	4.9	4.2	14.3	0.9	7.3	-1.2	16.5	13.2	11.2	20.8	7.4	31.3	18.2
27 trd_cns	0.7	0.6	0.6	0.1	0.5	0.3	-0.9	-2.8	0.0	0.1	-5.0	-5.6	-3.2	-0.9	-2.4
28 ely_wtr	0.6	0.5	0.3	-1.2	1.1	0.8	0.4	1.2	-3.1	0.7	-3.5	-4.6	-2.5	-8.6	-2.5
29 oil	1.2	0.1	0.7	1.9	7.4	-3.7	-18.0	-1.6	4.7	-45.4	12.1	-5.0	1.7	15.4	-0.4
30 frs	1.7	18.0	17.4	0.7	4.6	-13.7	21.9	18.1	-27.9	0.9	13.2	36.5	21.5	0.2	6.0

Source: Simulation results derived from SAMGEM

On the other hand, India's imports in agricultural and labour intensive manufacturing goods will increase by a greater percentage under the unilateral trade liberalisation due to unbiased tariff reduction against all trading partners. Hence, India is a net importer in agricultural and labour intensive manufacturing goods under the unilateral trade liberalisation scenario. Further, it is noted that there is a decline in imports of services such as trade and construction, electricity and water and other services such as communication, business and financial services as a result of development in the service sector due to a reduction in labour cost in those industries in the short-run.

The results on sectoral exports in Sri Lanka indicate that under the SAFTA and customs union, exports of metal products, oil seeds and vegetable oil will rise in the short-run whereas exports of other labour intensive manufacturing industries such as leather products, paper products and other manufacturing goods are also expected to rise under both these policy options. Nevertheless, exports of the wearing apparel sector decline by 28.4 per cent under the customs union. This is because, in Sri Lanka, most of the manufacturing industries use imported intermediate inputs and, therefore, maintaining a 13 pe rcent common external tariff would result in increasing the production costs. On the other hand, under the unilateral trade liberalisation, Sri Lanka's exports and imports are expected to increase considerably. Under this policy option, exports of wearing apparel sector are expected to increase by 8.33 per cent in the short-run. The estimated results on imports in Sri Lanka indicate that there is a notable increase in import of paddy rice and processed rice under all three policy options. In addition, it is clear that imports in the manufacturing sector will decline under the customs union scenario as a result of lifting tariffs against the rest of the world.

The sectoral exports of agricultural goods such as, oil seeds and vegetable oil, plant based fibres, sugar, and also labour intensive manufacturing goods such as textiles wearing apparel, leather products, paper products, electronic equipment and other manufacturing goods in Bangladesh and Rest of South Asia are expected to increase under all three trade policy options. Isolating Bangladesh under the customs union and unilateral trade liberalisation, it can be seen that import of agricultural goods increase significantly compared to the Rest of South Asia since Bangladesh has a larger population, which in turn causes higher demand for imported agricultural goods. Trade liberalisation would also result in cheaper imports of such goods from their trading partners as high initial tariffs persist in these sectors in Bangladesh and the Rest of South Asia.

Tables 6.7 and 6.8 below illustrate the percentage change in exports and imports in all South Asian countries under different trade policy options in the long-run. Under the SAFTA, there is an increase in exports of agriculture and labour intensive manufacturing industries in India, Pakistan, Sri Lanka and Bangladesh in the long-run. It shows that exports of these commodities in Rest of South Asia rise considerably in the long-run because of trading more with regional partners. Exports of labour intensive industries are increased due to inter–sectoral mobility of labour which moves labour from less to more efficient sectors whereas employment is determined exogenously in the long-run. Labour combined with more capital increases labour productivity, as capital stock is variable in the long-run. Furthermore, there is a noticeable increase in exports in capital intensive industries such as electronic equipment, machinery, equipment necessaries, and m the

contrast to

intermediate inputs -

As in the short run, imports of agricultural commodities increase substantially under unilateral trade liberalisation in the long-run as a result of a greater reduction in prices of imports of such commodities. Imports of gas and gas manufactures decline by large amounts in all economies under the customs union, as this sector is largely unprotected in the base year (see Table D.1 toD.5 in Appendix D). Hence, maintaining a common external tariff of 13 per cent would result in a rise in cost of imports in this industry.

Table 6.7 Projections of Percentage Change in Exports in Long-Run under Different Trade Policy Options

	SAFTA					Customs Union					Unilateral Trade Liberalisation				
	IND	PAK	LKA	BGD	XSA	IND	PAK	LKA	BGD	XSA	IND	PAK	LKA	BGD	XSA
1 pdr_pcr	11.5	1.6	0.6	3.5	4.7	13.3	3.0	10.3	7.5	8.0	15.4	9.7	11.3	16.3	28.3
2 wht_gro	2.1	9.3	1.0	116.0	8.3	12.2	22.3	4.8	88.8	5.9	12.2	15.9	14.3	61.8	7.7
3 v_f	5.2	18.1	21.6	5.4	68.9	8.0	13.6	23.7	6.1	52.6	8.3	11.5	18.5	8.6	47.3
4 osd_vol	2.6	-0.6	120.4	119.9	102.6	7.2	7.1	33.4	126.2	19.2	9.3	0.2	14.7	119.4	26.5
5 pfb_ocr	6.0	4.1	8.1	27.0	45.2	13.2	9.7	17.9	28.7	45.2	11.6	13.4	16.5	19.7	36.2
6 c_b_sgr	25.3	11.4	3.2	3.5	14.1	23.7	-9.1	2.8	2.1	7.7	17.3	-7.9	-3.2	13.5	29.7
7 rmk_mil	24.0	34.4	26.2	32.6	11.1	24.8	44.6	48.8	39.9	-8.7	23.9	25.1	24.3	42.6	3.4
8 fsh	0.2	-0.4	1.3	1.4	2.8	2.6	0.6	4.5	2.8	4.1	4.0	5.7	6.0	7.3	11.9
9 cmt_oap	-1.7	5.5	43.8	10.0	11.4	4.9	8.6	51.6	17.2	17.1	8.0	13.4	31.1	28.3	34.7
10 ofd	-0.2	8.5	3.0	3.3	19.9	3.4	9.6	9.3	5.5	15.9	4.6	10.9	19.1	15.3	25.7
11 b_t	7.6	-2.6	5.2	3.7	59.2	9.5	-3.9	6.8	3.0	0.4	11.3	-2.7	7.8	7.6	20.2
12 tex	0.9	2.7	9.2	6.0	11.3	6.8	6.6	-5.0	10.3	7.6	13.4	24.6	17.2	29.0	17.6
13 wap	-1.7	-1.2	0.7	8.2	12.3	4.4	4.6	-28.3	26.0	12.3	9.3	22.9	11.4	50.0	42.9
14 lea_lum	-1.9	1.0	27.5	4.3	23.1	4.0	5.2	33.8	10.1	37.8	10.7	18.1	41.6	25.0	57.9
15 ppp	11.0	5.0	33.7	5.4	11.0	14.9	8.4	28.7	10.8	15.5	20.0	18.4	46.1	27.1	31.3
16 crp	2.5	5.7	12.7	20.1	36.8	7.0	6.9	8.1	22.4	36.5	31.4	9.1	28.7	26.7	19.2
17 i_s_nfm_fmp	1.5	-0.6	88.1	30.1	49.2	8.4	0.8	61.5	36.2	43.7	33.7	13.7	57.0	39.9	19.5
18 ele	1.8	-0.7	8.8	6.0	14.2	1.8	5.0	-14.0	11.4	19.0	41.3	38.5	38.6	32.9	66.4
19 ome	2.2	9.1	28.1	13.6	14.9	12.2	12.2	6.6	16.4	20.6	42.9	43.6	43.4	30.4	30.6
20 omf	-1.4	0.8	5.7	7.0	21.5	5.3	4.0	-10.2	13.6	27.4	25.3	21.0	35.5	25.9	49.7
21 mvh_otn_otp	3.4	-0.1	2.1	1.8	2.2	6.9	0.8	4.7	5.5	4.3	16.2	30.4	13.6	9.0	27.9
22 p_c_coa	8.8	-2.4	2.6	31.9	5.8	-2.3	-19.7	-24.5	46.5	7.0	33.7	-7.6	8.7	83.2	15.8
23 gas_gdt	8.4	-18.0	6.5	14.8	2.4	56.8	-1.7	62.0	27.6	20.3	77.6	-39.4	86.5	89.7	118.2
24 cmn_ros	-1.3	-0.9	-1.9	0.6	-0.4	2.4	1.4	9.3	1.7	1.5	6.7	8.5	2.2	2.0	10.3
25 osg_dwe	-1.5	-1.5	-3.4	1.5	1.8	1.8	0.1	11.4	3.8	3.8	1.7	0.8	-1.9	7.7	15.5
26 wol_omn_nmm	0.3	7.4	5.6	3.0	9.0	2.8	8.4	11.9	7.7	11.4	11.4	14.2	9.7	14.1	15.5
27 trd_cns	-1.3	-1.5	-0.5	1.7	3.1	2.2	0.6	7.9	4.2	5.5	6.6	2.4	6.4	9.0	17.8
28 ely_wtr	-0.4	-0.8	0.8	1.2	2.7	0.9	0.2	-2.6	4.8	3.9	6.3	10.1	8.3	9.3	18.1
29 oil	-1.2	-2.1	41.6	5.0	12.5	68.0	4.4	56.4	6.7	18.4	22.4	37.6	46.9	36.0	60.0
30 frs	3.8	0.3	38.3	58.4	42.8	8.7	4.5	50.3	57.6	51.6	7.5	11.4	40.5	56.5	55.9

Table 6.8 Projections of Percentage Change in Imports in Long-Run under Different Trade Policy Options

	SAFTA					Customs Union					Unilateral Trade Liberalisation				
	IND	PAK	LKA	BGD	XSA	IND	PAK	LKA	BGD	XSA	IND	PAK	LKA	BGD	XSA
1 pdr_pcr	1.9	21.4	71.9	56.5	0.0	38.1	11.0	69.6	56.1	-0.1	70.6	23.2	73.4	55.4	-0.5
2 wht_gro	1.2	1.0	6.4	3.5	3.2	-0.2	17.1	-6.3	0.0	-19.1	27.0	36.2	16.5	11.0	-4.2
3 v_f	4.3	3.9	16.9	11.8	1.8	28.4	1.0	15.4	11.8	1.6	43.8	17.8	26.6	20.4	1.9
4 osd_vol	2.8	2.6	9.2	3.7	4.0	84.6	18.7	0.5	12.3	0.2	102.5	42.2	25.6	30.4	1.8
5 pfb_ocr	8.4	4.6	18.2	3.4	5.1	24.5	-2.6	43.8	-21.0	2.5	53.1	24.4	57.9	8.4	8.4
6 c_b_sgr	8.0	2.8	1.4	0.6	0.1	90.0	24.9	4.2	27.0	-0.9	106.7	49.1	9.3	47.3	-1.3
7 rmk_mil	1.8	2.4	0.4	14.7	4.0	51.8	29.9	-9.8	46.1	1.2	88.9	62.7	13.3	70.4	8.0
8 fsh	2.3	1.3	1.1	22.3	1.4	6.7	-6.0	-6.1	22.8	0.2	22.0	13.6	6.5	25.2	2.6
9 cmt_oap	1.7	1.3	-0.9	-0.7	2.8	-11.2	-9.6	0.2	-1.6	4.0	25.0	19.8	27.1	24.8	7.8
10 ofd	4.7	5.8	1.3	4.4	3.0	36.2	19.3	-1.8	8.9	3.2	54.9	84.6	7.1	24.5	5.3
11 b_t	4.4	0.8	0.9	5.7	-3.0	53.5	36.1	21.6	28.0	-3.4	79.1	46.4	30.8	53.9	-2.8
12 tex	2.8	1.9	1.5	10.4	6.7	12.5	17.1	-20.5	38.5	3.4	50.0	51.7	8.9	65.5	15.8
13 wap	5.8	1.0	5.7	17.0	-0.3	13.6	29.3	7.5	44.1	-4.4	84.8	61.6	18.6	61.4	-2.2
14 lea_lum	3.2	2.4	5.9	3.6	2.9	4.0	12.2	-3.7	16.2	3.9	43.3	44.2	14.9	46.7	9.6
15 ppp	2.2	1.1	5.6	3.9	6.3	4.0	5.8	-0.2	14.8	5.7	41.8	24.6	11.7	33.6	13.2
16 crp	1.2	2.5	2.8	3.4	5.9	3.4	3.7	-4.5	3.9	6.6	23.7	28.6	8.6	23.1	9.1
17 i_s_nfm_fmp	1.0	1.5	15.2	4.8	7.8	6.1	1.6	4.9	8.3	7.8	25.6	19.3	18.4	26.2	14.9
18 ele	1.3	1.1	3.7	3.2	2.6	-16.8	4.8	-9.8	9.7	1.1	13.8	31.6	9.3	29.5	7.8
19 ome	0.8	1.8	3.4	1.1	3.8	2.2	3.5	-5.1	-0.2	4.0	21.1	26.0	8.2	10.9	10.6
20 omf	1.0	2.8	6.1	5.2	6.5	3.5	10.6	-12.4	41.0	12.5	32.0	56.0	21.3	70.1	22.7
21 mvh_otn_otp	0.9	0.4	4.5	1.8	3.2	-0.5	0.7	-0.5	1.8	3.2	22.1	7.4	12.0	19.9	13.5
22 p_c_coa	0.8	1.1	36.2	5.0	1.5	11.7	13.7	-35.8	16.4	-0.1	21.8	19.8	88.9	33.5	3.2
23 gas_gdt	4.6	5.8	-0.5	-5.1	18.4	-42.8	-137.3	-121.5	-147.7	-100.8	77.0	13.7	-17.5	-31.3	-13.2
24 cmn_ros	0.6	0.5	0.9	0.1	0.9	0.0	-0.1	-3.4	0.3	0.6	1.6	-1.6	-0.1	1.8	0.3
25 osg_dwe	0.4	0.9	1.6	-0.3	-1.3	1.1	0.2	-5.2	-0.5	-2.1	3.5	2.2	1.2	-0.7	-8.0
26 wol_omn_nmm	0.6	1.3	5.8	4.1	11.7	0.4	7.0	-2.8	15.9	10.6	14.1	23.6	9.7	32.4	14.5
27 trd_cns	0.8	1.1	0.4	0.1	1.0	-0.6	-0.3	-4.0	-0.3	0.5	0.9	2.0	-2.7	-0.6	0.3
28 ely_wtr	0.7	0.5	-0.2	-0.6	1.0	0.3	0.3	1.0	-2.6	0.6	-1.3	-2.4	-3.1	-4.7	-2.0
29 oil	1.3	0.0	1.7	1.3	-6.6	-4.4	-18.0	-2.8	4.9	-59.9	13.3	-4.2	3.8	15.9	-31.2
30 frs	1.9	18.5	18.7	0.3	2.3	-14.4	22.5	17.3	-30.1	-1.4	19.0	39.0	23.8	-2.4	1.4

Source: Tables 6.7 and 6.8 – Simulation results derived from SAMGEM

The industry analysis in South Asian economies shows that exports and imports are dominated by a few agricultural products and labour-intensive manufacturing products, even though the region is commonly perceived to be a food deficit area given it has one-fifth of the world population (see Table 2.2 in Chapter 2). The South Asian economies trade most of their agricultural products among regional trading partners and India is the largest food exporter to the region. Hence, it is important for the South Asian economies to initiate steps to liberalise the agricultural sector to boost intra-regional trade.

Regarding the manufacturing sector, the ready-made garment industry is one of the most important industries for all South Asian countries. This sector contributes to more than 75 per cent of export earnings of Bangladesh and Pakistan, and more than 50 per cent of Sri Lanka's and nearly 30 per cent of India's export earnings (Das, 2007). Being largely endowed with labour resources, the region's exports are generally dominated by this sector for more than a decade. Under the quota regime from 1995-2005, these countries export readymade garments especially to USA and EU. Most of South Asian countries use imported intermediate inputs in manufacturing ready-made garments. Nonetheless, the results point out that the wearing apparel sectors in India, Sri Lanka and Pakistan continue to struggle under the SAFTA in the short run due to increased worldwide competition from larger suppliers such as China, and particularly since the expiration of the Multi Fibre Agreement in 2005. Yet, in Bangladesh and the Rest of South Asia, there is a rise in exports of wearing apparel because, being the least developed economies in the region, they still continue to enjoy tariff preferences in major markets (Adhikari and Weeratunge, 2006). The exports of the wearing apparel sector from all South Asian economies under the unilateral trade liberalisation have significantly increased both in the short-run as well as in long-run as a consequence of a reduction in costs of imported inputs in manufacturing ready-made garments.

Additionally, under all three policy options, apart from Sri Lanka under the customs union, there is an increase in the exports of textiles from all South Asian countries in the short-run and the long-run. Hence, it is essential to improve trade facilitation services in the region to improve delivery times and custom clearance because textiles are one of the most important intermediate inputs required for manufacturing garments. Developing the textile industry will help South Asian economies to emerge as more efficient and cost competitive suppliers within the region as well as in the global market.

The industry level projections indicate that, exports and imports increase significantly in all South Asian countries under unilateral trade liberalisation than under the SAFTA and the customs union both in the short-run and long-run. Thus, unilateral trade liberalisation may be likely to expand the total trade in South Asia in the world market.

b) Projections on Intra-Regional Trade

Table 6.9 illustrates the share of bilateral trade in the base year (calculated from GTAP version 7 database, 2004) of South Asian countries with their major trading partners.

Table 6.9 Percentage of Intra-Regional and Extra-Regional Trade in South Asian Economies in the Base Year

Country /Region	IND	PAK	LKA	BGD	XSA	IND	PAK	LKA	BGD	XSA
	Exports (Percentage)					Imports (Percentage)				
IND	0.00	0.90	6.20	1.00	18.60	0.00	2.00	15.80	12.80	20.70
PAK	0.50	0.00	0.60	0.50	1.90	0.14	0.00	2.00	2.00	9.20
LKA	1.40	1.10	0.00	0.10	0.70	0.40	0.20	0.00	0.10	1.80
BGD	1.50	1.40	0.20	0.00	0.50	0.09	0.30	0.10	0.00	0.20
XSA	1.00	2.80	1.10	0.10	0.10	0.43	0.20	0.20	0.10	0.00
USA	17.50	24.60	28.30	27.50	18.40	7.06	9.90	4.10	3.80	6.30
CAN	1.70	1.40	1.50	3.30	1.60	0.95	1.50	0.70	1.00	0.70
EU	30.50	32.00	35.90	54.10	36.00	22.90	22.70	20.40	10.80	15.60
ASE	7.40	2.70	2.60	1.70	3.50	9.20	10.30	16.70	14.90	8.20
HIA	4.10	4.20	2.20	1.30	2.00	4.90	4.50	8.70	11.10	3.00
JPN	3.60	2.00	3.90	2.00	4.40	3.20	6.80	4.40	6.20	3.40
CHN	5.70	3.40	0.70	0.60	1.80	5.70	8.50	8.20	15.50	4.40
XME	11.60	10.40	5.80	2.40	1.70	21.40	21.50	9.00	8.20	16.60
AUS_NZL	1.20	1.30	1.50	0.50	0.90	4.50	2.00	3.70	2.10	1.20
RUS_XSU	1.00	0.40	2.40	0.30	1.20	1.53	1.40	0.20	2.70	1.50
ROW	11.30	11.40	7.10	4.60	6.70	17.60	8.20	5.80	8.70	7.20
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: Own calculations from GTAP database Version 7, 2004

As noted in Chapter 2, the South Asian bloc is distinct from other regional blocks in the world for its dominance by a few large countries (India, Pakistan, Bangladesh and Sri Lanka in terms of total value of external trade) which suffered from bilateral political conflicts, thus circumventing neighbouring trade and tending to do business with the rest of the world instead. On the contrary, the smaller countries in South Asia such as Nepal, Bhutan, Maldives and Afghanistan are more integrated with the regional trading partners.

There is more evidence of trade with industrial countries seen in Table 6.9 followed by other developing countries than it is within the region. Of India’s total exports, 4.4 per cent goes to SAARC countries while imports from SAARC are 1.06 per cent. Even though India's trade volume is increasing, its intra-trade with regional trading partners' is well below its potential.

Table 6.10 illustrates the bilateral trade of South Asian countries under the SAFTA. Under this policy, India's total share of intra-regional exports has gone up to 6.7 per cent and imports by 1.7 per cent as a largest trading partner and the Rest of South Asia (Nepal, Bhutan, Maldives and Afghanistan) is the largest exporter to India among the SAARC. Sri Lanka's exports to India have also increased under the SAFTA policy.

Table 2.13 in Chapter 2 showed that Bangladesh, Nepal, Bhutan and Sri Lanka have entered into bilateral free trade agreement with India. Under the bilateral trade treaties, India has given duty free access to these countries and this has resulted in such economies increasing trade with India, hence strengthening the SAFTA. One can conclude that tariff concessions play a significant role in enhancing the trade flows among the regional trading partners. Even so, the trade between the two largest economies in the region (i.e. India and Pakistan) is not impressive. India is a key player in the region and therefore should occupy a greater role in ensuring that the goals of SAFTA are achieved.

Table 6.10 Percentage of Intra-Regional and Extra-Regional Trade in South Asian Economies under the SAFTA

Region /Country	IND	PAK	LKA	BGD	XSA	IND	PAK	LKA	BGD	XSA
	Exports (Percentage)					Imports (Percentage)				
IND	0.00	1.50	10.80	1.50	23.90	0.00	3.00	19.40	19.60	29.40
PAK	0.80	0.00	1.00	0.70	2.50	0.20	0.00	2.30	3.90	9.40
LKA	1.80	1.30	0.00	0.20	0.90	0.70	0.40	0.00	0.20	3.00
BGD	2.50	3.00	0.40	0.00	1.00	0.20	0.30	0.20	0.00	0.40
XSA	1.6	3.00	2.00	0.20	0.10	0.60	0.30	0.30	0.20	0.10
USA	17.2	23.90	26.30	27.30	17.50	7.00	9.80	3.80	3.50	5.80
CAN	1.60	1.40	1.40	3.30	1.50	0.90	1.50	0.70	0.80	0.70
EU	29.70	31.10	33.60	53.80	32.00	22.80	22.50	19.30	9.80	13.70
ASE	7.20	2.70	2.40	1.70	3.20	9.10	10.10	15.90	13.40	6.80
HIA	4.00	4.10	2.10	1.20	1.90	4.90	4.40	8.40	9.70	2.50
JPN	3.50	2.00	3.60	1.90	4.10	3.20	6.80	4.00	5.40	2.90
CHN	5.50	3.30	0.60	0.50	1.60	5.70	8.40	7.80	13.40	3.60
XME	11.40	10.20	5.50	2.30	1.60	21.40	21.10	8.70	7.60	13.30
AUS_NZL	1.20	1.30	1.40	0.40	0.80	4.50	2.00	3.60	1.90	1.00
RUS_XSU	1.00	0.40	2.20	0.30	1.20	1.50	1.40	0.20	2.50	1.40
ROW	11.00	10.8	6.70	4.70	6.20	17.50	8.00	5.40	8.10	6.00
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Calculated from the projected results from the SAMGEM

Table 6.11 exemplifies the projected percentage change in bilateral trade of SAARC members with their regional trading partners and the rest of the world under the customs union. The results revealed that bilateral trade among South Asian economies would not be enhanced considerably under the customs union compared to SAFTA. Sri Lanka’s imports from India increase from 15.8 per cent (see Table 6.9) in the base year to 21.3 per cent under the customs union due to 13 per cent common external tariff on the rest of the world.

Table 6.11 Percentage of Intra-Regional and Extra-Regional Trade in South Asian Economies under the Customs Union

Region/ Country	IND	PAK	LKA	BGD	XSA	IND	PAK	LKA	BGD	XSA
	Exports (Percentage)					Imports (Percentage)				
IND	0.0	1.2	10.6	1.4	21.8	0.0	2.9	21.3	18.1	29.2
PAK	0.8	0.0	1.1	0.6	2.5	0.2	0.0	3.0	3.2	9.1
LKA	1.9	1.6	0.0	0.2	1.0	0.6	0.3	0.0	0.2	2.9
BGD	2.4	2.6	0.4	0.0	1.0	0.1	0.3	0.3	0.0	0.4
XSA	1.5	2.8	2.1	0.2	0.0	0.5	0.3	0.3	0.2	0.0
USA	17.2	24.1	23.9	27.8	17.9	6.8	9.4	3.8	3.1	6.7
CAN	1.6	1.4	1.4	3.4	1.5	0.9	1.4	0.6	0.7	0.6
EU	29.8	31.3	33.7	53.8	33.0	23.1	22.4	18.8	9.3	14.3
ASE	7.2	2.7	2.5	1.7	3.3	10.5	11.4	15.4	15.0	7.3
HIA	4.0	4.1	2.3	1.2	1.9	4.7	4.6	7.7	11.0	2.6
JPN	3.5	2.0	3.9	1.9	4.2	3.2	6.8	4.0	5.2	2.8
CHN	5.5	3.3	0.6	0.5	1.7	5.7	9.3	7.4	16.3	4.1
XME	11.4	10.2	6.1	2.2	1.7	20.5	20.4	8.9	7.3	12.7
US_NZL	1.2	1.2	1.5	0.4	0.9	4.7	1.6	3.3	1.6	1.0
US_XSU	1.0	0.4	2.6	0.3	1.2	1.6	1.1	0.2	1.7	1.3
ROW	11.0	11.1	7.3	4.4	6.4	16.9	7.8	5.0	7.1	5.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Calculated from the projected results from the SAMGEM

Table 6.12 below depicts bilateral trade as a percentage of total trade of South Asian countries with their regional trading partners and the rest of the world under the unilateral trade liberalisation. It was explained in Chapter 2 that South Asia accounted for 2.7 per cent of the world GDP in 2010 and it remains a highly protected region in the world (see Figure 2.8, p.53). Therefore, Panagariya (2003) argued that there is high potential of trade diversion from the preferential trading agreement in South Asia. This is because with 97.3 percent of the world production outside the region, it is unlikely to find most efficient suppliers within the region which may result in harmful trade diversion effects in South Asia following PTAs.

Table 6.12 Percentage of Intra-Regional and Extra-Regional Trade in South Asian Economies under the Unilateral Trade Liberalisation

	IND	PAK	LKA	BGD	XSA	IND	PAK	LKA	BGD	XSA
	Exports (Percentage)					Imports (Percentage)				
IND	0.0	0.9	7.9	1.0	16.5	0.0	2.3	18.7	14.4	24.5
PAK	0.5	0.0	0.7	0.4	2.0	0.1	0.0	2.4	2.7	7.5
LKA	1.5	1.2	0.0	0.1	0.8	0.5	0.3	0.0	0.2	2.4
BGD	1.8	2.0	0.3	0.0	0.9	0.1	0.3	0.2	0.0	0.3
XSA	1.1	1.9	1.5	0.1	0.1	0.4	0.2	0.3	0.2	0.1
USA	17.9	24.7	27.2	27.8	19.9	6.7	7.3	3.9	3.2	7.0
CAN	1.6	1.4	1.5	3.4	1.7	1.0	1.1	0.7	0.8	0.8
EU	29.9	32.1	35.2	54.8	35.3	22.5	22.1	18.6	9.3	14.6
ASE	7.4	2.7	2.6	1.6	3.5	10.6	12.2	16.6	15.5	8.3
HIA	4.1	4.2	2.2	1.3	2.1	4.7	4.9	8.6	11.8	3.4
JPN	3.5	2.0	3.9	1.9	4.5	3.4	9.2	4.2	5.5	3.9
CHN	5.4	3.5	0.6	0.5	1.8	6.0	9.5	8.1	17.6	4.6
XME	11.7	10.1	5.7	2.1	1.8	20.6	20.0	8.9	7.3	15.2
AUS_NZL	1.2	1.3	1.4	0.4	0.9	4.6	1.7	3.5	1.8	1.1
RUS_XSU	1.0	0.4	2.3	0.2	1.3	1.6	1.0	0.2	2.3	1.0
ROW	11.4	11.6	7.0	4.4	6.9	17.2	7.9	5.1	7.4	5.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Calculated from the projected results from the SAMGEM

Table 6.12 highlights that bilateral trade among trading partners is considerably lower under unilateral trade liberalisation in South Asia, compared to the SAFTA and customs union trade policy options. Table 6.13 summuries the intra-regional trade as a percentage of total trade in South Asia under each policy option. The highest intra-regional trade is under SAFTA and the lowest under the unilateral trade liberalisation. South Asia has more prospect of trading with the rest of the world.

Table 6.13 Projected Total Intra-Regional Trade as a Percentage of Total Trade in South Asia under Different Trade Policy Options

Policy Options	Percentage
Base Year	4.51
SAFTA	6.60
Customs Union	6.32
Unilateral Trade Liberalisation	5.01

Source: Calculated from the projected results from the SAMGEM

Although the increased intra regional trade under the SAFTA seems small, it does not mean that it will not create benefit to its regional trading partners. This is because, there are evidences[25] to support the view that the official accounts of South Asia's international trade statistics are flawed due to the high incidence of informal trade between India and its neighbours. Taneja et al. (2005) found that substantial amounts of informal trade takes place through the borders of neighbouring countries. For instance, the informal trade between India and Pakistan was estimated to be US$ 1 billon for the year 2004/2005. They also noted that there is very high informal trade between India, Bangladesh, Nepal, and Sri Lanka. Taneja et al. (2005) mentioned that important factors that are thriving informal trade have been differences in the tariff structures among the South Asian countries, as well as the incidence of high transaction costs in the formal routes. In addition, Taneja (1999) noted that, the absence of synchronised fiscal policies and distortions in domestic policies (presence of domestic subsidies), may also continue to make illegal trade remunerative. Hence, Taneja (1999) suggested that the South Asian economies will have to make a concerted effort towards synchronising both trade and domestic policies in order to convert illegal trade flows to legal flows.

[25] Pitigala (2005), Taneja et al. (2005)

Kelegama (2010) also explains that the existing pattern of intra-regional trade in South Asia fails to capture the extent of complementarities in the region due to a high incidence of NTBs and informal trade. Moreover, given the large population in the region compared with other regions in the world such as ASEAN, NAFTA and EU, South Asia is likely to expand its intra-regional trade if it removes all tariff and NTBs, minimises transportation cost and improves trade facilitation measures in the region.

6.4.3 Household Level Effects

The impact of different trade policy options at the household level can be determined from the results generated from the SAMGEM, whereas the effects on poverty and income inequality pertaining to Sri Lankan households can be ascertained from income distribution models, which will be explained in Chapter 7. Reimer (2002) emphasised that not only the consumption side effects but also factor market effects are important in determining the impact of trade liberalisation on poverty. Hence, this section reports the percentage changes in household income and real household consumption under different trade policy options discussed in Section 6.2.

a) Impact on Household Income

Private households receive income from lending factors such as unskilled labour, skilled labour and capital. Further, transfers from government also form a part of household income, which is modelled separately from the factor income. In Chapter 4 we noted that the nominal government transfers depend on the share weights of CPI and the price of savings. It is obvious that poor households rely more on these transfers than richer households.

Since the focus of the present study is on South Asia, private households in South Asian economies are disaggregated into different groups based on the per capita income as clarified in Chapter 5. As the model assumes perfect competition in factor market, the total factor income of each household group differs from each other depending on the factor ownership by such household group. Hence, the factor income has been distributed among different household groups in each South Asian country based on the shares calculated from the Household Survey Data of the respective economy (see Table C.8 Appendix C). Chapter 5 also explains the occupational categories included within unskilled labour and skilled labour, while capital includes income from land, renting houses dividend income, interest income and income from natural resources.

Tariff cuts generally reduce the domestic price of imported manufactured goods that are used as inputs, as well as the prices of imported consumer goods. Such tariff cuts may lead to an increase in competition in the domestic market and, therefore, there will be more incentives to reduce costs and increase efficiency. Consequently, these factors may result in a decline in the CPI and increase real returns to factors. However, a change in nominal household income depends both on the change in factor employment and their respective nominal returns. In SAMGEM, the choice is made to hold real wages fixed, with adjustment to employment in each industry in the short run. It is expected that to hold real wages fixed, the reduction in CPI leads to a decrease in corresponding nominal wages. Hence, the impact on skilled and unskilled labour income depends on net effect of changes in nominal wages and total employment in the short-run. On the other hand, the capital stock is fixed, while real rental rate is allowed to vary in the short run. Therefore, short-run capital income depends on change in the nominal returns to rental rate based on demand for capital in each industry since supply is exogenous. Moreover, real transfers are assumed to be exogenous, therefore, to hold real transfers fixed nominal transfers need to decline in line with CPI and price of savings due to trade liberalisation.

In the long-run, nominal wages determine demand for labour in each industry as labour supply is exogenous. Accordingly, skilled and unskilled labour income depends on nominal wages because labour supply is fixed. Moreover, the real rental rate is fixed while capital stock is endogenous in long-run. Thus, it is expected that nominal rental rate decreases to hold real rental rate fixed when there is a reduction in the CPI. For this reason, income accruing to capital owners depends on the net effect of nominal rental and capital stock in the long-run. Nevertheless, it is expected that total household income will increase due to better utilisation of resources in general in the long-run. This is because in the long-run, with the assumption of full employment, capital and labour can move from less efficient to more efficient sectors increasing the efficiency of factor allocations.

Projections on percentage change in household income in India under different trade policy scenarios are illustrated in Figures 6.3 to 6.5 below. Under the SAFTA, India's CPI increases slightly in the short-run, hence corresponding nominal wage rates increase in order to keep real wages fixed. The result suggests that nominal wages and CPI increase by 0.26 per cent under this policy scenario. Figure 6.2 shows that, in India, unskilled labour employment increases slightly more than skilled labour employment under the SAFTA, while the opposite is the case with the customs union and unilateral trade liberalisation. According to Table C.2 in Appendix C in Chapter 5, the share of unskilled labour takes a significant part of the total household income in the rural sector, whereas skilled labour and capital contribute to a major part of income in urban richer household groups.

The results suggest that, under the SAFTA, unskilled labour income increases proportionately more in rural households whereas their urban counterparts benefit more from increased skilled labour and capital income. The increase in labour income is due to increase in employment and in nominal wages. The increase in capital income is due to increase in rental rate with fixed capital in the short-run. As nominal transfers depend on share weighted price of CPI and savings, the results show that there is a marginal increase in transfers under the SAFTA, thus favouring more poor households in the rural sector than urban richer households. The same tendency can be seen under the long-run SAFTA scenario where the respective percentage increase in household income is higher in comparison to the short run as predicted by H-O-S theory. Hence, it is worthwhile noting that this policy would narrow the income inequalities in India.

Under the customs union, Indian households stand to gain in the short-run mainly from increase in income from skilled labour and capital. Because India trades more with the rest of the world than with regional trading partners, there is a higher demand for capital intensive manufacturing goods such as motor vehicles and motor vehicle parts, electronic equipment, and information and communication technology (ICT) products manufactured by India from the rest of the world. Hence, there is higher potential for increase in skilled labour and capital income in the short-run. On the other hand, in short-run unskilled labour income of low income households in the rural sector and the urban sector also increase marginally as a result of slight increases in employment of unskilled labour (see Figure 6.2).

However, it is expected that household income from unskilled labour and capital will fall in India in the long run if India maintains a common external tariff of 13 per cent against the rest of the world. This is because under the customs union India's imports (see Table 6.7) of agricultural products increases more than that of exports (see Table 6.6) in the long-run as higher initial tariffs prevail in the agricultural sector. Since unskilled labour and landowners draw most of their income from the agricultural sector, the results indicate that income from these sources may be adversely affected under the customs union in the long-run. Additionally, it is clear that government transfers to households decline both in the short run and long run in line with CPI and price of savings under the customs union scenario. Hence, it is possible the income distribution gap widen in India under the customs union in the long-run.

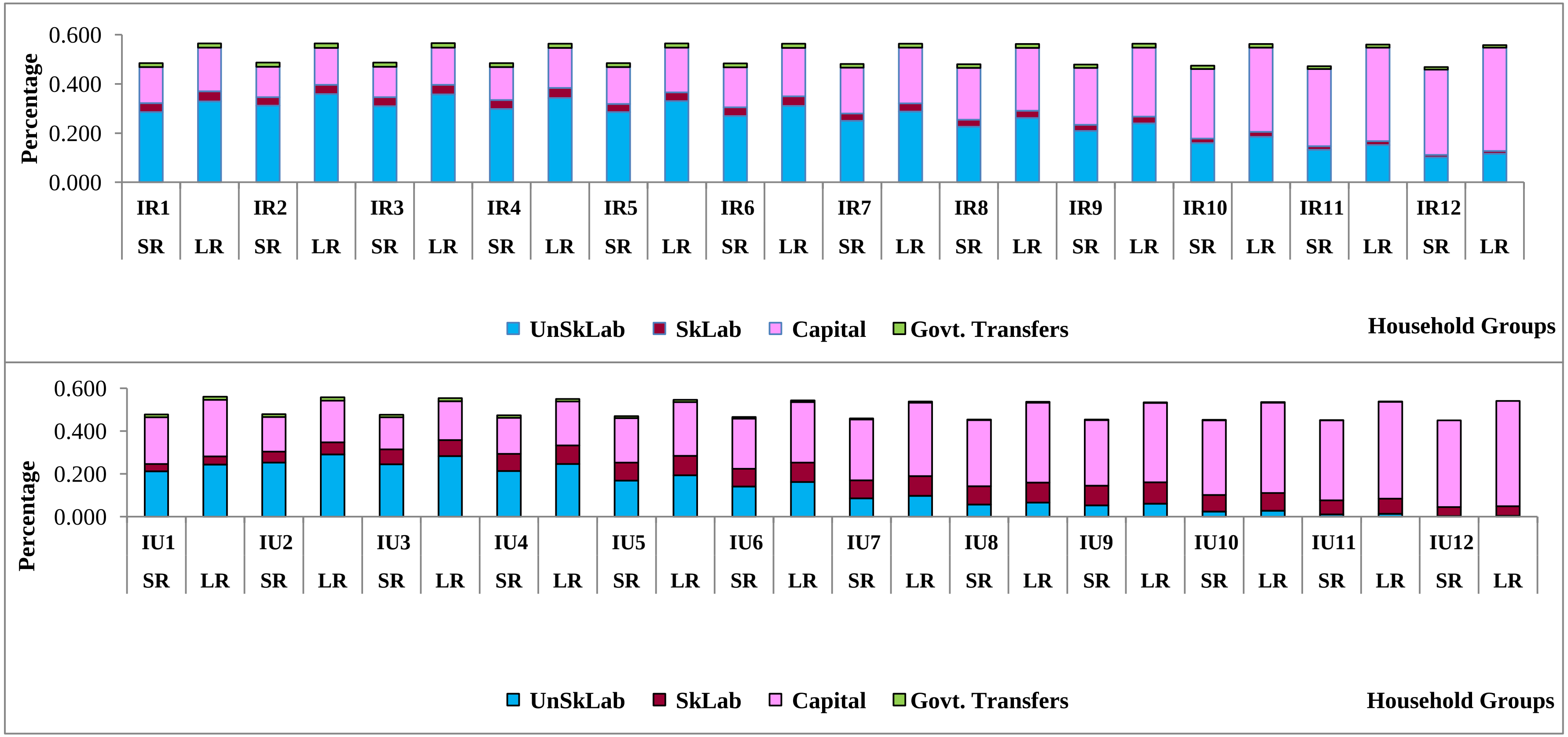
In contrast, under the unilateral trade liberalisation, household income from labour increases marginally in the short-run as a result of a large volume of imports areentering the country from the rest of the world (see Table 6.12). The short-run unilateral trade liberalisation scenario suggests that CPI and nominal wages decline by 4.16 per cent while unskilled labour and skilled labour employment increases by 4.35 per cent and 4.63 per cent respectively. Hence, it is clear that there is a slight net positive impact on unskilled labour and skilled labour income. The owners of capital even lose in the short-run due to a decline in the rental rate of capital in the short-run. Conversely, in the long-run there are considerable gains to all households in rural and urban sectors as a result of better utilisation of resources. Given the inter-sectoral labour mobility in the long-run, labour income (especially unskilled labour) will increase substantially as labour moves from less efficient to more efficient sectors. This is clear from the Table 6.6 as there is a more rapid increase in exports in the manufacturing sector and agricultural sector than the other two policy options. Hence, it can be concluded that income inequality may be reduced in India under the unilateral trade liberalisation in the long-run.

Figures 6.6 - 6.8 display the projected percentage change in household income in Pakistan under different trade policy options. Similar to India, in Pakistan unskilled labour in rural households, and skilled labour and capital in urban richer households gain more under the SAFTA in the short- run. In addition, long-run SAFTA scenario predicts that there is a greater increase in household income in all sources due to better utilisation of resources. It also shows that government transfers increase marginally in the short run as well as in the long run as a result of increases in CPI and price of savings under this scenario. Similar to India, rural sector household groups in Pakistan also receive more transfers than urban households under the SAFTA. This shows that under the SAFTA policy, income distribution gaps among Pakistani households may reduce in the long-run.

However, with the customs union, the Figures show that in the short-run only skilled labour and capital benefit marginally as a result of higher imports of unskilled labour intensive products (e.g. agricultural goods) from the rest of the world. On the other hand owners of capital benefit even more than skilled labour as a result of an increase in nominal rental rate with fixed capital in the short-run. Household income from all sources increases in the long-run, due to expansion in both the agriculture and manufacturing sectors. There is a reduction in government transfers especially in rural sector households due to a greater fall in CPI under this policy option.

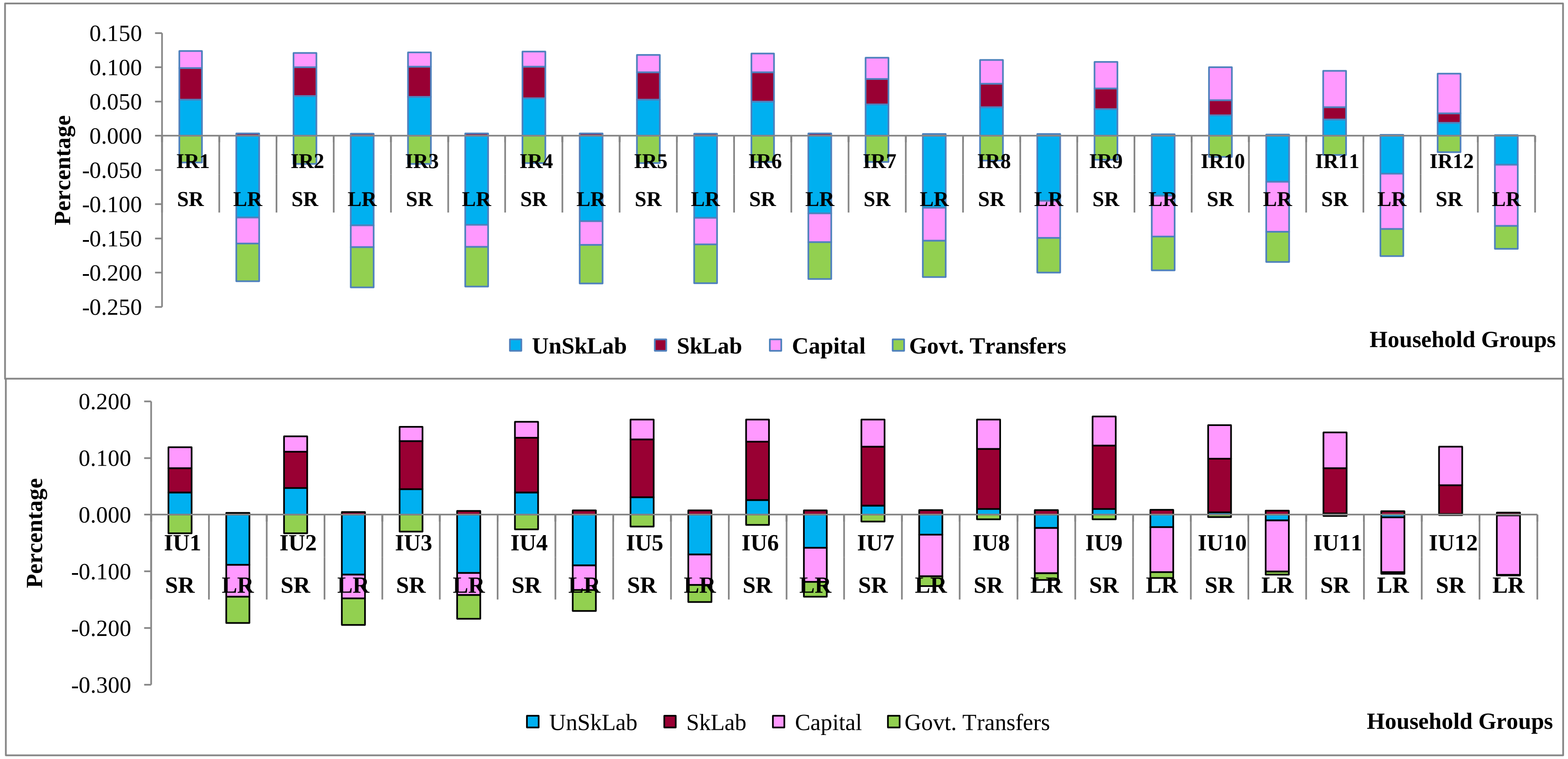
As in India, under the unilateral trade liberalisation, Pakistani households do not benefit in the short-run. However, gains to all households considerably increase in the long-run due to increases in efficiency in all sectors. It is obvious that there is a lessening in government transfers markedly for rural households due to a greater reduction in CPI. In considering the change in overall household income, unilateral trade liberalisation may also reduce income disparities in Pakistan in the long-run.

Figure 6.3 Projections of Change in Household Income under SAFTA: India



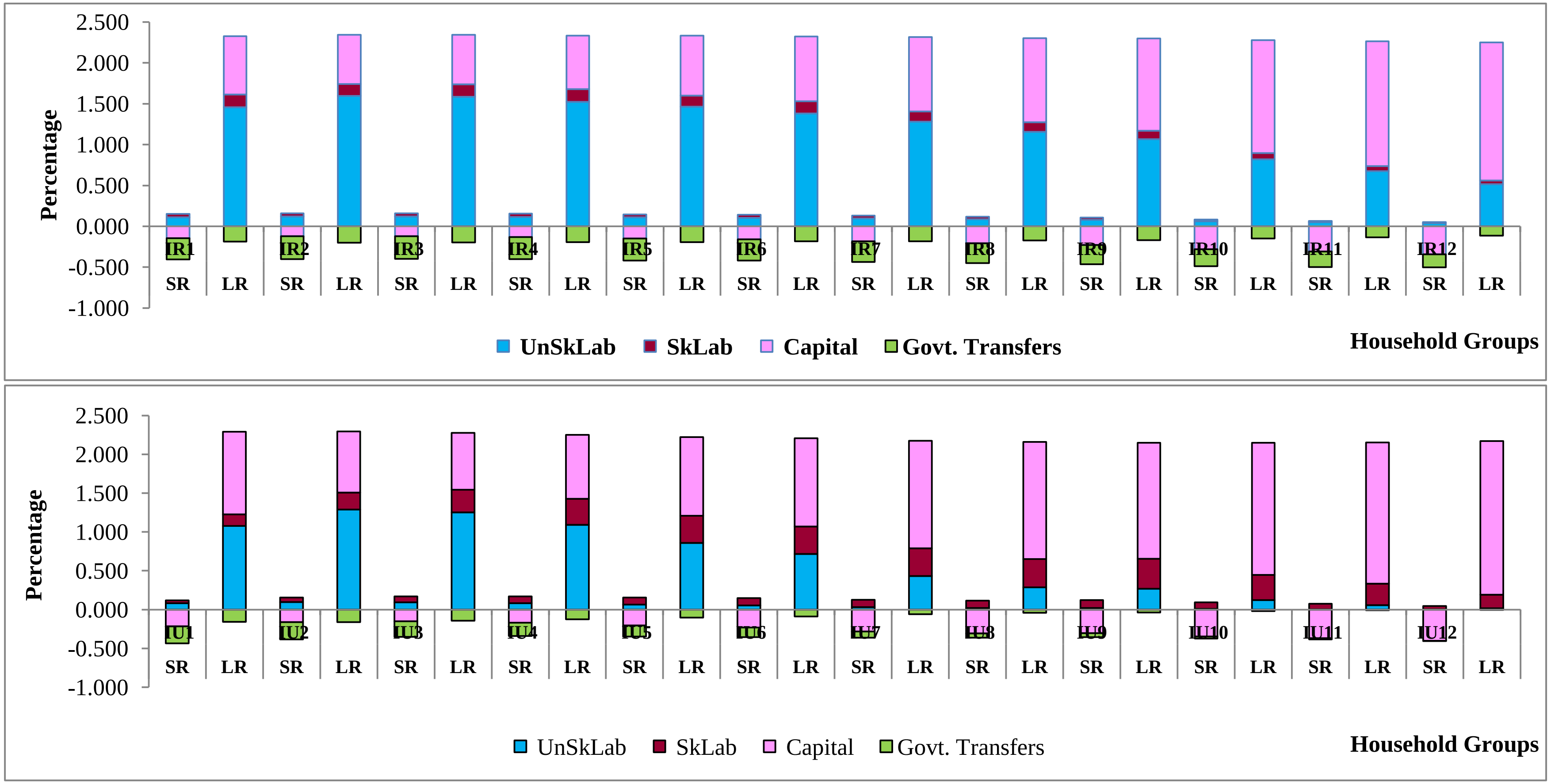
Source: Simulation results derived from SAMGEM Note: SR-Short-Run LR-Long-Run
IR1-IR12 - Rural Household Groups IU1-IU12- Urban Household Groups

Figure 6.4 Projections of Change in Household Income under Customs Union: India



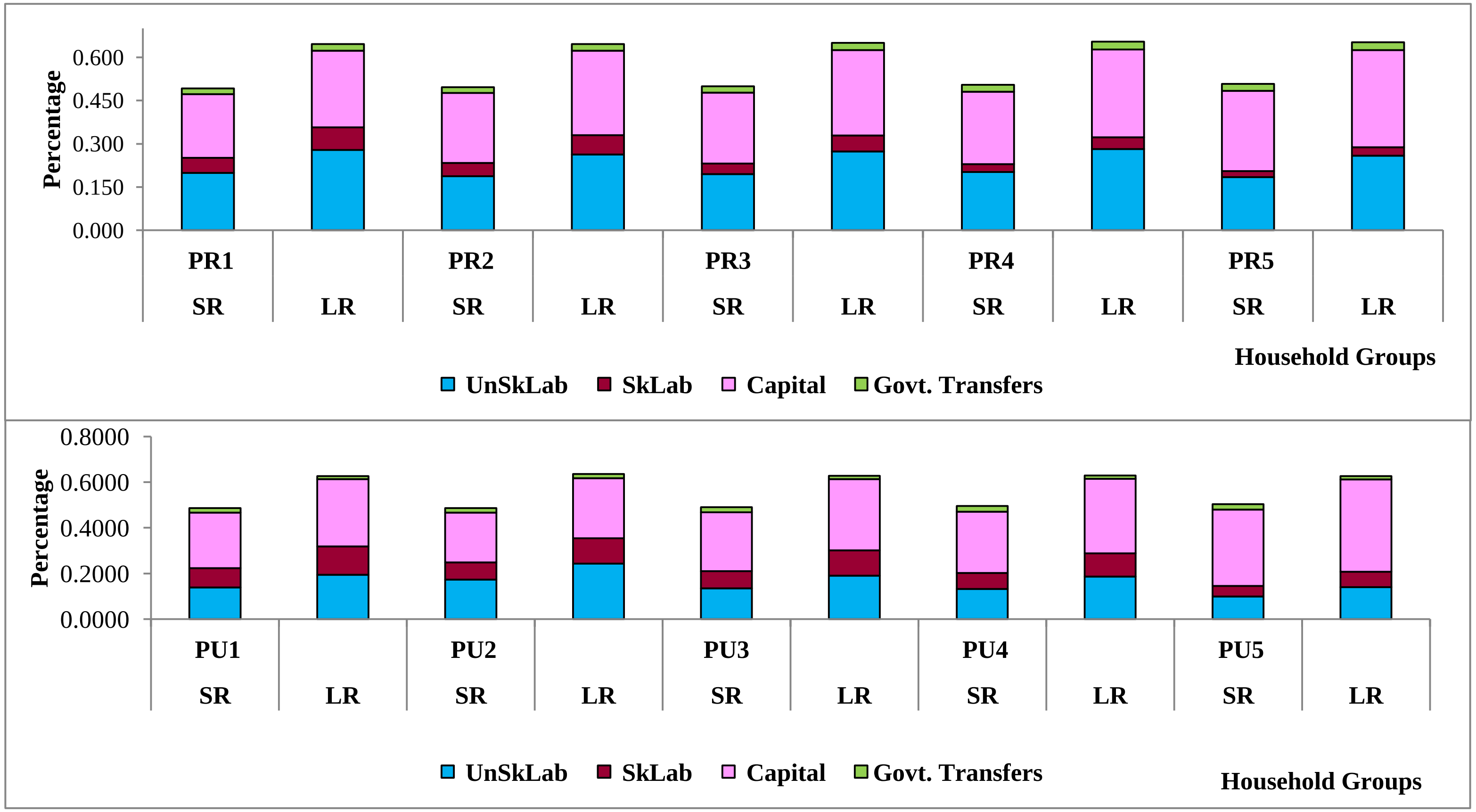
Source: Simulation results derived from SAMGEM Note: SR-Short-Run LR-Long-Run
IR1-IR12 - Rural Household Groups IU1-IU12- Urban Household Groups

Figure 6.5 Projections of Change in Household Income under Unilateral Trade Liberalisation: India



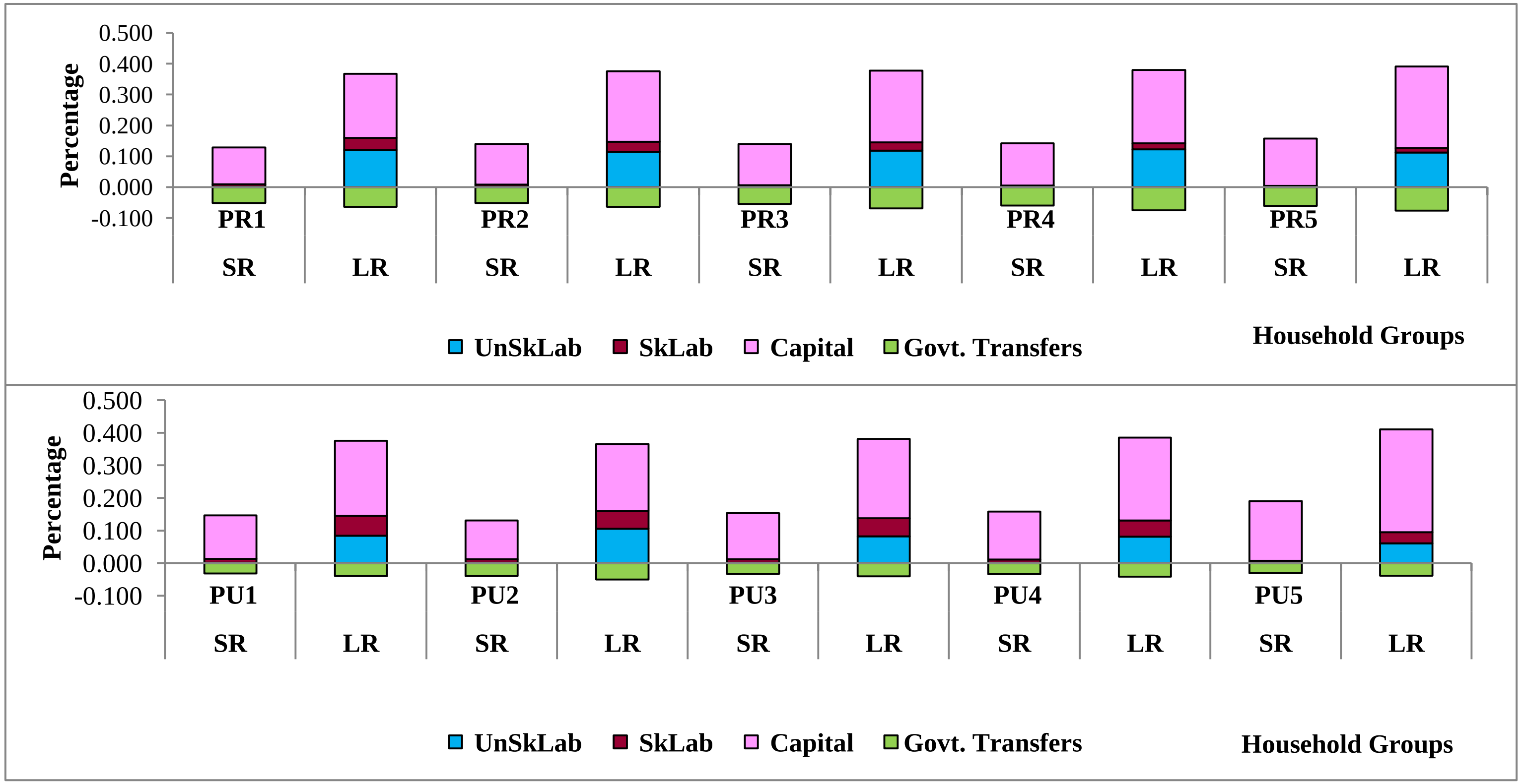
Source: Simulation results derived from SAMGEM Note: SR-Short-Run LR-Long-Run
IR1-IR12 - Rural Household Groups IU1-IU12- Urban Household Groups

Figure 6.6 Projections of Change in Household Income under SAFTA: Pakistan



Source: Simulation results derived from SAMGEM Note: SR-Short-Run LR-Long-Run
PR1-PR5- Rural Household Groups PU1-PU5-Urban Household Groups

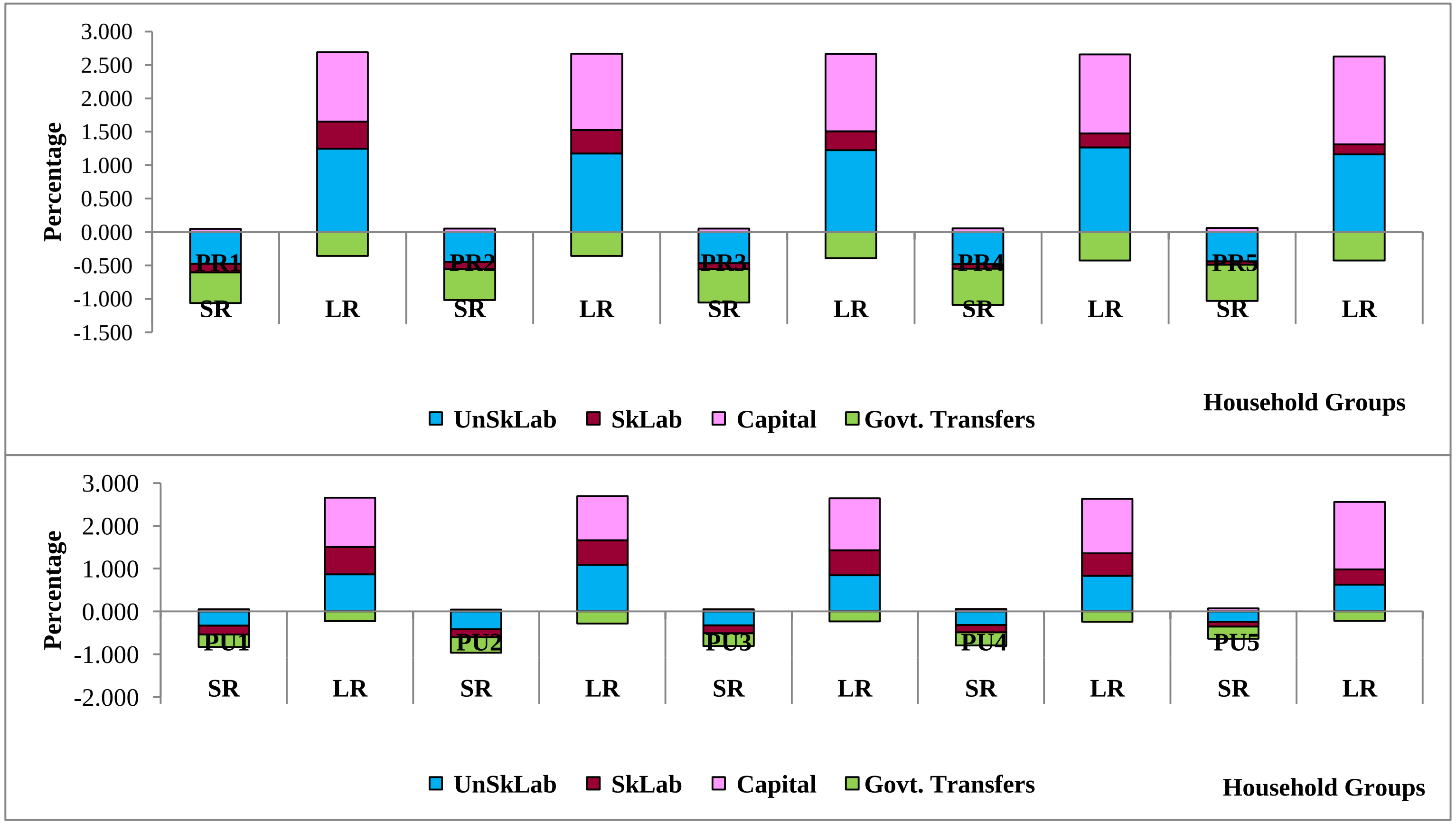
Figure 6.7 Projections of Change in Household Income under Customs Union: Pakistan



Source: Simulation results derived from SAMGEM Note: SR-Short-Run LR-Long-Run

PR1- PR5-Rural Household Groups PU1-PU5-Urban Household Groups

Figure 6.8 Projections of Change in Household Income under Unilateral Trade Liberalisation: Pakistan



Source: Simulation results derived from SAMGEM Note: SR-Short-Run LR-Long-Run PR1- PR5-Rural Household Groups PU1-PU5-Urban Household Groups

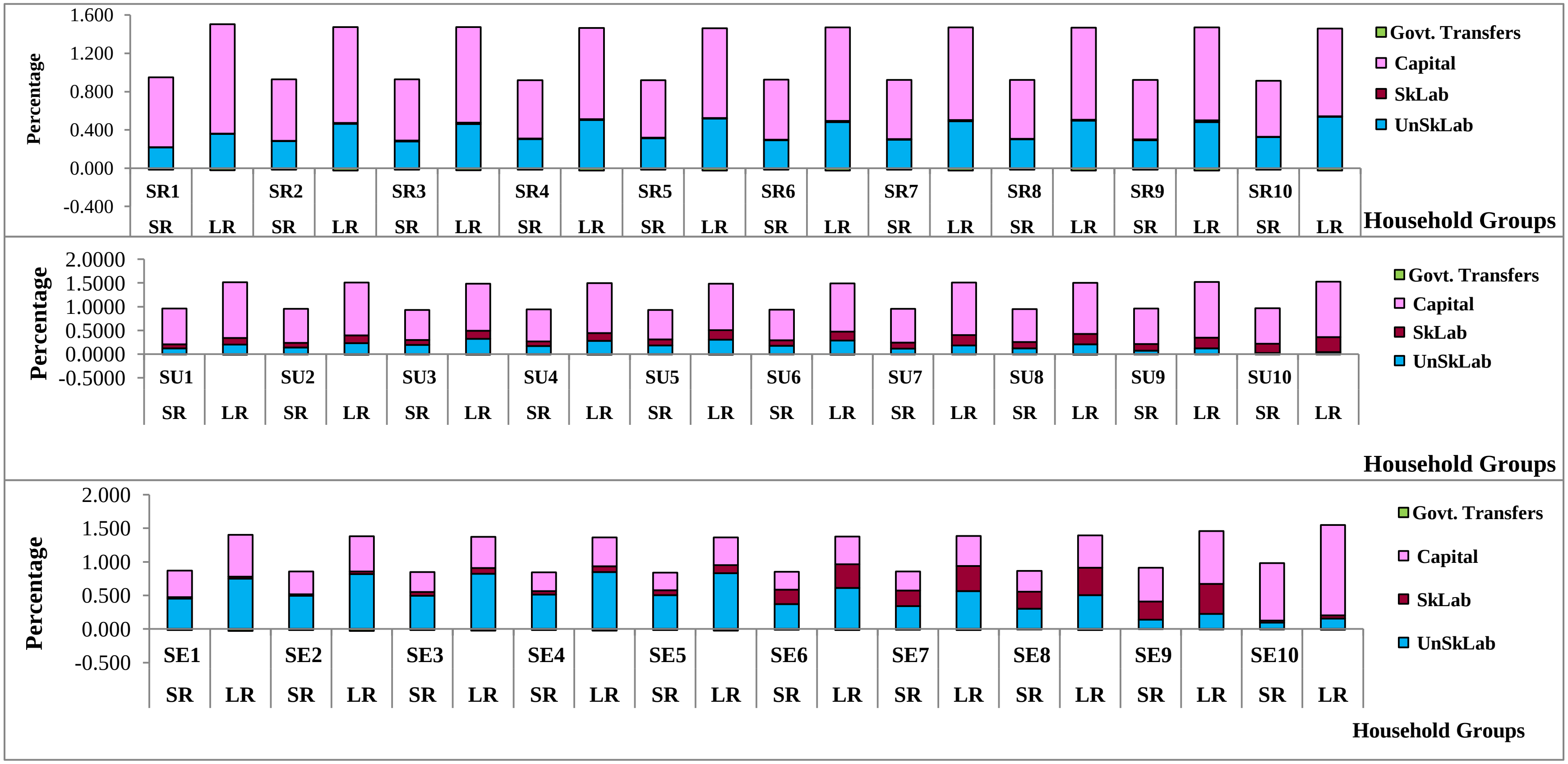
The percentage change in household income in Sri Lanka under different trade policy options are demonstrated in Figures 6.9 - 6.11. Under the short-run SAFTA trade policy, poorer households gain from increases in unskilled labour income while richer households gain more from capital and skilled labour, similar to India and Pakistan. In the short-run, CPI declines in Sri Lanka under the SAFTA as a result of having fairly low tariffs in the manufacturing sector (see Table D.3 in Appendix D). However, household income increases as the percentage increase in employment is higher than the reduction in nominal wages. The long-run gains are higher than short run gains as capital and labour can be combined more efficiently in the long run. As there is a marginal decline in CPI and price of savings, government transfers to all household groups fall slightly in line with changes in the CPI and price of savings.

Conversely, there is a negative impact on household income in Sri Lanka under the customs union both in the short run and long run. As mentioned before, Sri Lanka is a low-tariff country compared to other South Asian economies. Therefore, if Sri Lanka were to maintain a common external tariff of 13 per cent, it will mean increased protection, particularly in the manufacturing sector, which will cause negative impacts on GDP and employment. As in the case of India and Pakistan, under unilateral trade liberalisation, Sri Lanka's household income (especially that of unskilled labour) decreases in the short-run due to a substantial reduction in nominal wages (due to large reduction in CPI) in comparison with an increase in employment. However, in the long-run, households gain significantly due to an expansion in production in the manufacturing sector. Similar to India and Pakistan, government transfers to all household groups in Sri

Lanka also decreases under unilateral trade liberalisation. It is also noticeable that the reductions in government transfers are greater in the rural and estate sector poor households than in their urban counterparts, as they are the largest recipients of government transfers. Despite the decline in government transfers, the results suggest that under unilateral trade liberalisation, household income disparities may decrease in Sri Lanka in the the long-run.

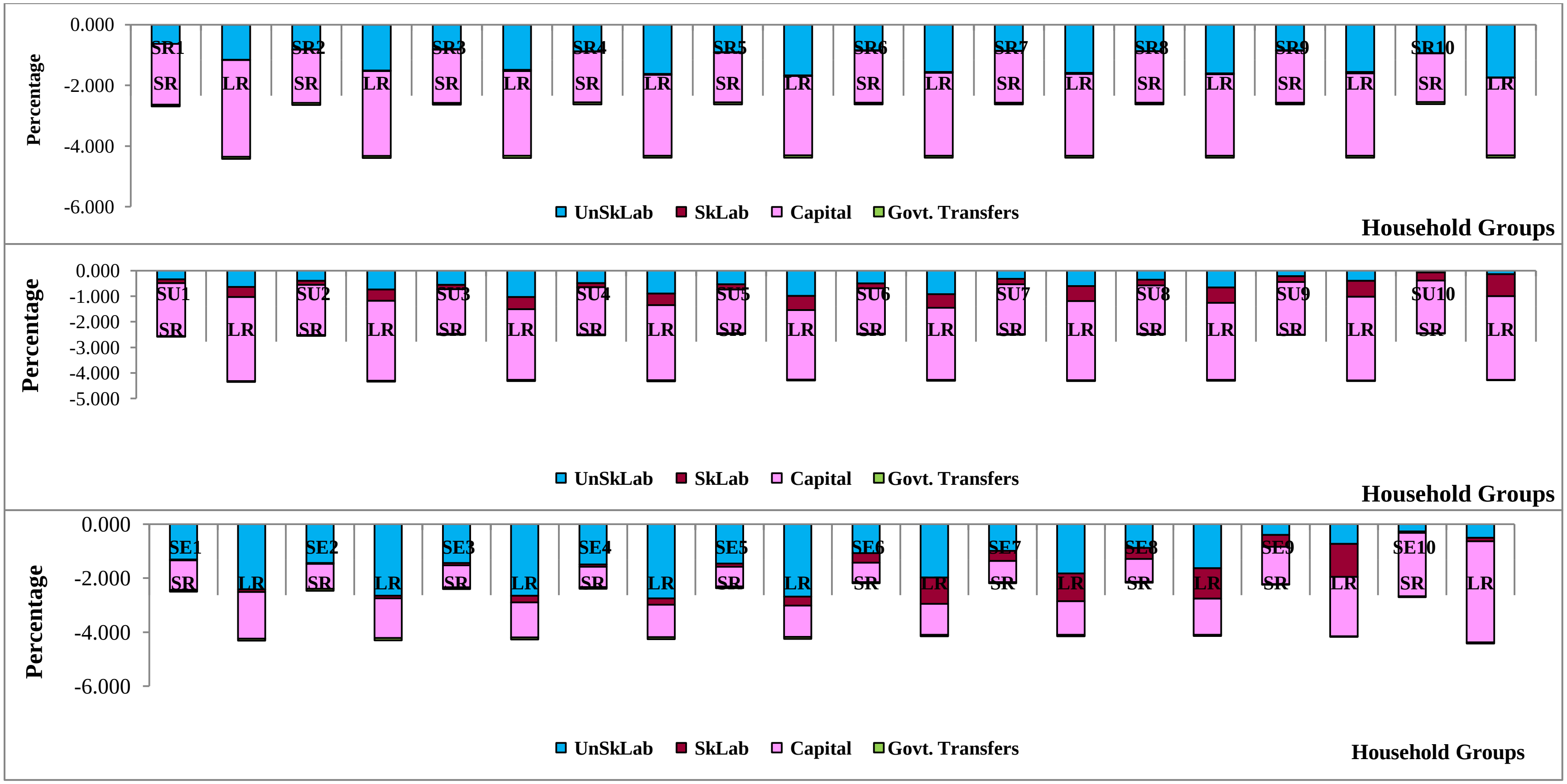
The percentage changes in household income in Bangladesh are illustrated in Figures 6.12 - 6.14. The unskilled labour in rural households benefits under the SAFTA in the short-run as in other countries. There is a marginal decrease in rental income on capital in the short-run. The results indicate that in the short-run, the reduction in CPI is higher than in the long-run under the SAFTA. This causes a greater decrease in the nominal wages to hold real wages fixed in the short-run. On the other hand, although real rental rate increase by 0.87 per cent (see Table 6.1) due to a fall in CPI, the nominal rental rate decreases marginally due to less expansion in capital-intensive industries in the short-run. As explained above, the government transfers to all household groups decline under this policy option, and greater reduction occurs in the case of rural households in comparison to the urban richer household groups. However, in the long-run household income from all sources will increase in Bangladesh under the SAFTA. Hence, the income gap would be minimised under the SAFTA in the long-run.

Figure 6.9 Projections on Change in Household Income under SAFTA: Sri Lanka



Source: Simulation results derived from SAMGEM Note: SR-Short-Run LR-Long-Run
SR1- SR10-Rural Household Groups SU1-SU10-Urban Household Groups SE1-SE10-Estate Sector Household Groups

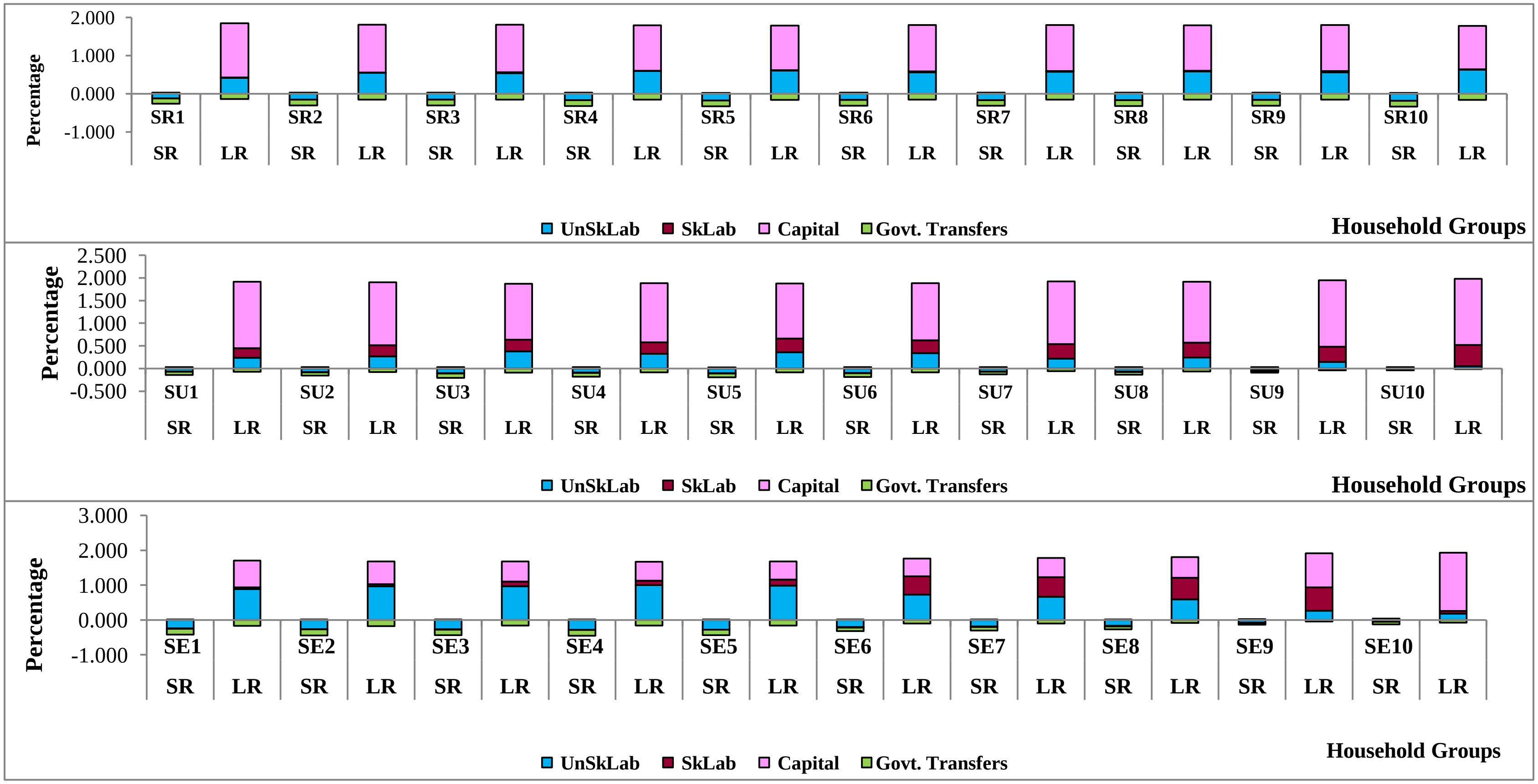
Figure 6.10 Projections on Change in Household Income under Customs Union: Sri Lanka



Source: Simulation results derived from SAMGEM Note: SR-Short-Run LR-Long-Run

SR1-SR10- Rural Household Groups SU1-SU10-Urban Household Groups SE1-SE10-Estate Sector Household Groups

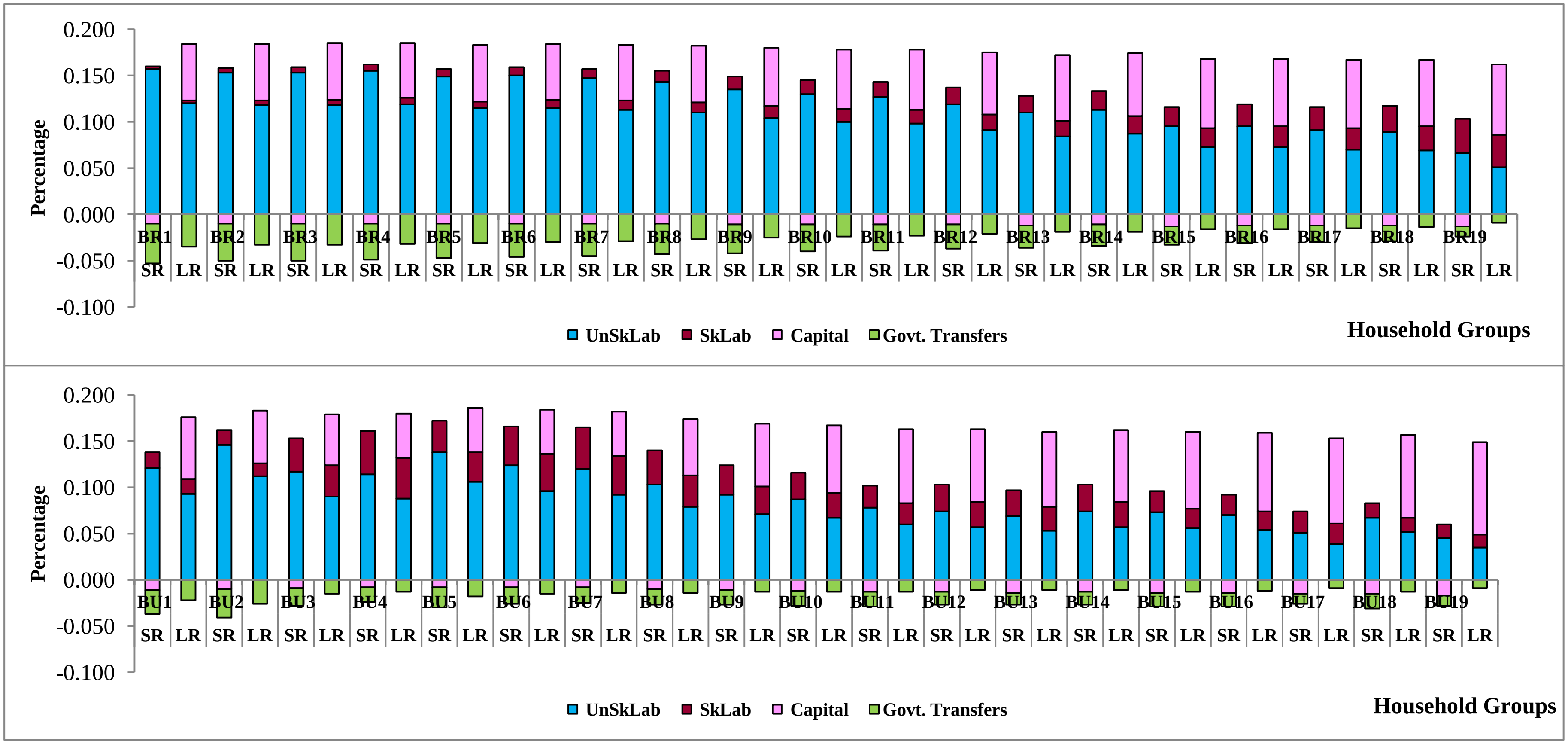
Figure 6.11 Projections on Change in Household Income under Unilateral Trade Liberalisation: Sri Lanka



Source: Simulation results derived from SAMGEM Note: SR-Short-Run LR-Long-Run

SR1-SR10- Rural Household Groups SU1-SU10-Urban Household Groups SE1-SE10-Estate Sector Household Groups

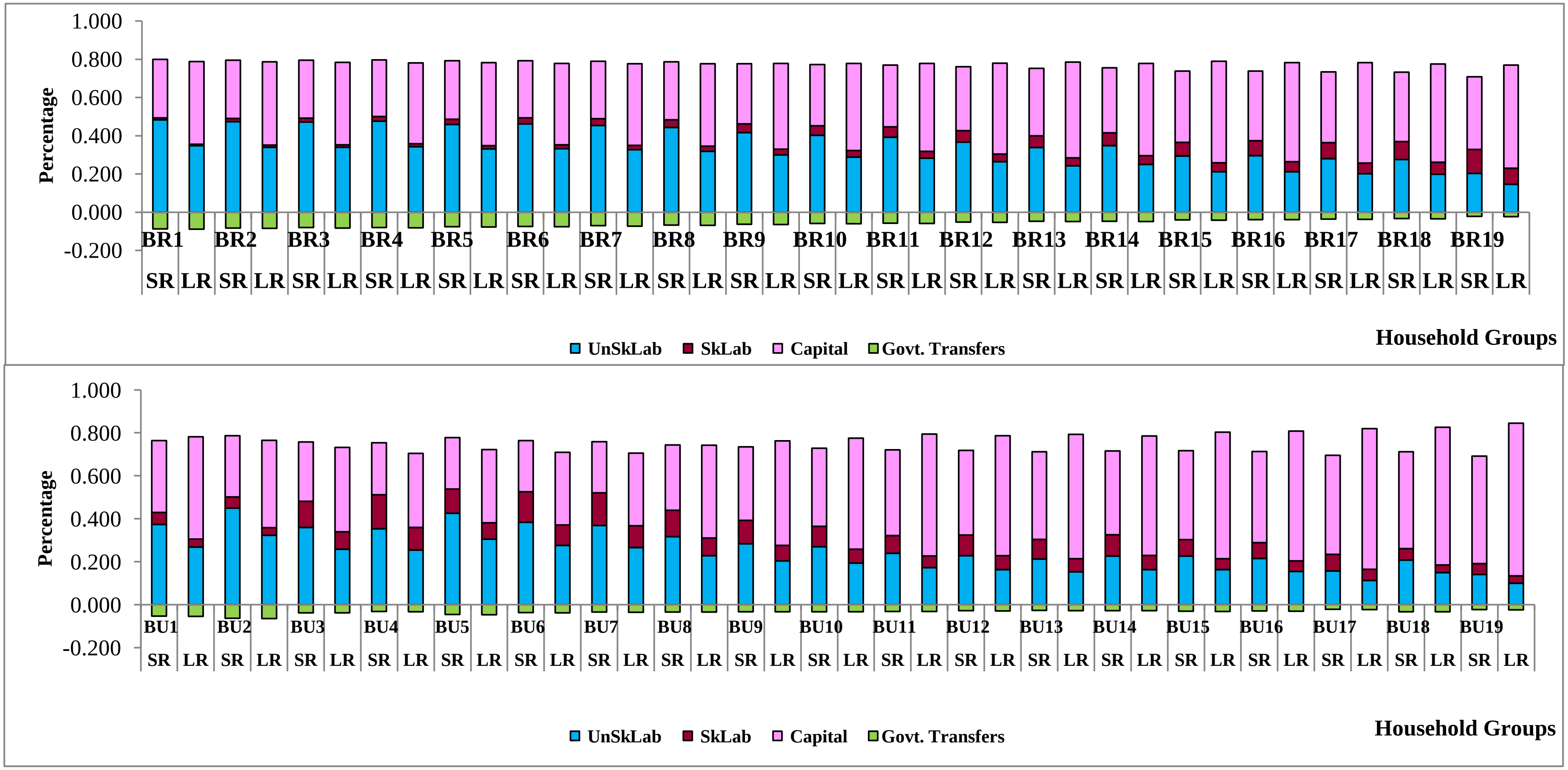
Figure 6.12 Projections on Change in Household Income under SAFTA: Bangladesh



Source: Simulation results derived from SAMGEM

Note: SR-Short-Run LR-Long-Run BR1- BR19-Rural Household Groups BU1-BU19-Urban Household Groups

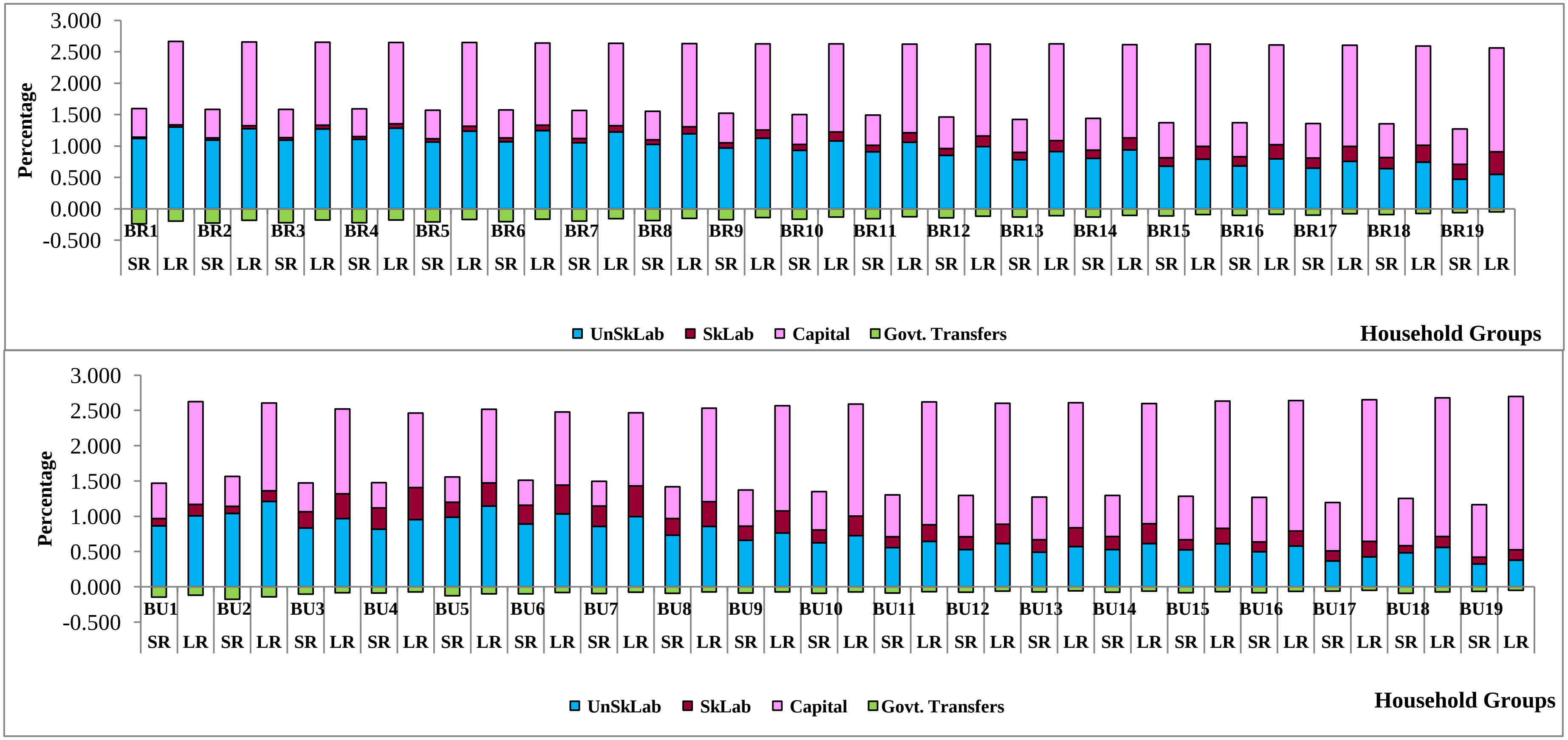
Figure 6.13 Projections on Change in Household Income under Customs Union: Bangladesh



Source: Simulation results derived from SAMGEM

Note: SR-Short-Run LR-Long-Run BR1- BR19-Rural Household Groups BU1-BU19-Urban Household Groups

Figure 6.14 Projections on Change in Household Income under Unilateral Trade Liberalisation: Bangladesh



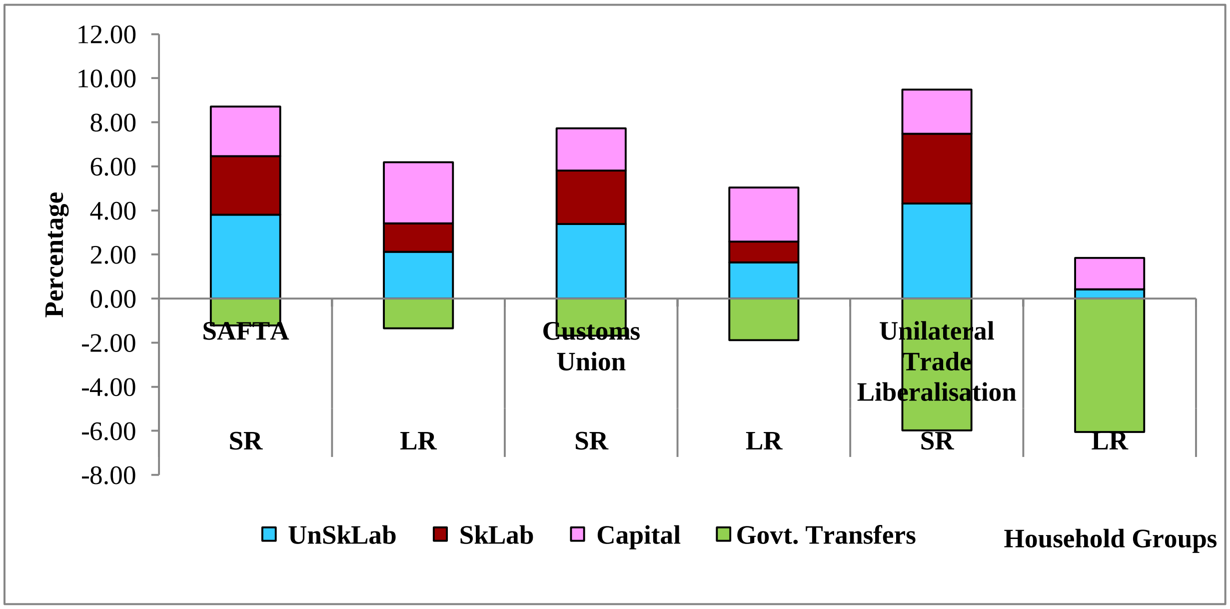
Source: Simulation results derived from SAMGEM

Note: SR-Short-Run LR-Long-Run BR1- BR19-Rural Household Groups BU1-BU19-Urban Household Groups

The short-run customs union scenario indicates that in Bangladesh household income from unskilled labour increases by a higher percentage than skilled labour and capital due to increase in demand for labour intensive manufacturing goods (e.g. from the textiles and wearing apparel sector). Although, Bangladeshi households stand to benefit under the long-run customs union scenario, the gains are not substantially higher compared to the short-run with a common external tariff of 13 per cent as it may need to compete with the low-cost labour intensive manufacturing goods in the world market that are sourced from countries such as China, India and other East Asian economies. In the case of unilateral trade liberalisation, household income will increase considerably in comparison to the other two policy options both in the short run and the long run. There is a reduction in government transfers under all three policy options due to a decrease in the CPI and price of savings. As there is a greater increase in household income under the unilateral trade liberalisation, such a policy may help to reduce income inequalities and poverty in Bangladesh.

The Rest of South Asia includes all small economies in the region. As noted before, these economies trade more with regional trading partners than with larger economies in the region. Figure 6.15 illustrates the percentage change in household income under all three policy options for the Rest of South Asia. It is noticeable that gains to households are higher in the short run than in the long run. This is because, percentage change in output and exports in labour intensive manufacturing industries marginally decline in the long-run as these economies also compete with larger economies in the region and with the rest of the world. Further, it is evident that there is a greater reduction in government transfers under the unilateral trade liberalisation in comparison to the other two trade policy options as a result of greater decline in CPI and price of savings. Hence, household gains are highest under the SAFTA followed by the customs union and the unilateral trade liberalisation.

Figure 6.15 Projections on Change in Household Income under Different Trade Policy Options: Rest of South Asia



Source: Simulation results derived from SAMGEM Note: SR-Short-Run LR-Long-Run

b) Impact on Household Consumption

As noted in Chapter 4, in SAMGEM, nominal household consumption depends on disposable income, which can directly affect changes in nominal household consumption. However, it is important to understand the impact of trade liberalisation on household real consumption, as it can affect the level of welfare of the economy. Real household consumption changes as a result of changes in nominal consumption and CPI. As previously argued, tariff cuts resulted in a large influx of imported goods into the domestic market, which make imported goods cheaper relative to domestically produced import-competing goods. Consequently, in general, trade liberalisation would result in a reduction in the CPI. Figure D.1 to D.5 in Appendix D depict the impact of the aforementioned trade policy options on the real consumption of India, Pakistan, Sri Lanka, Bangladesh and Rest of South Asia respectively.

In India the highest increase in real household consumption is observed under unilateral trade liberalisation followed by the customs union and SAFTA (see Figure D.1 in Appendix D). India heavily trades with the rest of the world rather than with regional trading partners and, therefore, under unilateral trade liberalisation, the CPI reduces substantially which would result in a larger increase in real household consumption. Poor households groups benefit more under unilateral trade liberalisation and the customs union. With the exception of the customs union, the long-run gains are higher than in the short-run. Further there is no larger change in real consumption under the long-run customs union in comparison to that of short run. This is because, even though the CPI reduces considerably, nominal household income does not increase as expected due to a common external tariff 13 per cent on all traded commodities in the long-run (see Figure 6.4 above).

Figure D.2 in Appendix D displays the percentage change in real income in Pakistan under all trade policy options. Similar to India, unilateral trade liberalisation records the highest percentage change in real consumption, followed by the customs union and SAFTA. The results suggest that under the SAFTA there is a marginal increase in real household consumption and this trend is similar to change in income. Furthermore, increase in real consumption is greater in the short-run in Pakistan than in the long-run.

Figure D.3 in Appendix D illustrates the impact of the different trade policy options on real household consumption in Sri Lanka. The results suggest that unilateral trade liberalisation ensures the highest increase in real consumption followed by the SAFTA both in short and long runs. It shows that there is a reduction in real household consumption irrespective of decline in CPI under the customs union. This is due to a decline in household income under this policy option (see Figure 6.10 above). Hence, Sri Lankan households are adversely affected under the short run and long run customs union scenarios due to a common external tariff of 13 per cent.

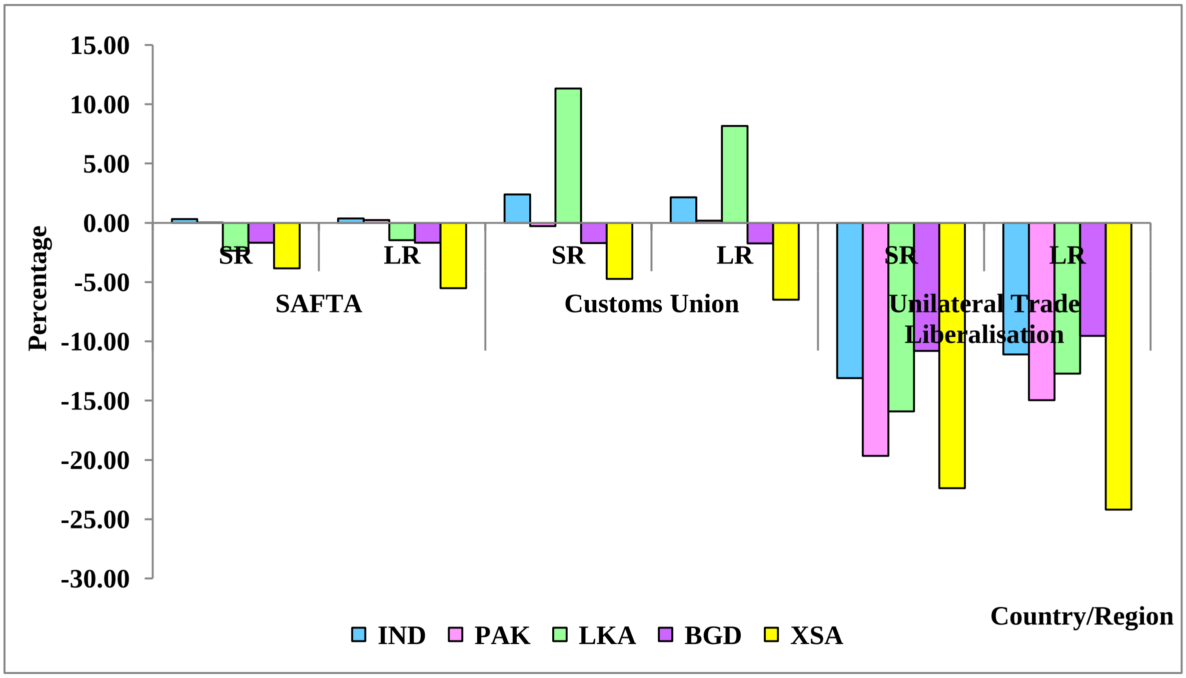
Figure D.4 and Figure D.5 in Appendix D show the percentage change in real household consumption in Bangladesh and the Rest of South Asia respectively, under different trade policy scenarios discussed above. The results indicate that under the SAFTA scenario, Bangladeshi poor household groups in the rural sector benefit more in the long-run compared to short run due to the associated change in CPI in that household group. Conversely, there is a greater increase in real consumption in urban sector households in the short-run compared to the long run as a result of greater reduction in CPI (see Table 6.3). On the other hand, under the customs union, lower income households in both rural and urban sectors benefit more than richer household groups in the short run and long run. This is because under the customs union, if Bangladesh maintains a common external tariff of 13 per cent on all traded commodities against the rest of the world, it might lead to increase in imports of agricultural goods to Bangladesh because higher initial tariffs prevail in this sector. It is expected that Bangladeshi households will gain substantially under the unilateral trade liberalisation. Therefore, unilateral trade liberalisation may help to reduce poverty in Bangladesh.

Figure D.5 in the Appendix D illustrateds that the households in Rest of South Asia gain more under all trade policy options than the larger economies in the region. Also, unilateral trade liberalisation brings the highest gain to these economies like other countries in the region. On the other hand, these countries enjoy more or less similar benefits under the SAFTA and the customs union as they trade heavily with the regional trading partners (see Table 6.10 and Table 6.11).

6.4.4 Impact on Government Revenue

Trade taxes form a significant part of government revenue in most developing countries. There is a general concern that trade reforms may lead to lower government revenue when trade taxes are reduced. Therefore, in an effort to maintain macroeconomic stability, governments may cut social welfare expenditures or introduce new taxes that could disproportionately affect the poor (Bannister and Thugge, 2001). The percentage changes in total government revenues in the South Asian economies under different trade policy options are represented in Figure 6.16.

Figure 6.16 Percentage Change in Government Revenue



Source: Simulation results derived from SAMGEM Note: SR-Short-run affects
LR- Long-run effects

In addition, the change in tax revenue from different sources is portrayed in Table D.11 in Appendix D. The results under SAFTA suggest that, the elimination of tariffs would result in reductions in government revenue in many South Asian economies, with the exception of India and Pakistan, where there is a marginal increase in tariff revenue due to trade liberalisation in the short run and the long run. This is because India does not import greatly from her regional trading partners. Revenue from import taxes is positive in India, whereas in Pakistan, although revenue from import tariff is negative, there is an increase in direct taxes and hence there is a marginal increase in total tax revenue (see Table D.11 in Appendix D).

Under the customs union option, government revenue is expected to increase in India and Sri Lanka (a marked increase of 11.3 per cent in the short-run and 8.17 per cent in the long-run in Sri Lanka). Total government revenue may also increase marginally in Pakistan in the long-run. For India, total tariff revenue increases as a result of increases in the volume of imports while India is maintaining 13 per cent common external tariff on all traded goods. For Sri Lanka, although enforcing a common external tariff to 13 per cent on all traded goods would result in a reduction of volume of imports, it raises the import tariff revenue due to an increase in prices of such imported commodities. As in the case of SAFTA, Pakistan's increase in direct taxes is greater than the reduction in indirect taxes and consequently total tax revenue is expected to increase in the long-run. In contrast, government revenue is expected to decline in Bangladesh and Rest of South Asia. This is mainly due to the high average tariffs in these countries prior to trade liberalisation (see Table D.3 and D.4 in Appendix D). Hence, maintaining a common external tariff (13 percent) on all traded goods would result in a decrease in government revenue in these countries.

In the case of unilateral trade liberalisation, government revenues will decrease substantially in all South Asian economies due to non-discriminatory tariff reductions both in the short run and long run. Figure 6.16 shows that the largest drop in percentage change in government revenue is recorded in Rest of South Asia followed by Pakistan, Sri Lanka, India and Bangladesh. This is because the smaller economies, such as Bhutan and Maldives, largely import from the other countries[26]. Hence, unilateral trade

---

[26] This is because in these economies trade dependency ratio is considerably higher in comparison with the other South Asian economies (see Table 2.1 in Chapter 2).

liberalisation is expected to reduce tariff revenue largely in smaller economies in the region.

6.4.5 Impact on Welfare

Equivalent Variation (EV) is used to determine the overall level of welfare under each policy option. EV is an absolute monetary measure of welfare improvement in terms of income that results from the fall in import prices when tariffs are reduced or eliminated (Huff and Hertel, 2000).

Table 6.14 illustrates the overall level of welfare as an absolute value (in terms of US$) and as a percentage of total regional income (household income and government revenue). Although India gains significantly under all three trade liberalisation scenarios in absolute terms, it is clear that smaller economies (Bangladesh and Rest of South Asia) benefit more than the larger economies in the region under the same trade policy option in relative terms. Moreover, all South Asian countries gain substantially under the unilateral trade liberalisation, followed by the customs union (with the exception of Sri Lanka) and SAFTA both in the short run and long run.

It is also clear that Bangladesh and Rest of South Asia gain less in the long-run compared to the short-run under all three policy options. This is consistent with the percentage change in real GDP in these countries as noted in Table 6.1 in Section 6.4.1.

A number of empirical and quantitative studies have generated debate over the desirability of SAFTA, with differing viewpoints. Similar to the discussion in Section 6.4

the present study holds a moderate view of the SAFTA and is in agreement with the findings of Srinivansan and Canonero (1993) and Srinivansan (1998). The findings reveal that SAFTA still ensures considerable benefits for small countries in the region, even though there are less potential gains from SAFTA than of unilateral trade liberalisation. The results of the present study are also consistent with the studies undertaken by UNCTAD and ADB (2008) and RIS (2005) as these studies suggest that SAFTA would create some welfare gains for its member countries and smaller economies would gain more from the PTA than the larger economies in the region.

Hence, it can be recommended that implementation of the SAFTA as the preferred channel of promoting regional economic integration in South Asia. As Pitigala (2005) noted, it can be suggested to continue the process of unilateral trade liberalisation in parallel with regional integration in South Asia. This process may help South Asian countries to diversify their narrow export bases and potentially evolve with new comparative advantages and complementarities which could facilitate the successful implementation of the SAFTA.

Table 6.14 Projected Equivalent Variation under Different Trade Policy Options

Country/ Region	SAFTA				Customs Union				Unilateral Trade Liberalisation			
	SR		LR		SR		LR		SR		LR	
	US$ Million	As a % of Total Regional Income	US$ Million	As a % of Total Regional Income	US$ Million	As a % of Total Regional Income	US$ Million	As a % of Total Regional Income	US$ Million	As a % of Total Regional Income	US$ Million	As a % of Total Regional Income
IND	1146.58	0.18	1344.94	0.21	6217.29	0.97	5661.53	0.88	14488.29	2.47	18675.71	2.91
PAK	226.94	0.24	302.79	0.32	482.87	0.51	717.90	0.76	1248.95	1.44	2856.99	3.02
LKA	152.44	0.76	247.89	1.23	126.58	0.63	-141.24	-0.70	199.67	1.12	472.44	2.35
BGD	344.99	0.62	241.72	0.43	1084.18	1.94	975.87	1.75	2144.32	4.22	1970.68	3.52
XSA	386.16	2.78	261.35	1.88	388.88	2.80	267.71	1.93	621.93	4.88	474.18	3.41
USA	-95.66	0.00	-25.37	0.00	497.89	0.00	278.50	0.00	3772.45	0.04	1243.70	0.01
CAN	-5.87	0.00	-3.29	0.00	49.92	0.01	13.73	0.00	323.31	0.04	156.71	0.02
EU	-175.06	0.00	-43.71	0.00	979.63	0.01	958.23	0.01	4329.76	0.04	2843.85	0.02
ASE	-80.31	-0.01	-39.18	0.00	679.25	0.09	467.28	0.06	1482.52	0.22	1691.56	0.22
HIA	-74.30	-0.01	-36.70	0.00	5.10	0.00	16.69	0.00	337.51	0.03	669.61	0.06
JPN	-111.38	0.00	-28.49	0.00	175.04	0.00	157.63	0.00	1083.79	0.03	724.62	0.02
CHN	-108.98	-0.01	-60.86	0.00	95.70	0.01	63.97	0.00	219.81	0.01	484.82	0.03
XME	-75.72	-0.01	-33.67	0.00	-73.22	-0.01	-365.57	-0.04	1921.02	0.25	4091.31	0.48
AUS_NZL	-29.77	0.00	-11.21	0.00	-3.97	0.00	136.48	0.02	539.76	0.08	512.58	0.07
RUS_XSU	-7.19	0.00	-6.52	0.00	-14.59	0.00	59.35	0.01	237.85	0.04	241.76	0.04
ROW	-128.95	0.00	-21.14	0.00	6.11	0.00	-248.08	-0.01	1662.94	0.04	2085.14	0.05

Source: Simulation results derived from SAMGEM

Note: SR-Short-run effects LR- Long-run effects

6.5 Sensitivity Analysis

As discussed in Section 5.6.2 in Chapter 5, most of the elasticity values required to calibrate SEMGEM were obtained from the GTAP version 7 database. In the standard GTAP model, Armington elasticities are based on econometric estimates by Hertel et at. (2007), which were dependent on imports from the world into seven countries[27] and the pooled estimates of these elasticities for each product category are assumed to apply to all countries in the world. However, many practitioners (Lloyd and Zhang 2006, Valenzuela et al. 2008 and Pearson and Arndt, 1998) argue that the model results often hinge crucially on the values of the Armington elasticities employed in the model.

Hence, it is important to determine how variations in the values of these parameter values affect the model results. A SSA is undertaken to check the robustness of simulation results under different elasticity values. This section is intended to determine how sensitive the results of simulations 1 and 3 are with respect to changes in the values of certain elasticities used to calibrate the model. The analysis is confined to Armington elasticities between domestic and imported goods (ESUBD(i)), Armington elasticity of substitution among imports from different destinations (ESUBM(i)) and the elasticity of substitution between primary factor inputs (ESUBVA(j)). These elasticities were allowed to vary by 50 per cent from the original base values based on a triangular distribution, and were carried out in simulations using *Stroud's quadrature* (Stroud, 1957) (Stroud,

[27] United States, New Zealand, and five South American countries

1957). The short-run and the long-run SSA results for some important variables of the two policy scenarios are reported in Tables D.12 to Table D.13 in Appendix D.

The SSA mean values of the variables listed do not significantly deviate from the original simulation results. In addition, by observing the values of the standard deviations reported in the SSA results, it is noted that deviations from the mean are lower for many of the variables listed in Table D.12 to Table D.13 in Appendix D for simulation 1 and 3. However, the results for smaller economies (Bangladesh and Rest of South Asia) are somewhat sensitive to changes in Armington elasticities. This is because these economies in South Asia are protected from import competition to a large extent (especially agricultural commodities) and trade liberalisation leads to increase in imports into these countries, and more so in the case where the Armington elasticities have been increased.

Furthermore, according to Chebyshev's inequality[28], it can be considered with a 75 percent confidence that the actual values of most of the variables listed in the above-mentioned tables would fall within two standard deviations plus or minus the mean. Therefore, we can specify confidence intervals for each of the endogenous variables in the model by taking the mean values and the standard deviations estimated in the SSA. Moreover, a relatively low standard deviation values reported suggest that the confidence

[28] A well-known theorem provided by the Russian mathematician Chebyshev states that, no matter what the shape of the population distribution (e.g. bell, skewed, binomial etc.), at least 75 per cent of the population values lies within "plus or minus" two standard deviations (σ) of the mean (μ) This means that the population value of a randomly selected individual variable lies between the lower bound μ-2σ and the upper bound of μ+2σ has the probability $\geq$ 75 per cent. According to Chebychev's inequality at 95% confidence level, the upper limit and the lower limit are calculated with the formula, $\mu \pm (4.47^* \sigma)$ (Saw J.G. et al., 1984) .

intervals are rather narrow for most of the important macroeconomic variables. Hence, the results of the policy experiments discussed in the above sections are generally robust with respect to Armington elasticities and elasticity of substitution between primary factor inputs.

6.6 Concluding Remarks

The present chapter has examined the impact of trade liberalisation in South Asia on broader macroeconomic variables, sectoral level variables, trade, household level variables, government revenue and welfare of the South Asian economies using the SAMGEM. The impacts of three trade policy options were simulated: SAFTA zero tariff agreement, South Asian customs union and unilateral trade liberalisation.

In general, there is a positive impact on economic growth (with the exception of Sri Lanka under the customs union) in all South Asian countries. Also smaller economies gain more than larger economies in the region under all three policy options. Furthermore, the trade reforms have a favourable impact on household income distribution and real consumption (again with the exception in Sri Lanka under the customs union). The findings reveal that the poorer households gain from increases in unskilled labour income while richer households gain more from capital and skilled labour, and these gains are higher in the long-run as a result of better utilisation of capital. Therefore, as the literature suggests (Davis, 1996) trade liberalisation in South Asia may reduce poverty in the region.

The sectoral results indicate that the tariff reforms would lead to a greater increase in imports and exports of agricultural products among the regional trading partners than non-agricultural goods under all three trade policy options. Hence, the member countries should work towards elimination of tariff and non-tariff barriers that prevail in the agricultural sector to boost the intra-regional trade among regional trading partners. The projections on bilateral trade among regional trading partners under all three policy options indicate that intra-regional trade is rather low and the SAFTA will not greatly increase the intra-regional trade. A study undertaken by the Economic Commission for Africa (2012) indicates that an African FTA would raise the current intra-African trade from 11 per cent to 15 per cent of Africa's total trade. However, if trade facilitation was enhanced, the intra-African trade would double to 22 per cent by 2022. This is a good example which South Asian economies can learn from to remove non-tariff barriers, enhance trade facilitation and liberalise barriers in services trade to boost the intra-SAARC trade. The results of the present study indicated that South Asian countries will continue to trade heavily with countries outside the region (e.g. USA and EU). Hence, it is clear that South Asia can benefit from a twin track approach: better integration within itself and better integration with the rest of the world. The outcome of the present analysis also revealved that the unilateral trade liberalisation in South Asia would yield more economic benefits to these economies as it unequivocally reduces protection on a MFN basis.

The fiscal revenues of South Asian governments will decline markedly under unilateral trade liberalisation compared with the SAFTA and customs union options. On the contrary, under the customs union, government revenue in India and Sri Lanka is expected to increase in the short run and long run with a common external tariff of 13 per cent. Additionally, in Pakistan, fiscal revenue will increase in the long-run under the customs union. The 13 per cent common external tariff rate is likely to increase the protection as the region is trading substantially with countries outside the SAFTA members. Furthermore, the fiscal revenues of the South Asian governments will decline with tariff elimination under the SAFTA, except in India and Pakistan because these two economies trade less with each other.

The welfare analysis indicates that smaller economies in the region will benefit more than the larger economies under all three policy options because these economies maintain higher initial tariffs, particularly in the agricultural sector. Hence, trade liberalisation would bring substantial efficiency gains to these economies as indicated by higher percentage change in GDP. The welfare gains projected by the equivalent variation indicate that South Asian economies might gain much more from the unilateral trade liberalisation than under the SAFTA and customs union. Hence, SAFTA could be an important vehicle for economic integration in South Asia and it can be a path towards moving into a deeper integration and also promoting unilateral trade liberalisation in the region. Also, because of human resources and aspirations for a global role, India will be required taking on a larger responsibility for promoting regional economic integration in South Asia (Kumar and Singh, 2009). However, regional economic integration will not be achieved by India’s unilateral actions alone and hence, the neighboring governments need to support and join with India to achieve successful regional integration in South Asia. This is also important to raise household income and reduce poverty in the region.

The overall results of the SSA revealed the relatively low values of standard deviation for most of the endogenous variables. This indicates that the model produces a rather robust set of results with respect to trade policy shocks. Chapter 8 considers the impact of the different trade policy options on household income distribution and poverty in the Sri Lankan economy.

CHAPTER 7 THE IMPACT OF TRADE LIBERALISATION ON POVERTY AND INCOME INEQUALITY IN SRI LANKA

7.1 Introduction

The Chapter examines the poverty and income distribution impacts of trade liberalisation in South Asia on the Sri Lankan economy[29]. As noted in Chapter 3, trade liberalisation affects income distribution and poverty in a country through two main transmission channels: changes in the relative prices of factors of production (labor and capital) and commodities. These changes will lead to some households gaining while others will lose. The link between trade liberalisation and poverty and inequality is important for two reasons: firstly, social scientists, economists and society in general all are concerned about equity as inequality can lead to social and political tensions and eventually the reversal of trade policy reforms, secondly, increases in poverty and inequality might cause lower economic growth (Aghion et al., 1999, Azaridis et at., 2005). Hence, it is important to understand the extent to which the trade reforms can affect poverty and inequality in households.

[29] The analysis of the poverty and income inequality impacts on trade liberalisation in South Asia on the Sri Lankan economy outlined in this Chapter was presented at the 53rd Annual Conference of the New Zealand Association of Economists (Palmerston North, June 2012). The comments and the feedback received from my discussant, Associate Professor Debabrata Datta and the conference participants are gratefully acknowledged.

As discussed in Chapter 3, approaches to undertake poverty analysis in a CGE framework can be aggregated into two major categories: Micro-simulation (MS) and Representative Household (RH) approaches. The RH approach is the traditional and the most frequently used method in a CGE framework which enables the performance of an inter-group distribution analysis in combination with an endogenous poverty line (Decaluwé et al., 1999). On the otherhand, the micro-simulation approach consists of large number of households in a CGE model and thereby takes intra-group variance into consideration when performing poverty and income distribution analysis (Savard, 2004a). In this study, the RH approach is used because the analysis is focused on the household income and expenditure structure and not on behavioural heterogeneity. The RH approach assumes that, following an external shock to the economy, the intra-group distributions shift proportionally with the change in mean income. This means that the variance of each distribution is considered fixed and exogenous to the model (Savard, 2004a).

Since the late 1970s and at the beginning of the 1990s several authors (e.g: Adelman and Robinson (1977) and Dervis, de Melo and Robinson (1982) studying Korea; and Bevan et al., (1987) studying Kenya) used CGE models to study the impact of economic reforms on the distribution of income and poverty. In order to model income distribution and poverty impacts of trade reforms, different functional forms have been used by different modellers. For instance, de Janvry et al. (1991) employed the Pareto distribution to characterise the income distribution of different sub-groups of the population of Ecuador, Chia et al. (1994) applied the lognormal distribution for groups in Ivory Coast and Decaluwé et al. (1999) used the beta distribution for their African archetype economy. This approach is known as the ‘parametric method’, where it is assumed that income distribution follows a specific functional form with unknown parameters (Boccanfuso et al., 2003).

In the present study, non-parametric or the Kernel method (Cockburn, 2001 and Savard, 2004) is used to estimate the income distribution of different household groups in Sri Lanka. In order to undertake poverty and income distribution analysis, micro household data of the Consumer Finances and Socio-Economic Survey (CFS) conducted by the Central Bank of Sri Lanka for the year 2003/2004 is used. This survey covered a sample of 11,722 households representative of the household density across provinces and sectors (urban, rural and estate) in the entire country. The choice is made to confine the poverty and income distribution analysis only to Sri Lanka for two reasons: firstly, Sri Lanka is the pioneer in adopting more market friendly policies in their economic management, and, secondly, it is not viable to obtain micro household survey data for all South Asian countries given the very high cost of acquiring such data.

The study uses FGT indices (Cockburn, 2005) for poverty measurements with an endogenous poverty line and for each household group, while the S-Gini index and Lorenz curves will be applied for income distribution analysis for pre and post simulation periods. In addition, the Kernel density estimation method will be employed in specifying the probability density (PDF) function. For poverty and income distribution analysis, the study compares pre and post simulation scenarios of SAFTA and unilateral trade liberalisation in South Asia. The SAMGEM outlined in previous chapters follows the Extended Representative Agent approach (ERA), which has the ability to generate percentage change in CPI for each household group (see Table E.1 in Appendix E) under the aforesaid two trade policy options. The simulation results obtained for these two policy options are used as these two policy options depicted the more favourable impacts for Sri Lankan households.

The chapter is organised as follows: Section 7.2 contains a brief discussion of the nonparametric technique used to estimate poverty levels; Section 7.3 briefly explains the concepts and measurements involved in poverty and income inequality; the details of the data and poverty indicators in Sri Lanka used in the study are given in Section 7.4; the results of the analysis are discussed in Section 7.5; and Section 7.6 contains a summary of the conclusions.

7.2 The Non-parametric or Kernel Method of Income Distribution

As the data on individual income and per capita household consumption levels for Sri Lankan households are available, one can estimate income distribution by specifying a parametric functional form such as a lognormal or beta distribution. A disadvantage of the parametric method is the need to assume that actual income density needs to be lognormal or other such functions (e.g. beta distribution), which may not always be true (Dhongde, 2004). For instance, Minhas et al. (1987) applied lognormal distribution to analyse income distribution in India. However, Kakwani and Subbarao (1990) noted that this lognormal distribution tends to overcorrect the positive skewness of income distribution and, thus, fit poorly to the actual data. Hence, the non-parametric approach, instead, estimates distribution directly from the given data, without assuming any particular form. Boccanfuso and Savard (2001) also noted that the parametric approach is particularly useful when the primary household or individual level data are unavailable. The present study employs the non-parametric method or Kernel method as the individual household data are available and, therefore, this data can be used directly for poverty and income distribution analysis without assuming any particular functional form for the true distribution.

The Kernel method is the most mathematically studied and commonly used non-parametric density estimation method. The Kernel function *(K)* is generally a unimodal, symmetric, bounded density function (Boccanfuso and Savard, 2001). The Rosenblatt-Parzen Kernel method of nonparametric probability density estimation $\hat{f}(x)$ is given by (Rosenblatt, 1956; Parzen, 1962).

$$\hat{f}(x) = \frac{1}{N}\sum_{i=1}^{N}\frac{1}{h}K\left(\frac{x - x_i}{h}\right)$$

In the Kernel density function, *h* is the smoothing parameter and *N* is the sample size. When using this estimator, each observation will provide a 'bump' to the density estimation of $\hat{f}(x)$, consequently the shape and the width of the density function depends on the shape of *K* and the size of *h* respectively. Once all these 'bumps' are summed, the distribution of all data points will be obtained. In this case *K* and *h* affect the accuracy of the density function, essentially the smoothing parameter *(h)*, which means, the smaller the value of *h,* the less smooth will be the density estimates, whereas the larger the value of *h,* the estimated density function will be too smooth. The poverty head count ratio is obtained by summing all the estimated densities until the poverty line income is reached. In performing non-parametric method or Kernel estimation, DAD software will be used. DAD[30] which stands for 'Distributive Analysis/Analyse Distributive' is specially designed to facilitate the analysis and the comparisons of social welfare, inequality and poverty using micro data.

7.3 Poverty and Inequality Measures

It is important to note that although there is some relationship between poverty and income inequality, they are two different concepts (Borraz et al., 2012). Armstrong et at. (2009) explained that poverty measures fall under two broad categories: absolute poverty, which measures the number of people below a certain income threshold that are unable to afford certain basic goods and services, and relative poverty that compares household income and spending patterns of groups or individuals with the income and expenditure patterns of the population. On the other hand, Haughton and Khandker (2009), describe that inequality is a broader concept than poverty and it is defined over the entire population and does not only focus on the poor. Inequality measurements generally sort the population from poorest to richest and exhibit the percentage of expenditure (or income) attributable to each fifth (quintile) or tenth (decile) of the population. In the literature, there are various measures of poverty and income inequality such as Sen Index (Sen, 1976), Watts Index (Zheng, 1993), S-Gini coefficient (Kakwani,

[30] DAD or Distributive Analysis/Analyse Distributive software (Duclos, Araar and Fortin, 2002), (Duclos and Araar 2009) was specifically developed to undertake poverty and income distribution analysis. It is freely distributed and available at www.mimap.ecn.ulaval.ca

1980), Theil Index (Champernowne, 1974) and Atkinson Index (1970). The present study uses the measurements described in the following section to analyse the impact of trade liberalisation on household income distribution and poverty in the Sri Lankan economy.

7.3.1 Poverty Measures

The present study employs the FGT indices to evaluate poverty for a base year and after simulation for each household group with an endogenous poverty line in the SAMGEM. The FGT index renders the properties such as monotonicity, flexibility and distributional sensitivity axiom and therefore, it is by far the most frequently used poverty index (Foster, Greer and Thorbecke, 1984). In addition to these characteristics, the FGT measure can also be applied to various sub-groups in a given population. In Section 7.5 the FGT measure is used to estimate poverty across the various sub-groups of urban, rural and estate sectors in Sri Lanka.

Cockburn (2005, p.2) explains the FGT index as follows:

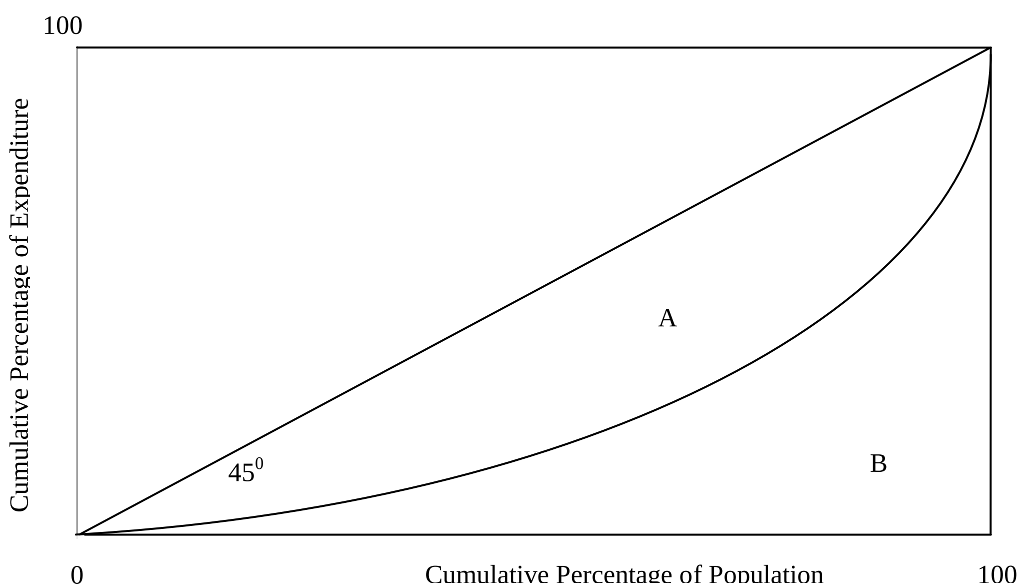
$$P_\alpha = \frac{1}{Nz^\alpha} \sum_{j=1}^{J} \left(z - y_j \right)^\alpha$$

In the above formula, *j* is the sub-group of individuals with income below the poverty line (z). *N* is the total number of individuals in the sample, y_j is the income of individual *j* and α is the parameter which allows the analysis to distinguish between alternative FGT indices. Therefore, by allowing the poverty parameter α to vary, it is possible to investigate different aspects of poverty. As explained by Cockburn (2005), when α is equal to 0, the above expression simplifies to $\frac{J}{N}$ and this measures the poverty head count ratio, which indicates the incidence of poverty. Similarly, poverty depth is measured by poverty gap, which can be obtained when α is equal to one and the poverty severity is measured by setting α is equal to two.

7.3.2 Inequality Measurements

While FGT indices are used to measure poverty, the Lorenz curve and the S-Gini index are widely and commonly used measures of income inequality. With households in rising order of income, the Lorenz curve expresses the cumulative percentage of population on the x-axis (the p-values) and the cumulative percentage of income or expenditure on the y-axis (Cockburn,2005). Figure 7.1 below gives a graphical representation of a typical Lorenz curve.

Figure 7.1 Lorenz Curve



Source: Author’s illustration

As shown in the figure, the curvature of the Lorenz curve summarises inequality: if everyone had the same income/expenditure (the perfect equality case), the Lorenz curve would lie along a 45^0 ray from the origin and, if all income/expenditure were held by just one person (complete inequality), and the curve would lie along the horizontal axis.

The Gini coefficient is a measure of income inequality which provides a compact version of the Lorenz curve (Kakwani, 1980, Kakwani, 1986, Villaseñor and Arnold, 1989, Basmann et al., 1990, Ryu and Slottje, 1996). This can be calculated as the ratio of area enclosed by the Lorenz curve and the perfect equality line to the total area below that line, which means that the Gini coefficient is defined as A/(A + B), where A and B are the areas shown in Figure 7.1. If A is equal to 0, the Gini coefficient becomes 0, which means perfect equality, whereas if B is equal to 0, the Gini coefficient becomes 1, which means complete inequality. Haughton and Khandker (2009) consider that inequality may be broken down by population groups or income sources or in other dimensions. However, they mentioned that the Gini index is not easily decomposable or additive across groups and, therefore, the total Gini of the society is not equal to the sum of the Gini coefficients of its sub groups.

7.4 Household Survey Data and Poverty Indicators in Sri Lanka

7.4.1 Household Survey Data

Data used in this chapter are drawn primarily from the Consumer Finances and Socio Economic Survey (CFS) in 2003/2004, which was conducted by the Central Bank of Sri Lanka. The CFS 2003/2004 covered a sample of 11,722 households representing all districts, provinces and sectors (urban, rural and estate) in the country excluding only Killinochchi, Mannar and Mullaitivu districts in the Northern Province[31]. The sample population totaled 50,545 individuals comprising 26,503 females and 24,042 males in the 11,722 households.

Tables 7.1 and 7.2 below illustrate the sample coverage by sectors, provinces and household units in the population frame. The housing units listed in the sampling frame were grouped into three sectors: urban, rural and estate. The urban sector consists of all housing units in the Municipal or Urban council areas as defined by the DCS, Sri Lanka. The estate sector consisted of all housing units in tea, rubber or coconut estates comprising 20 or more acres of land with 10 or more resident workers. The rural sector consisted of all housing units not included in urban or estate sectors.

In conducting the survey, initially a sample of census blocks were selected as Primary Spending Units (PSU) from all census blocks in each stratum in proportion to the number of housing units in that stratum. In the second stage a fixed number of housing units per PSU were randomly selected as Secondary Sampling Units (SSU) from the list of housing units in the selected PSU, thereby ensuring equal probability of selection of every housing unit in the stratum.

[31] These three districts in the Northern Province were excluded due to the prevailing security situation at that time.

Table 7.1 Sample Covered by Sectors and Provinces

Sector	Province	Sample Allocation of PSUs (a)	Coverage of PSUs (b)	Coverage Rate for PSUs (b)/(a)*100	Sample Allocation of SSUs in PSUs (c)	Respondent SSUs in the covered PSUs (d)	Response Rate for SSUs (d)/(c)*100
Urban	Western	145	145	100.00	856	850	99.30
Urban	Central	15	15	100.00	120	120	100.00
Urban	North Western	7	7	100.00	56	56	100.00
Urban	Southern	13	13	100.00	104	104	100.00
Urban	Subaragamuwa	5	5	100.00	40	38	95.00
Urban	Eastern	21	21	100.00	168	168	100.00
Urban	Uva	4	4	100.00	32	31	96.88
Urban	North Central	4	4	100.00	32	30	93.75
Urban	Northern	10	10	100.00	80	80	100.00
Rural	Western	293	293	100.00	2,344	2,341	99.87
Rural	Central	138	138	100.00	1,104	1,103	99.91
Rural	North Western	181	181	100.00	1,448	1,441	99.52
Rural	Southern	172	172	100.00	1,376	1,371	99.54
Rural	Subaragamuwa	133	133	100.00	1,064	1,061	99.72
Rural	Eastern	86	85	98.80	688	679	96.69
Rural	Uva	80	80	100.00	640	640	100.00
Rural	North Central	92	92	100.00	736	734	99.73
Rural	Northern	35	35	100.00	280	280	100.00
Estate	Western	3	3	100.00	24	24	100.00
Estate	Central	39	39	100.00	312	309	99.04
Estate	North Western	1	1	100.00	8	8	100.00
Estate	Southern	4	4	100.00	32	32	100.00
Estate	Sabaragamuwa	14	14	100.00	112	110	96.21
Estate	Uva	14	14	100.00	112	112	100.00
Total		1,509	1,508	99.93	11,768	11,722	99.61

Source: Central Bank of Sri Lanka, 2003/2004

Note: PSU- Primary Spending Units SSU- Secondary Spending Units

The CFS contains information on income and consumption at a household level. Cockburn (2005) noted that household consumption data are preferred to household income for distributive analysis as it tends to be more stable and reliable. Hence, household consumption data were converted into per capita level by taking into account the household size in conducting the poverty and income distribution analysis, which will be discussed in Section 7.5.

Table 7.2 Allocations of Sample Proportionate to Housing Units in Population Frame

Province	Population of Household		Sample of Households		Sample Allocation by Sector		
	No.	Percentage	No.	Percentage	Urban	Rural	Estate
Western	1,289,446	27.5	3,224	27.4	856	2,344	24
Central	612,368	13.1	1,536	13.1	120	1,104	312
North Western	603,840	12.9	1,512	12.6	56	1,448	8
Southern	599,765	12.8	1,512	12.8	104	1,376	32
Sabaragamuwa	485,237	10.4	1,216	10.3	40	1,064	112
Eastern	339,341	7.2	856	7.3	168	688	0
Uva	310,139	6.6	784	6.7	32	640	112
North Central	304,569	6.5	768	6.5	32	736	0
Northern	142,452	3.0	360	3.1	80	280	0
Total	1,687,157	100.00	11,768	100.00	1,488	9,680	600

Source: Central Bank of Sri Lanka, 2003/2004

Table 7.2 shows the coverage of the sample size and the surveyed population. The highest number of households (82.26 per cent) was from rural areas while the lowest sample size and the surveyed population were from the estate sector (5.09 per cent). On the other hand, the urban sector covers only 12.65 per cent of the sample size and the surveyed population. The sample size was designed according to the total population in respective sectors in Sri Lanka.

In conducting income distribution and poverty analysis, the households in Table 7.2 in urban, rural and estate sectors were divided into 10 groups based on the monthly per capita expenditure. Table 7.3 indicates the monthly per capita household expenditure by expenditure decile and by sector.

Table 7.3 Average Monthly Household Expenditure by Monthly Per Capita Expenditure Deciles: 2003/04

Decile Group	Urban		Rural		Estate	
	Per capital household expenditure Range (Rs.)	**Mean Household expenditure (Rs.)**	**Per capital household expenditure Range (Rs.)**	**Mean Household expenditure (Rs.)**	**Per capital household expenditure Range (Rs.)**	**Mean Household expenditure (Rs.)**
All Groups		**6383.35**	**3650.71**		**2367.05**	
1	Less than 1960	1517.56	Less than 1400	1040.43	Less than 1250	1013.90
2	1961-2550	2249.34	1401-1780	1611.87	1251-1475	1382.67
3	2551-3130	2841.10	1781-2110	1945.04	1476-1650	1573.62
4	3131-3850	3507.59	2111-2448	2278.51	1651-1835	1741.74
5	3851-4640	4236.78	2448-2830	2634.16	1836-2065	1937.95
6	4641-5650	5162.20	2831-3300	3059.68	2066-2300	2175.86
7	5651-7030	6256.70	3301-3910	3593.80	2301-2684	2488.48
8	7031-9460	8114.71	3911-4875	4351.82	2685-3173	2903.78
9	9461-14600	11329.87	4876-9600	5704.90	3174-4120	3598.02
10	More than 14660	25728.37	More than 9600	12960.10	More than 4120	6347.30

Source: Author's calculations from the CFS, 2003/2004

The average monthly per capita expenditure of the tenth decile (Rs. 25728.37) is sixteen times greater than that of the first decile (Rs. 1517.56) in the urban sector, whereas in the rural sector, average monthly per capita expenditure of the tenth urban decile (Rs. 12960.10) is twelve times more than that of first decile (Rs. 1040.43). In the estate sector, it is found that the tenth decile group (Rs. 6347.30) has average household expenditure only 6.2 times greater than that of the first decile. This suggests that the income inequality is lower in the estate sector in comparison to the other two sectors and also the income inequality is the highest in the urban sector.

7.4.2 Poverty Indicators in Sri Lanka

As noted in Chapter 3, like many other developing countries, Sri Lanka also committed to the achievement of the MDG by 2015. Eradicating extreme poverty and hunger constitute the first MDG (The World Bank, 2005) and Sri Lanka has made considerable progress in poverty reduction. For instance, as shown in Table 1.1, the national poverty level decreased from 26.1 per cent in 1990/91 to 22.7 per cent in 2002. However, the poverty in Sri Lanka is still widespread. Table 1.1 shows that the highest poverty is in the estate sector where in 2002, about 30 per cent were poor. This was followed by the rural sector, where about 24.7 per cent of the population live below the poverty line. In the urban sector, by contrast, poverty levels were considerably lower, with just 7.9 per cent in 2002. It is noticeable that poverty levels have declined considerably at the national level to 8.9 per cent in 2009/10. Further, it is evident that in Sri Lanka, poverty is, as in many countries, usually concentrated in the rural areas and therefore Sri Lanka should endeavour to mitigate these regional disparities.

The CFS in 2003/2004 reports that the per capita expenditure per one month in the urban, rural and estate sectors were Rs. 6,383, Rs.3,651 and Rs. 2,367 respectively or, in terms of US dollars: US$ 65, US$ 37 and US$ 24 at 2004 exchange rate respectively. However, Sri Lanka used several poverty lines based on different survey data, until acceptance of the poverty line established for Sri Lanka in June 2004, based on the year 2002 HIES data by the DCS. The OPL is an absolute poverty line which is fixed at a specific welfare level in order to compare over time with household food and non-food consumption expenditure. The cost of basic needs approach was used to get the value of the OPL (DCS, Sri Lanka, 2006/07). In 2002, the value of the OPL in Sri Lanka was Rs. 1,423 per person per month (just under US$ 15 at the 2002 exchange rate), based on the spending needed to obtain minimum basic needs. The DCS updated this value using the CCPI and the value of OPL for 2006/07 was reported to the Rs. 2,233 (under US$ 22 at 2007 exchange rate).

Fom the monthly per capita expenditure reported in the 2003/2004 CFS for urban, rural and estate sectors, the cost of living in urban areas are comparatively higher than that of rural and estate sectors. Therefore, it is more realistic to use different poverty lines for urban, rural and estate sectors in calculating poverty indices because cost of basic needs can be different in different geographical areas in the country.

Gunetilleke and Senanayake (2004) estimated the poverty line for Sri Lanka for the year 2004, using the CCPI on the 2002 poverty line, as Rs. 1526 per month (approximately US$ 16 at 2004 exchange rates). Hence, in calculating national poverty indices, Rs. 1526 will be taken as the national poverty line. Furthermore, DCS estimated different poverty lines for various districts in Sri Lanka in the HIES in 2002. For the present study these values have been updated by using CCPI for determining poverty lines for urban, rural and estate sectors in Sri Lanka. For the year 2004, the poverty line[32] for urban sector is estimated as Rs. 1767 (approximately US$ 18 at 2004 exchange rate), for rural sector Rs. 1652 (approximately US$ 17 at 2004 exchange rate) and for the estate sector as Rs.1570 (approximately US$ 16 at 2004 exchange rate).

[32] These amounts present the minimum expenditure that a person needs to spend to satisfy basic needs during a one month.

7.5 Incorporation of the CGE Model Results in Income Distribution and Poverty Analysis

The multi-household framework of the SAMGEM can capture the impact of trade liberalisation on the CPI for each household group included in the model (see Table E.1 in Appendix E). Changes in CPI for different household groups in the urban, rural and estate sectors under the SAFTA and unilateral trade liberalisation have been used to generate the new per capita expenditure. The base year and the post simulation per capita expenditure will be used to perform poverty and income distribution analysis in DAD. Further, SAMGEM has been formulated by endogenising poverty lines into the model by selecting basic commodity bundle[33] for urban, rural and estate sector households in Sri Lanka. Hence, changes in these poverty lines will be applied to calculate the poverty indices for urban, rural and estate sectors as a result of implementing the selected trade policy options.

7.5.1 Income Inequality in Sri Lanka

The Kuznet's hypothesis claims that faster GDP growth facilitates reduction of economic inequality in liberalised economies in the long-run. This hypothesis is popularly known as an 'inverted U-shaped pattern of income inequality', the inequality first increasing and then decreasing with development. On the other hand, the Hechscher-Ohlin-Samuelson theorem (H-O-S) posits that as less developed countries liberalise their

33 See footnote 3 in Chapter 4. As recommended by Ravallion and Sen (1996) these commodity bundles include the necessities of the respective sectors to satisfy their basic requirements.

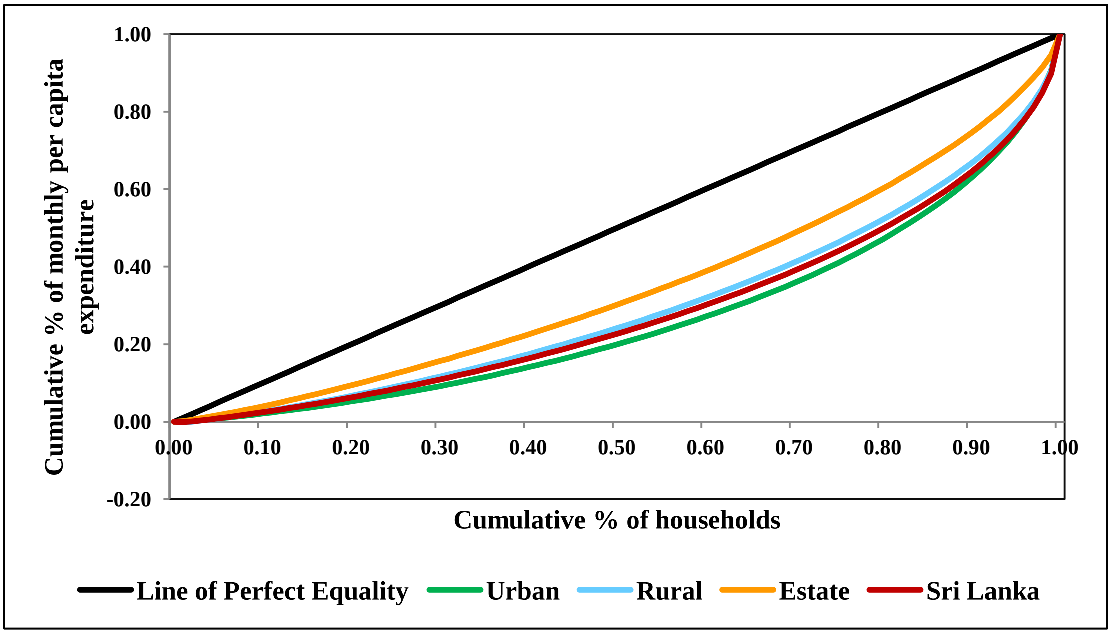
economies, they tend to specialise in the production of goods for which they hold a comparative advantage, namely low skilled labour intensive goods. Consequently, the wages of low skilled workers relative to high skilled workers tends to rise due to trade liberalisation. By using the skilled-unskilled wage ratio as a proxy for inequality, therefore, it is expected that inequality should decline in less developed countries in the long-run.

Sri Lanka initiated a process of trade policy reforms in 1977 and by 2012 the country had experienced almost 35 years of economic liberalisation. Therefore, Sri Lanka has advocated free market policies over more than three decades, which is sufficient time to generate anticipated benefits of economic liberalisation. Therefore, it is important to evaluate whether benefits from economic growth due to trade liberalisation in Sri Lanka would filter more equally to different income groups in different geographical areas in the country. As mentioned, the present study compares pre and post liberalisation scenarios of SAFTA and unilateral trade liberalisation on the Sri Lankan economy.

As previously noted, the Lorenz curve and the Gini coefficient are the most commonly used indicators of inequality. Lorenz curves are estimated for Sri Lanka at the national level as well as for different sectors (urban, rural and estate) by using the CFS 2003/04 household survey data. S-Gini coefficients are also calculated for different sectors and different household groups, to determine the extent to which trade liberalisation helps to reduce inequality between different groups in different sectors.

Figure 7.2 illustrates the estimated Lorenz curves for Sri Lanka at national level and for different sectors.

Figure 7.2 Lorenz Curves for Sri Lanka



Source: Author's estimation from the CFS 2003/04

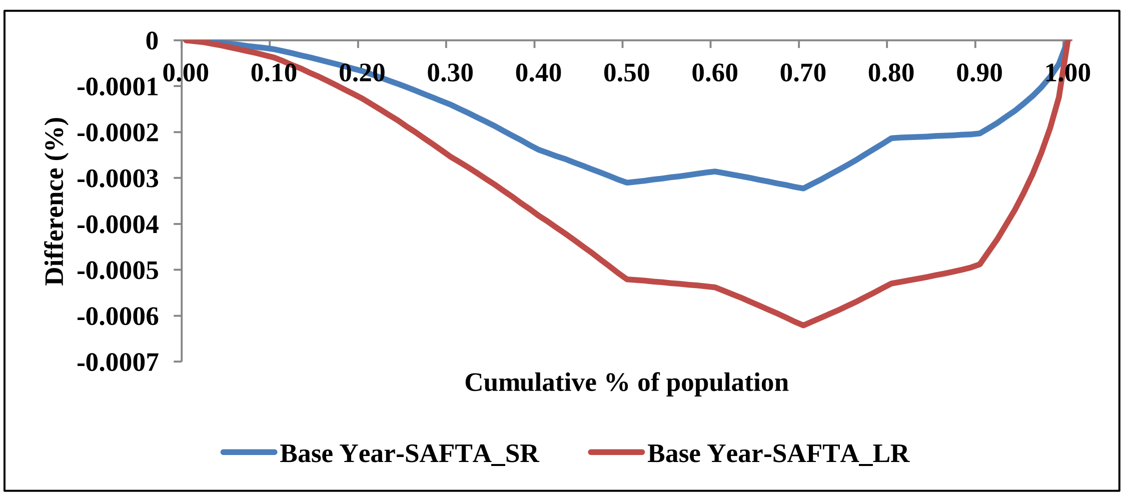
A comparison of the sectoral Lorenz curves for the base year shows that the urban sector Lorenz curves dominates the rural sector, which in turn dominates the estate sector Lorenz curve. Hence, it is clear that the inequality is the lowest in the estate sector and highest in the urban sector with the rural sector occupying a position in between.

Given these base year scenarios, it is interesting to determine whether SAFTA and unilateral trade liberalisation would reduce inequality in different sectors in Sri Lanka. Under these trade policy options, it appears that only very slight movement occurs in the Lorenz curve in all three sectors, so that there is no wider gap between Lorenz curves for two income distributions, i.e. between base year and after liberalisation. Araar and Duclos (2006) explained that when the gap between two Lorenz curves is marginal, it is appropriate to estimate the difference between two Lorenz curves. Figures 7.3 and 7.4

present such a plot for differences (i.e. the difference between base year and after trade liberalisation) in Lorenz curves under the SAFTA and unilateral trade liberalisation in the short run and long run in the urban sector. In estimating the difference between Lorenz curves, a new vector containing post liberalisation per capita expenditure for each household was obtained by applying the price changes generated by the SAMGEM under the policy options analysed.

The vertical axis of the graph depicts the difference between base year and post trade liberalisation income distributions and the horizontal axis represents the household deciles. It is noted that the curves under the SAFTA and unilateral trade liberalisation both in the short-run and long-run shows a *U* shape, indicating that there is a reduction in inequality, however, the reduction is higher in the long-run compared to the short-run under both policy options. Moreover, the reduction of inequality is more pronounced under the unilateral trade liberalisation in the urban sector.

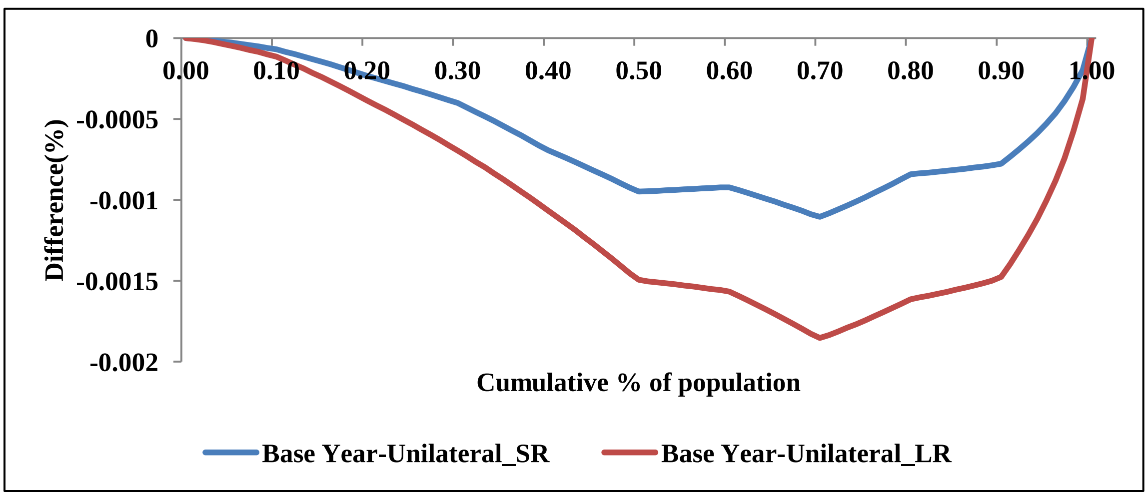
Figure 7.3 Differences between Lorenz Curves in Urban Sector: SAFTA and Base Year



Source: Author's estimation from the CFS 2003/04 and Results from SAMGEM

It is also apparent that the extent of redistribution of income is larger in the middle-income group than the lowest and the highest income groups. For instance, in the transition from base scenario to SAFTA at the fifth decile, there is a redistribution of 0.03 per cent and 0.05 per cent of total income in the short- and long-run respectively from the richer to poorer groups. Under the unilateral trade liberalisation it is apparent that at the fifth decile the inequality will further reduce from 0.10 per cent in the short-run to 0.15 percent in the long-run. This will further reduce at the seventh decile where the reduction of inequality 0.12 per cent and 0.18 per cent in the short run and the long run respectively.

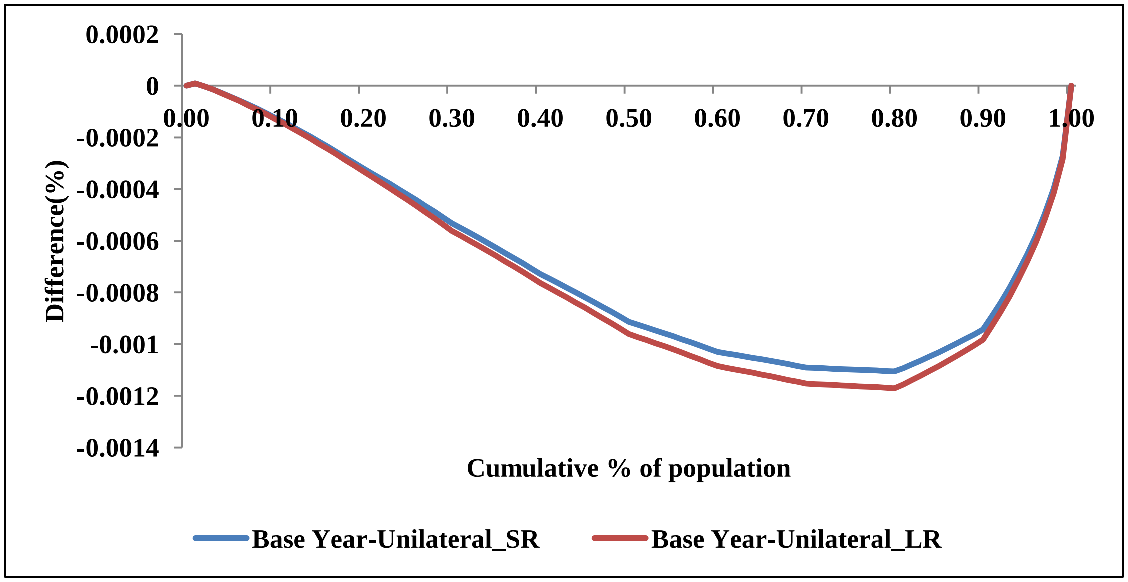
Figure 7.4 Differences between Lorenz Curves in Urban Sector: Unilateral Trade Liberalisation and Base Year



Source: Author's estimation from the CFS 2003/04 and Results from SAMGEM

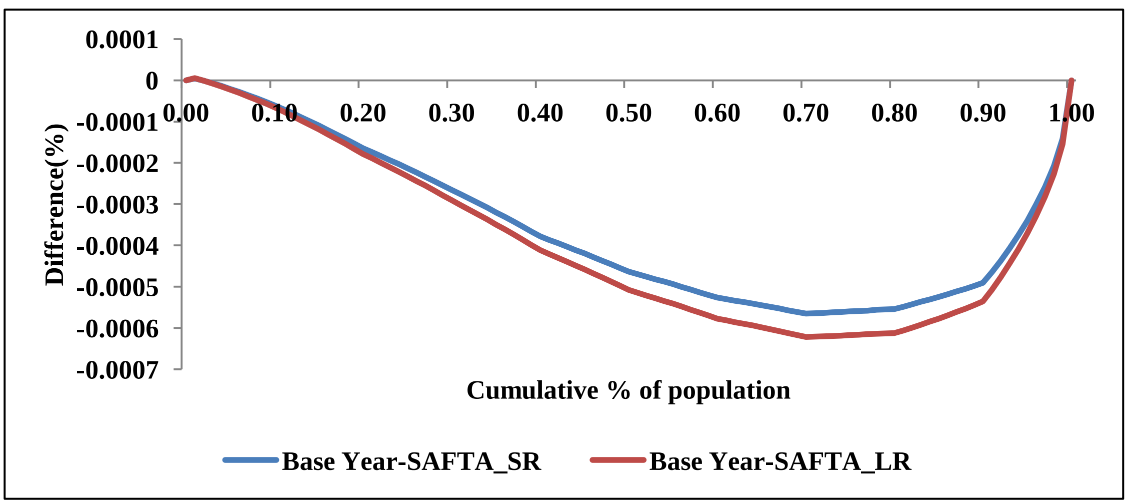
Figures 7.5 and 7.6 illustrate the difference between the Lorenz curves of the two trade policies in comparsion with the base scenario in the rural sector.

Figure 7.5 Differences between Lorenz Curves in Rural Sector: SAFTA and Base Year



Source: Author's estimation from the CFS 2003/04 and Results from SAMGEM

Figure 7.6 Differences between Lorenz Curves in Rural Sector: Unilateral Trade Liberalisation and Base Year

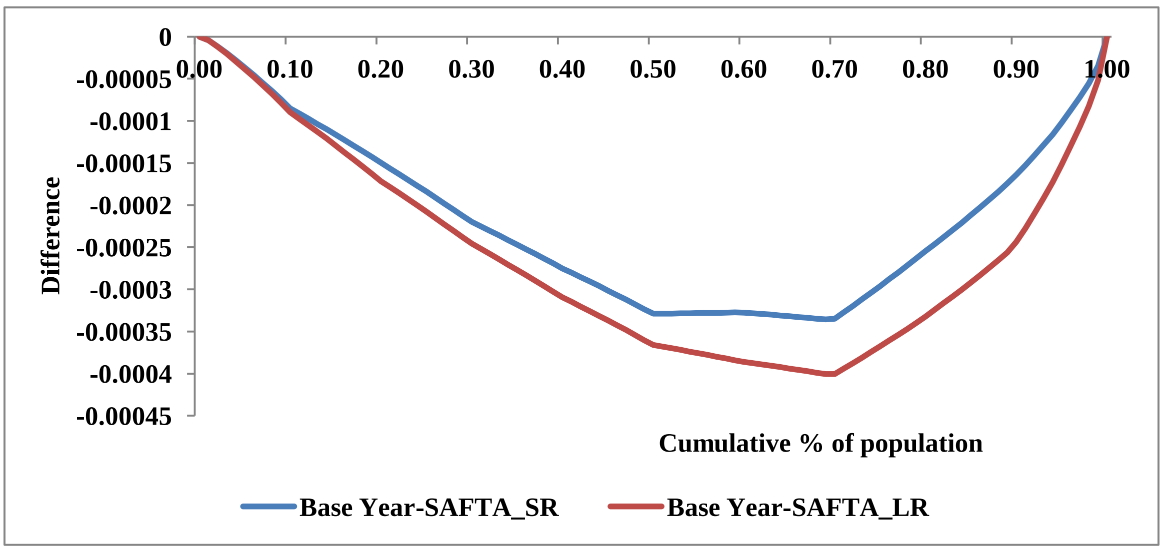


Source: Author's estimation from the CFS 2003/04 and Results from SAMGEM

The difference between Lorenz curves for two income distributions, under the SAFTA and unilateral trade liberalisation in the rural sector also reveals a *U* shape both in the short and long runs, indicating that inequality in the rural sector will also reduce under both policy options. Although the reduction in income inequality under the unilateral trade liberalisation is higher than that of SAFTA, there is no wider gap between the short-run and the long-run. It is also clear that the reduction in income inequality is higher in the middle-income groups than the lowest and the highest income groups. Consequently, in the rural sector also there is a redistribution of income from the richer household groups to the middle-income household groups due to trade liberalisation.

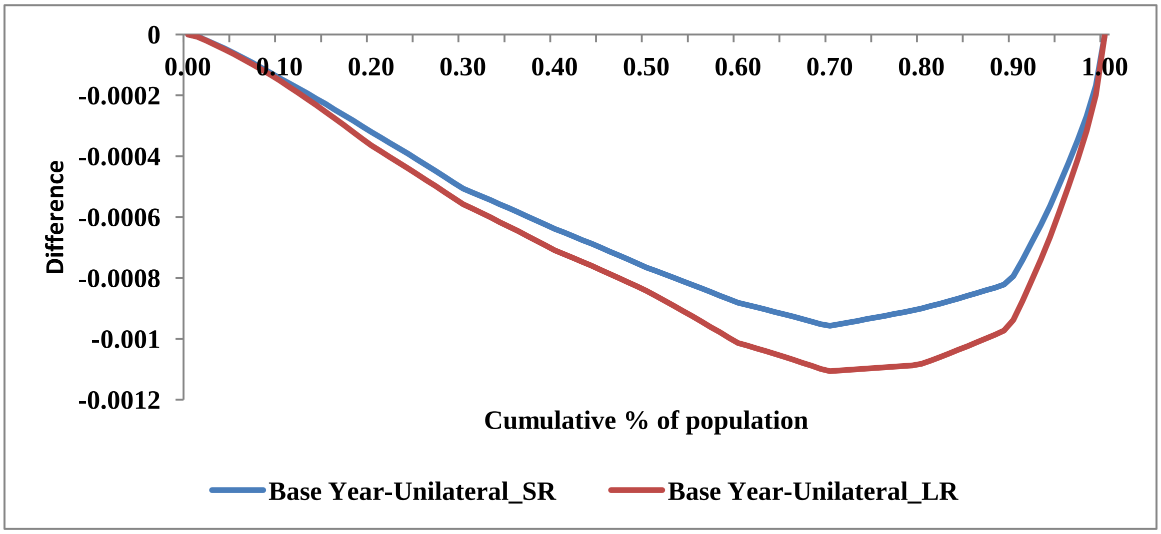
Figures 7.7 and 7.8 illustrate the difference between Lorenz curves under SAFTA and unilateral trade liberalisation in the estate sector in short-run and long-run.

Figure 7.7 Differences between Lorenz Curves in Estate Sector: SAFTA and Base Year



Source: Author's estimation from the CFS 2003/04 and Results from SAMGEM

Figure 7.8 Differences between Lorenz Curves in Estate Sector: Unilateral Trade Liberalisation and Base Year



Source: Author's estimation from the CFS 2003/04 and Results from SAMGEM

The above figures indicate that, similar to the urban and rural sectors, there is a notable reduction in income inequality in the estate sector middle-income household groups under both policy options. In the case of unilateral trade liberalisation, it appears that the reduction in income inequality is higher than that of SAFTA. There is a redistribution of income from rich to poor households under both the policy options.

The Lorenz curve provides useful ways of showing the complete pattern of income distribution. However, the S-Gini index is the most commonly applied inequality measure in the literature, probably because of its link to the Lorenz curves which provide an intuitive and graphical representation of inequality (Ourti and Clarke, 2008). Table 7.4 illustrates the Gini coefficients for Sri Lanka at a national level during different survey periods based on the monthly per capita expenditure.

Table 7.4 Gini Coefficient of Household Expenditure for Sri Lanka

	Survey Period				
	2002	**2003/04***	**2005**	**2006/07**	**2009/10**
Gini coefficient of household expenditure at national level	0.41	0.43	0.40	0.41	0.37

Source: Household Income and Expenditure Survey Reports, Various Issues, Department of Census and Statistics, Sri Lanka.
* Author's estimation from the CFS 2003/04

According to Table 7.4, the Gini index at national level in 2002 was 0.41 and the estimated results demonstrate that this increased to 0.43 in 2003/04. The likely reason for the rise in inequality in these periods was the political unrest and civil war, which prevailed in Sri Lanka for more than two decades, hindering the country's development process and disrupting the normalcy of the growth process. Hence, these factors also adversely affected different socio-economic groups in Sri Lanka, thereby raising inequality. However, it is apparent that by 2009/10 inequality drops by 10.8 per cent compared to 2006/07 as a result of improved political and economic stability in the country.

The DAD programme facilitates decomposition of the S-Gini index by different household groups, allowing estimation of the extent of inequality between different household groups. This is particularly useful to demonstrate how trade policies may alter the income distribution of households in different sectors in Sri Lanka. Tables 7.5-7.7 present the S-Gini coefficients for urban, rural and estate sectors in Sri Lanka under the base year, SAFTA and unilateral trade liberalisation.

Table 7.5 Decomposition of Inequality by Group Using the S–Gini Index: Urban Sector

Group	Population Share (%)	Base Year		SAFTA				Unilateral Trade Liberalisation			
				Short-Run		Long-Run		Short-Run		Long-Run	
		Expend (%)	S-Gini	Expend (%)	S-Gini	Expend (%)	S-Gini	Expend (%)	S-Gini	Expend (%)	S-Gini
Total	**100**	**100**	**0.4659 (0.0134)**	**100**	**0.4655 (0.0135)**	**100**	**0.4652 (0.0134)**	**100**	**0.4646 (0.013)**	**100**	**0.4638 (0.0135)**
Between Groups			**0.4525 (0.0135)**		**0.4522 (0.0137)**		**0.4518 (0.0133)**		**0.4513 (0.0136)**		**0.4505 (0.0134)**
S-Gini by groups											
Decile 1	10	2.12	0.1227 (0.008)	2.13	0.1226 (0.009)	2.13	0.1225 (0.008)	2.13	0.1225 (0.008)	2.14	0.1224 (0.008)
Decile 2	10	3.12	0.0436 (0.001)	3.12	0.0435 (0.002)	3.13	0.0434 (0.001)	3.13	0.0434 (0.002)	3.14	0.0433 (0.0015)
Decile 3	10	3.95	0.0321 (0.001)	3.94	0.0320 (0.002)	3.95	0.0320 (0.001)	3.95	0.0320 (0.001)	3.95	0.0321 (0.0012)
Decile 4	10	4.84	0.0340 (0.001)	4.85	0.0339 (0.001)	4.86	0.0339 (0.003)	4.87	0.0339 (0.001)	4.88	0.0339 (0.0013)
Decile 5	10	5.89	0.0321 (0.001)	5.89	0.0320 (0.001)	5.90	0.0320 (0.001)	5.91	0.0320 (0.001)	5.94	0.0320 (0.0011)
Decile 6	10	7.16	0.0332 (0.001)	7.15	0.0331 (0.001)	7.60	0.0331 (0.001)	7.15	0.0331 (0.001)	7.17	0.0330 (0.0011)
Decile 7	10	8.69	0.0383 (0.004)	8.70	0.0382 (0.002)	8.70	0.0382 (0.001)	8.71	0.0382 (0.001)	8.72	0.0381 (0.0014)
Decile 8	10	11.28	0.0491 (0.002)	11.28	0.0490 (0.002)	11.27	0.0490 (0.002)	11.26	0.0490 (0.001)	11.27	0.0490 (0.0018)
Decile 9	10	15.78	0.0679 (0.003)	15.78	0.0678 (0.003)	15.44	0.0678 (0.003)	15.78	0.0678 (0.002)	15.77	0.0677 (0.0029)
Decile 10	10	37.17	0.2738 (0.032)	37.16	0.2737 (0.033)	37.02	0.2736 (0.032)	37.11	0.2736 (0.032)	37.02	0.2735 (0.0321)

Source: Author's estimation from the CFS 2003/04 and Results from SAMGEM

Note: The respective standard errors are reported in parenthesis at 95% confidence limit Expend- Per capita expenditure

Tables 7.5 to 7.7 indicate that the estimated S-Gini coefficient of household per capital expenditure for urban, rural and estate sectors are 0.4659, 0.4040 and 0.2991 respectively. This means that the income disparity between households is highest in the urban sector and lowest in the estate sector in the base year, which indicates that there was a greater homogeneous consumption pattern among the households in the estate sector than the other two sectors. In the urban sector, 5.24 per cent of the total consumption expenditure is spent by those of the poorest two deciles, while 52.95 per cent of the total expenditure is spent by those in the richest two deciles in the base year. At the rural level, the corresponding figures are 6.72 per cent and 47.72 per cent respectively. On the other hand in the estate sector, the poorest two deciles spend 9.46 per cent whereas the richest two deciles spent 40.25 per cent of the total expenditure in the base year. This further highlights that inequality is higher in the urban sector than in the other two sectors in Sri Lanka.

When examining post liberalisation inequality under the SAFTA, it is apparent that in the urban sector inequality will decrease overall in the short-run (0.4655) and this further reduces in the long-run (0.4652). Table 7.5 illustrates the estimated S-Gini coefficients as 0.4646 and 0.4638 respectively under unilateral trade liberalisation, which indicates that inequality further reduces in the urban sector in the long-run.

Table 7.6 Decomposition of Inequality by Group Using the S–Gini Index: Rural Sector

Group	Population Share (%)	Base Year		SAFTA				Unilateral Trade Liberalisation			
		Expend (%)	S-Gini	Short-Run		Long-Run		Short-Run		Long-Run	
				Expend (%)	S-Gini	Expend (%)	S-Gini	Expend (%)	S-Gini	Expend (%)	S-Gini
Total	**100**	**100**	**0.4040 (0.0070)**	**100**	**0.4033 (0.0070)**	**100**	**0.4032 (0.0071)**	**100**	**0.4026 (0.0073)**	**100**	**0.4025 (0.0072)**
Between Groups			**0.3911 (0.0061)**		**0.3904 (0.0062)**		**0.3904 (0.0061)**		**0.3898 (0.0067)**		**0.3897 (0.0066)**
S-Gini by groups											
Decile 1	10	2.60	0.2584 (0.0672)	2.58	0.2583 (0.0672)	2.58	0.2582 (0.0672)	2.58	0.2581 (0.0672)	2.60	0.2580 (0.0673)
Decile 2	10	4.12	0.0363 (0.0005)	4.14	0.0363 (0.0005)	4.15	0.0363 (0.0005)	4.14	0.0362 (0.0056)	4.14	0.0361 (0.0005)
Decile 3	10	4.96	0.0276 (0.0004)	4.98	0.0275 (0.0004)	4.98	0.0275 (0.0004)	4.98	0.0274 (0.0004)	4.99	0.0273 (0.0004)
Decile 4	10	5.81	0.0247 (0.0003)	5.83	0.0246 (0.0003)	5.82	0.0246 (0.0003)	5.84	0.0245 (0.0003)	5.84	0.0244 (0.0003)
Decile 5	10	6.71	0.0245 (0.0003)	6.72	0.0244 (0.0003)	6.73	0.0244 (0.0003)	6.73	0.0243 (0.0003)	6.73	0.0242 (0.0003)
Decile 6	10	7.81	0.0264 (0.0004)	7.82	0.0263 (0.0003)	7.82	0.0263 (0.0004)	7.83	0.0262 (0.0004)	7.83	0.0262 (0.0003)
Decile 7	10	9.17	0.0283 (0.0004)	9.17	0.0283 (0.0004)	9.18	0.0283 (0.0004)	9.18	0.0283 (0.0004)	9.18	0.0282 (0.0004)
Decile 8	10	11.10	0.0365 (0.0005)	11.11	0.0365 (0.0005)	11.10	0.0364 (0.0005)	11.11	0.0363 (0.0005)	11.11	0.0363 (0.0005)
Decile 9	10	14.58	0.0560 (0.0009)	14.57	0.0559 (0.0008)	14.57	0.0558 (0.0008)	14.57	0.0557 (0.0008)	14.56	0.0557 (0.0008)
Decile 10	10	33.14	0.3025 (0.0178)	33.08	0.3026 (0.0178)	33.07	0.3025 (0.0178)	33.04	0.3024 (0.0178)	33.02	0.3024 (0.0178)

Source: Author’s estimation from the CFS 2003/04 and Results from SAMGEM
Note: The respective standard errors are reported in parenthesis at 95% confidence limit

Expend: Per capita expenditure

Table 7.7 Decomposition of Inequality by Group Using the S-Gini Index: Estate Sector

Group	Population Share (%)	Base Year		SAFTA				Unilateral Trade Liberalisation			
				Short-Run		Long-Run		Short-Run		Long-Run	
		Expend (%)	S-Gini	Expend (%)	S-Gini	Expend (%)	S-Gini	Expend (%)	S-Gini	Expend (%)	S-Gini
Total	**100**	**100**	**0.2991 (0.0134)**	**100**	**0.2986 (0.0134)**	**100**	**0.2985 (0.0134)**	**100**	**0.2980 (0.0134)**	**100**	**0.2978 (0.0134)**
Between Groups			**0.2915 (0.0135)**		**0.2912 (0.0136)**		**0.2911 (0.0135)**		**0.2905 (0.0136)**		**0.2904 (0.0135)**
S-Gini by groups											
Decile 1	10	4.02	0.1054 (0.0209)	4.03	0.1053 (0.0209)	4.03	0.1052 (0.0209)	4.03	0.1051 (0.0209)	4.03	0.1050 (0.0209)
Decile 2	10	5.44	0.0279 (0.0014)	5.45	0.0279 (0.0014)	5.44	0.0279 (0.0014)	5.43	0.0279 (0.0014)	5.43	0.0279 (0.0014)
Decile 3	10	6.16	0.0188 (0.0011)	6.17	0.0188 (0.0011)	6.17	0.0188 (0.0011)	6.18	0.0188 (0.0011)	6.18	0.0188 (0.0011)
Decile 4	10	6.94	0.0166 (0.0009)	6.94	0.0166 (0.0009)	6.95	0.0166 (0.0009)	6.95	0.0166 (0.0009)	6.96	0.0166 (0.0009)
Decile 5	10	7.60	0.0220 (0.0011)	7.60	0.0220 (0.0011)	7.60	0.0220 (0.0011)	7.61	0.0220 (0.0011)	7.62	0.0220 (0.0011)
Decile 6	10	8.53	0.0188 (0.0011)	8.53	0.0188 (0.0011)	8.53	0.0188 (0.0011)	8.54	0.0188 (0.0011)	8.54	0.0188 (0.0011)
Decile 7	10	9.75	0.0272 (0.0015)	9.76	0.0272 (0.0015)	9.76	0.0272 (0.0015)	9.76	0.0272 (0.0015)	9.76	0.0272 (0.0015)
Decile 8	10	11.31	0.0263 (0.0017)	11.30	0.0263 (0.0017)	11.30	0.0263 (0.0017)	11.31	0.0262 (0.0017)	11.31	0.0262 (0.0017)
Decile 9	10	14.12	0.0399 (0.0027)	14.12	0.0399 (0.0027)	14.12	0.0399 (0.0027)	14.14	0.0398 (0.0027)	14.15	0.0398 (0.0027)
Decile 10	10	26.13	0.1923 (0.0305)	26.10	0.1923 (0.0305)	26.10	0.1923 (0.0305)	26.05	0.1923 (0.0305)	26.02	0.1923 (0.0305)

Source: Author's estimation from the CFS 2003/04 and Results from SAMGEM

Note: The respective standard errors are reported in parenthesis at 95% confidence limit Expend: Per capita expenditure

Moreover, in the urban sector the share of the expenditure of the poorest two deciles increases to 5.26 per cent and in the richest two deciles reduces to 52.46 per cent in the long-run under the SAFTA. Additionally, under the unilateral trade liberalisation the share of total expenditure of the poorest two deciles increases to 5.28 per cent and in the richest two deciles decreases to 52.79 per cent in comparison to the base year. This indicates that there is a redistribution of income from the rich to the poor households in the long-run due to trade liberalisation in the urban sector.

The S-Gini coefficient in the rural sector under the SAFTA will also reduce to 0.4033 and 0.4032 in the short-run and the long-run respectively. There is a greater reduction in inequality under the unilateral trade liberalisation with the estimated S-Gini coefficient in the short-run equals to 0.4026 and in the long-run equals to 0.4025. Under the SAFTA, the share of expenditure that will be spent by the poorest two deciles increases to 6.73 per cent while in the richest two deciles the share reduces to 47.65 per cent in the long-run. Under unilateral trade liberalisation it also appears that there is a redistribution of income from rich to poor household groups in the rural sector as the share of expenditure that the poorest two deciles increases to 6.74 per cent and in the richest two deciles reduce to 47.58 per cent in the long-run.

The estimated Gini coefficients in the estate sector under the SAFTA shows a slight decrease in inequality from 0.2986 in the short-run to 0.2985 in the long-run. In the case of unilateral trade liberalisation, the estimated Gini coefficients in the short-run (0.2980) and long-run (0.2978) indicate that the income disparity in the estate sector will further narrow in the long-run as a result of trade liberalisation.

The estimated S-Gini coefficients between household groups indicate that there is a reduction in inequality between household groups under the two trade policies in all three sectors. Hence, it is clear that income disparities may narrow down between the household groups due to trade liberalisation. As previously explained, there is lower inequality between household groups in the estate sector than in the urban and rural sectors in Sri Lanka.

Changes in the S-Gini coefficients under the SAFTA and unilateral trade liberalisation confirm that inequality in urban, rural and estate sectors will decrease especially in the long-run. The standard deviations reported in the parentheses in Tables 7.5-7.7 were used to calculate “t” values for respective S-Gini coefficients. These values are reported in Appendix E.2. Since, there are a large number of observations, the critical “t” value when α=0.025 is 1.95. This is compared with the calculated “t” values to determine the significance of the above results. The “t” tests indicated that all the calculated S-Gini-coefficients are significant at five per cent significance level (95 per cent confidence limit).

In summary, the estimated Lorenz curves and the Gini coefficients suggest that inequality in households in urban, rural and estates sectors is expected to fall under the SAFTA and unilateral trade liberalisation both in the short-run and long-run. This is consistent with the results obtained from the SAMGEM, as it reveals that real consumption will increase in all household groups in all three sectors under both these policy options. It was also noted in Chapter 6, that unskilled labour benefits more in the rural and estate sectors than in the urban sector under these trade policies, although the gains are higher in the long-run. Hence, it appears that these long-term effects of trade liberalisation are consistent with the H-O-S theorem. Furthermore, the *U* shape difference between Lorenz curves (base year and after trade liberalisation) indicates that there is redistribution of income from rich to poor households under both the trade policy options.

7.5.2 Non-parametric Estimation of Poverty in Sri Lanka

As mentioned in Chapter 3, a number of studies (e.g. Bourguignon and Morisson 1990; Barro, 2000 and Dollar and Kraay, 2004) support the view that open trade regimes lead to faster growth and poverty reduction in poor countries. However, others (e.g. Annabi et al. (2005), Khondker and Raihan (2004)) are of the opinion that trade liberalisation produces welfare loss and thereby increases poverty in developing countries. For this reason, it is worthwhile to further examine the nexus between the impact of trade liberalisation, growth and poverty. The aim of the this section is, therefore, to investigate the impact of trade liberalisation on poverty of different household groups in urban, rural and estate sectors in Sri Lanka. Poverty indicators are estimated for the base year and after liberalisation, under the SAFTA and unilateral trade liberalisation, which determine to what extent trade liberalisation affects poverty in Sri Lanka.

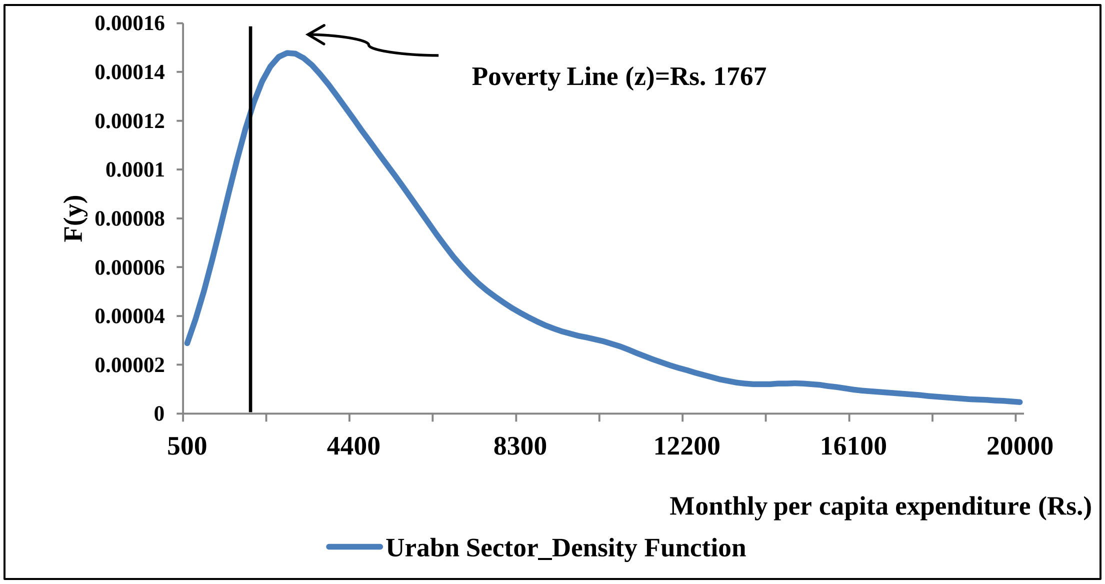
As discussed in Section 7.3.1, the FGT index is used to analyse the poverty in urban, rural and estate sectors in Sri Lanka. The poverty head-count ratio (α=0) is the most commonly used indicator of poverty as it gives the proportion of the population earning income less than or equal to the poverty line income level. In analysing poverty, other poverty measures are estimated such as the poverty gap (α=1), which measures the extent to which individuals fall below the poverty line and poverty severity (α=2), which averages the squares of the poverty gaps relative to the poverty line.

In order to estimate the poverty head count ratio, one needs to estimate the distribution of income (Dhongde, 2004). The income distribution functions for urban, rural and estate sectors in Sri Lanka are estimated by employing the non-parametric technique, as this method estimates income distribution directly, without assuming any particular functional form for the true distribution.

- **Urban Sector Density Function**

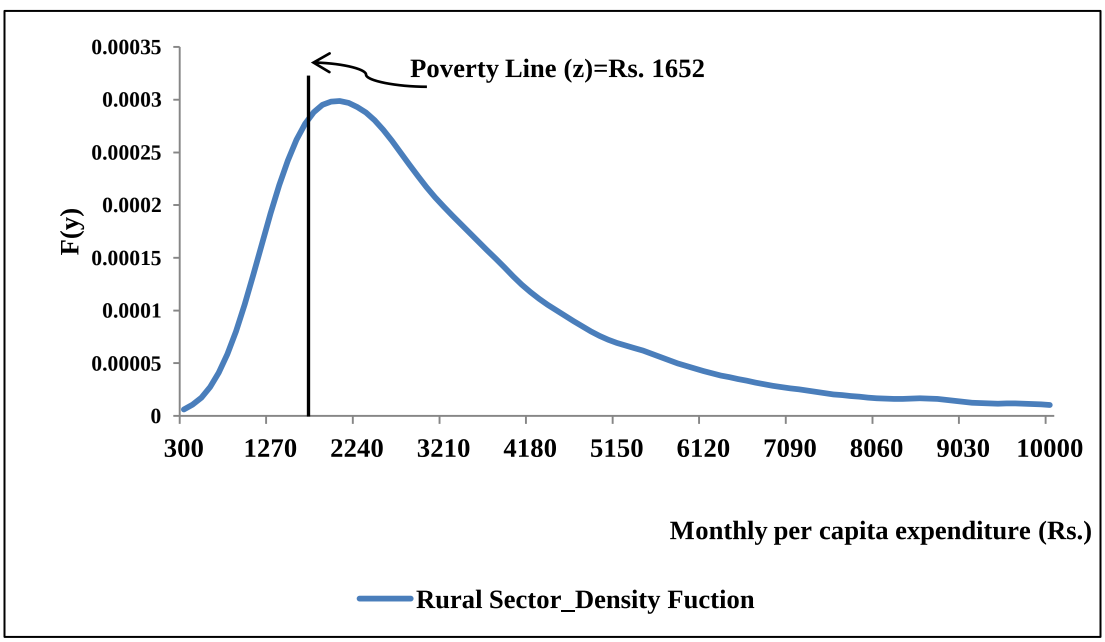
Figures 7.9 to 7.11 illustrate the Kernel Density Function of per capita expenditure for urban, rural and estate sector household groups in Sri Lanka in the base year. The vertical axis presents an estimate of the probability density at value of *x* (monthly per capita expenditure). The vertical line is the poverty line in: urban sector Rs. 1767, rural sector Rs. 1652 and estate sector Rs. 1570 in the base year respectively.

Figure 7.9 Urban Sector Density Function: Base Year 2003/04



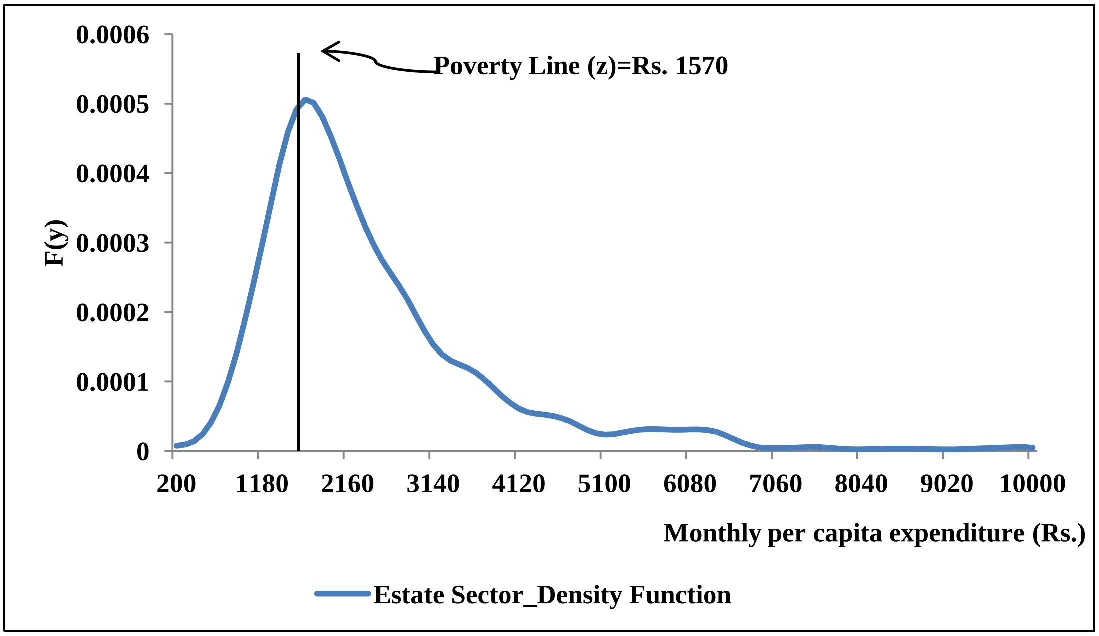
Source: Author's estimation from CFS, 2003/04

Figure 7.10 Rural Sector Density Function: Base Year 2003/04



Source: Author's estimation from CFS, 2003/04

Figure 7.11 Estate Sector Density Function: Base Year 2003/04



Source: Author's estimation from CFS, 2003/04

Dhongde (2004) explained that in using the Kernel method, the poverty head count ratio is calculated by taking the sum of the estimated densities until the poverty line of income (per capita expenditure) level is reached. From the above estimated density functions it is clear the urban sector has the smallest proportion of households living below the poverty line with the highest proportion in the estate sector.

The results obtained from the SAMGEM, indicated that Sri Lanka's economic growth will increase under the SAFTA and unilateral trade liberalisation. Given these apparent benefits it is worthwhile to study in detail, how this growth benefits affected different household groups in different sectors in Sri Lanka.

In Chapter 4, it is noted that SAMGEM has been formulated by incorporating monetary poverty lines for urban, rural and estate sectors in Sri Lanka. These changes in monetary poverty lines will be taken into account in calculating FGT indices for different trade policy scenarios: SAFTA and unilateral trade liberalisation. Table 7.8 illustrates the percentage changes in average poverty line for urban, rural and estates sectors in Sri Lanka under SAFTA and unilateral trade liberalisation.

Table 7.8 Percentage Change in Poverty Lines in Different Sectors in Sri Lanka

Sector	SAFTA		Unilateral Trade Liberalisation	
	Short-Run	**Long-Run**	**Short-Run**	**Long-Run**
Urban	-0.3370	-0.5601	-3.3387	-3.4669
Rural	-0.6391	-1.0624	-3.9818	-4.5568
Estate	-0.6903	-1.1150	-4.2033	-4.7778

Source: Simulation Results from SAMGEM

The poverty line declines for all three sectors under both trade policy options although the magnitudes of the decrease in values are higher in the long-run. Further, it is apparent that there is larger reduction in monetary poverty lines under unilateral trade liberalisation due to non discriminatory trade liberalisation. Additionally, one can observe that the reduction in prices of a basic commodity bundle is larger for the rural and estate sectors households than the urban sector as the basic commodity bundle mainly includes food items for which the rural and estate sectors have a higher demand. As a result of the removal of tariffs under the two trade policy options, the prices of basic goods are cheaper in comparison to manufacturing and industrial goods. The estimated values of per capita expenditure and new prices generated under the trade policy options were used in calculating FGT indices to ascertain the post simulation poverty profiles in urban, rural and estate sectors in Sri Lanka.

In order to understand how poverty profiles change in urban, rural and estate sectors in Sri Lanka as a result of implementing the two trade policies, it is useful to estimate the density functions incorporating post simulation results with new per capita income and new poverty line. The Density function for per capita expenditure illustrates the percentage of individuals with a given per capita expenditure. However, the estimated post liberalisation density functions overlap the density functions as illustrated in Figures 7.9-11, since simulated post shock values are comparatively smaller. Hence, under such circumstances, Araar and Duclos (2006) suggest that it is appropriate to estimate difference between two density functions: difference between base year values and post simulation values.

Figures 7.12-17 explain the difference between density functions (i.e. the difference between the post simulation values and the base year values) under the SAFTA and unilateral trade liberalisation for urban, rural and estate sectors respectively. Figures 7.12-13 estimate the difference between the density function under SAFTA and unilateral trade liberalisation in the urban sector. Figure 7.12 shows that, in the short–run, there is a tendency that the number of households whose monthly per capita expenditure between Rs.500-3000 will decrease marginally and there is a greater decline in the number of household who fall in this range in the long-run. There is a higher probability of decline in the number of households whose monthly per capita expenditure ranges from Rs500-4400 under the unilateral trade liberalisation (see Figure 7.13).

Figure 7.12 Differences between Density Functions under SAFTA: Urban Sector

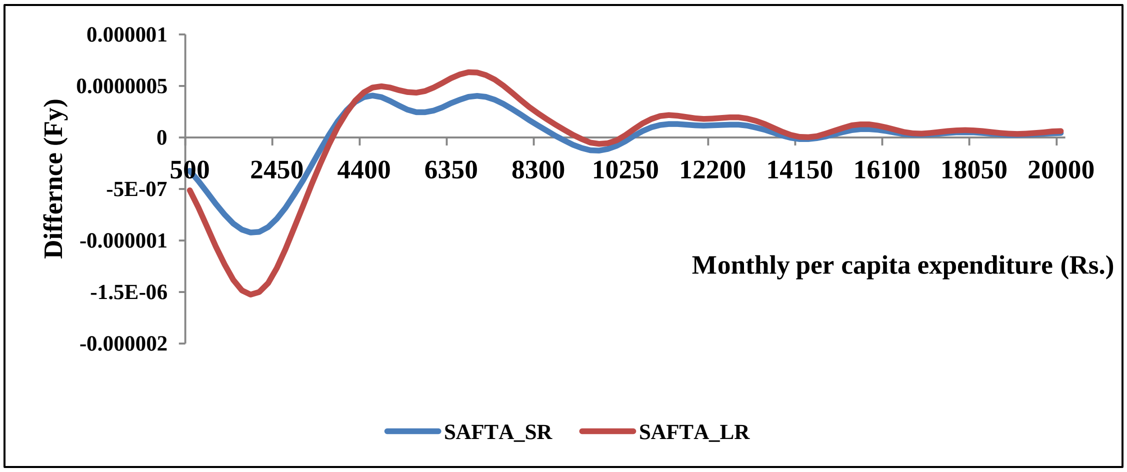
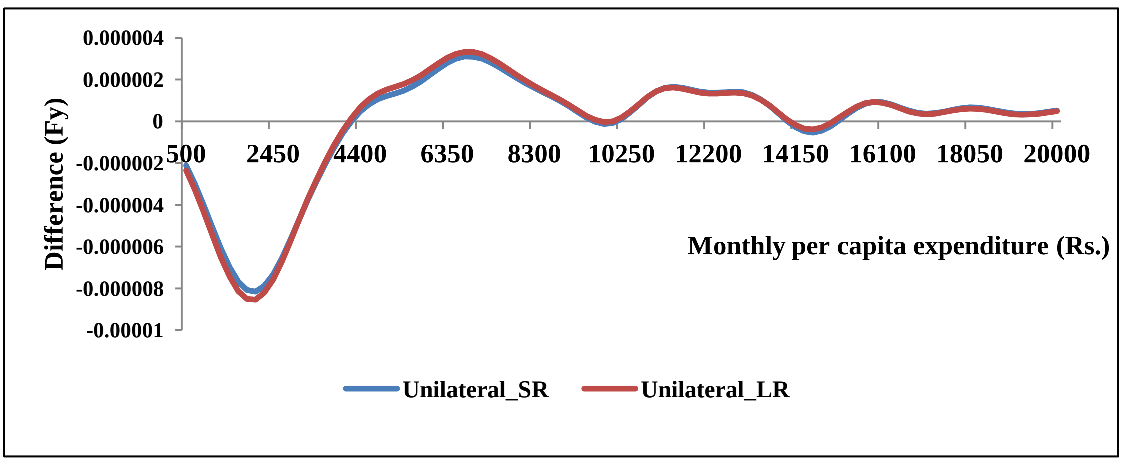


Figure 7.13 Differences between Density Functions under Unilateral Trade Liberalisation: Urban Sector



Source: Author's estimation from CFS, 2003/04

Similar explanation can be seen in Figure 7.14 and Figure 7.15 under the rural sector with a difference in monthly household per capita expenditure between Rs300-2250 under the SAFTA and unilateral trade liberalisation between Rs300- 2270. There is a probability of higher decline in poverty in the rural sector than there is in the urban sector as the consequence of trade liberalisation.

Figure 7.14 Differences between Density Functions under SAFTA: Rural Sector

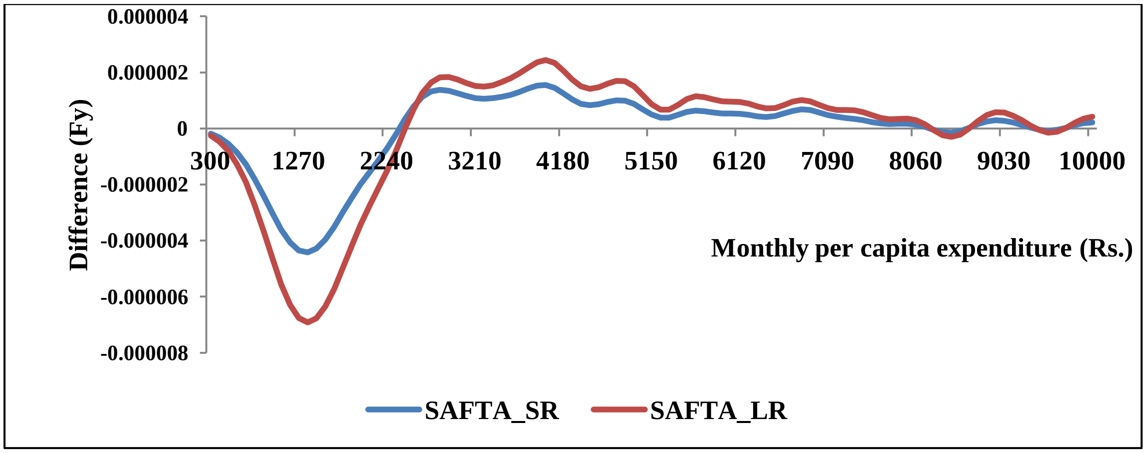
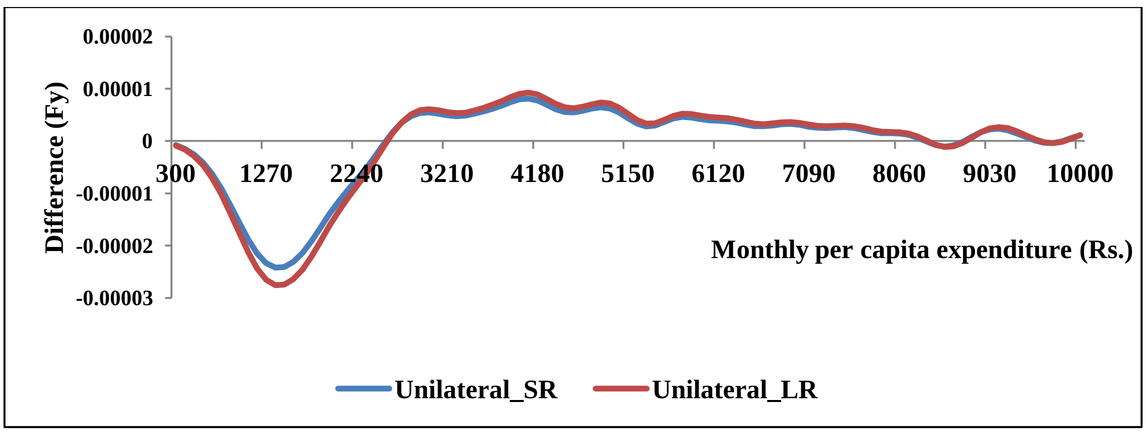


Figure 7.15 Differences between Density Functions under Unilateral Trade Liberalisation: Rural Sector



Source: Author's estimation from CFS, 2003/04

In Figure 7.16 and Figure 7.17 there is an even higher probability of poverty decline in the Estate Sector with the implementation of SAFTA and unilateral trade liberalisation. There is a trend of moving from lower to a higher monthly per capita expenditure level in all the three sectors under both policy options. The FGT poverty indices are presented in Tables 7.9 -11 for the urban, rural and estate sectors in Sri Lanka.

Figure 7.16 Differences between Density Functions under SAFTA: Estate Sector

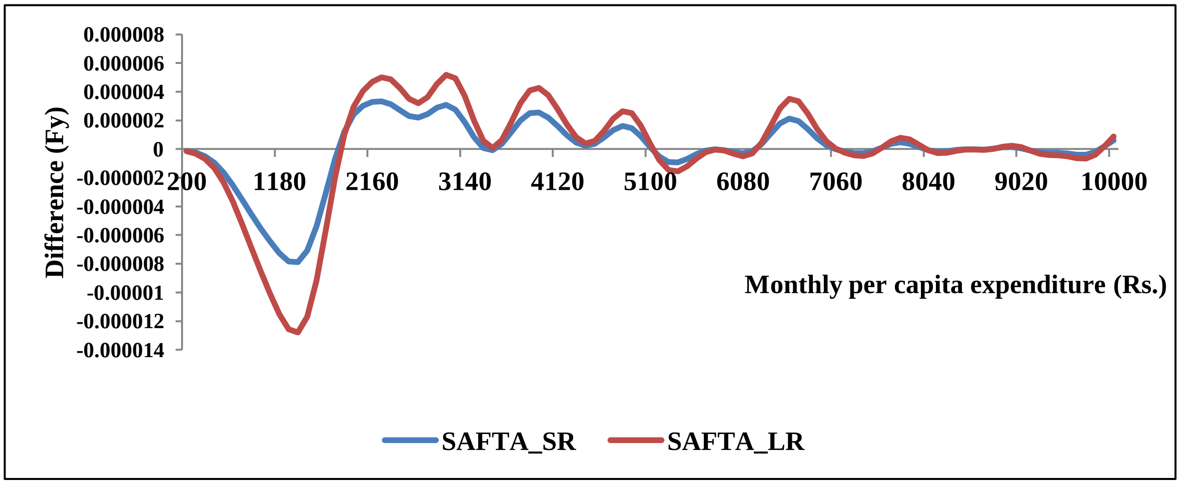
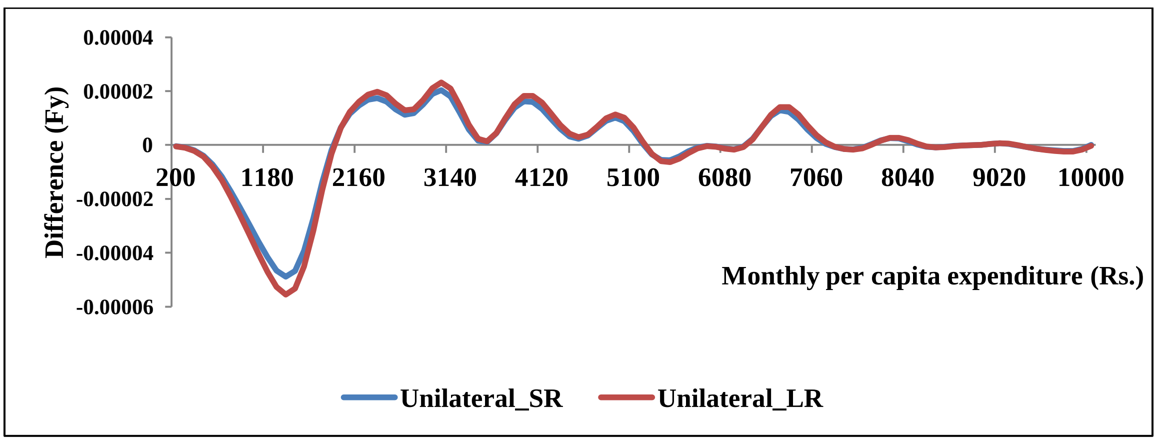


Figure 7.17 Differences between Density Functions under Unilateral Trade Liberalisation: Estate Sector



Source: Author's estimation from CFS, 2003/04

Table 7.9 FGT Poverty Indices under the Base Year and Different Trade Policy Options: Urban Sector

Household Group	Population Share (%)	Base Year (z=Rs. 1767)			SAFTA						Unilateral Trade Liberalisation					
					Short-Run (z=Rs.1761)			Long-Run (z=Rs.1757)			Short-Run (z=Rs.1707)			Long-Run (z=Rs.1705)		
		α =0 (%)	α =1 (%)	α =2 (%)	α =0 (%)	α =1 (%)	α =2 (%)	α =0 (%)	α =1 (%)	α =2 (%)	α =0 (%)	α =1 (%)	α =2 (%)	α =0 (%)	α =1 (%)	α =2 (%)
Total	**100.00**	**7.32 (0.006)**	**1.50 (0.001)**	**0.53 (0.000)**	**7.12 (0.006)**	**1.46 (0.002)**	**0.51 (0.000)**	**6.90 (0.006)**	**1.43 (0.001)**	**0.50 (0.000)**	**5.01 (0.005)**	**1.16 (0.001)**	**0.41 (0.000)**	**4.87 (0.005)**	**1.15 (0.001)**	**0.40 (0.000)**
Decile 1	10	72.92 (0.036)	15.01 (0.014)	5.30 (0.007)	70.94 (0.037)	14.62 (0.014)	5.16 (0.007)	69.59 (0.038)	14.31 (0.014)	5.08 (0.007)	50.00 (0.041)	11.60 (0.013)	4.10 (0.006)	48.64 (0.041)	11.49 (0.013)	4.06 (0.006)
Decile 2	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 3	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 4	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 5	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 6	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 7	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 8	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 9	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 10	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)

Source: Author’s estimation from the CFS 2003/04 and Results from SAMGEM
Note: z= Poverty Line The respective standard errors are reported in parenthesis at 95% confidence limit

According to Table 7.9, it is apparent that poverty head count ratio ($\alpha=_0$), poverty gap (α=1) and poverty severity (α=2) in the urban sector is 7.32 percent, 1.5 percent and 0.53 percent respectively. As shown in Table 7.9, urban sector poverty is expected to decline under the SAFTA and unilateral trade liberalisation both in the short run and long run. Further, it is noted that poverty reduction in the urban sector is higher under the unilateral trade liberalisation in comparison to the SAFTA outcome due to non-discriminatory trade liberalisation. Moreover, the decomposition of FGT indices based on household groups indicate that, only households belonging to the first decile fall below the poverty line in all cases. For instance, in the base year 72.92 per cent of the households in the first decile fall below the poverty line. In the short-run this is reduced to 70.94 percent and 50 percent under the SAFTA and unilateral trade liberalisation respectively. This is expected to further decline in the long run under both trade policy options.

As illustrated in Table 7.10, poverty is higher in the rural sector than in the urban sector. For instance, in the base year the poverty head count ratio (α=0), poverty gap (α=1) and poverty severity (α=2) in the rural sector is 16.02 percent, 4.27 percent and 1.07 percent respectively. Similar to the urban sector, poverty is expected to be reduced in the rural sector under the trade policy scenarios, both in the short run and in the long run.

Table 7.10 FGT Poverty Indices under the Base Year and Different Trade Policy Options: Rural Sector

Household Group	Population Share (%)	Base Year (z=Rs. 1652)			SAFTA						Unilateral Trade Liberalisation					
					Short-Run (z=Rs.1641)			Long-Run (z=Rs.1634)			Short-Run (z=Rs.1586)			Long-Run (z=Rs.1576)		
		α =0	α =1	α =2	α =0	α =1	α =2	α =0	α =1	α =2	α =0	α =1	α =2	α =0	α =1	α =2
		(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Total	**100.00**	**16.02 (0.003)**	**4.27 (0.003)**	**1.07 (0.004)**	**15.31 (0.004)**	**4.10 (0.003)**	**1.01 (0.001)**	**14.95 (0.003)**	**4.01 (0.003)**	**0.97 (0.001)**	**12.21 (0.003)**	**3.41 (0.003)**	**0.74 (0.003)**	**11.08 (0.003)**	**3.30 (0.003)**	**0.71 (0.003)**
Decile 1	10	100 (0.000)	38.86 (0.033)	10.55 (0.003)	100 (0.000)	37.96 (0.033)	9.99 (0.003)	100 (0.000)	37.43 (0.033)	9.67 (0.003)	100 (0.000)	33.48 (0.036)	7.54 (0.002)	100 (0.000)	32.65 (0.036)	7.51 (0.002)
Decile 2	10	60.14 (0.015)	3.88 (0.001)	0.34 (0.001)	53.11 (0.016)	3.11 (0.001)	0.24 (0.001)	49.48 (0.017)	2.68 (0.001)	0.20 (0.001)	22.15 (0.013)	0.64 (0.000)	0.025 (0.000)	18.01 (0.012)	0.40 (0.000)	0.012 (0.000)
Decile 3	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 4	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 5	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 6	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 7	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 8	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 9	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 10	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)

Source: Author's estimation from the CFS 2003/04 and Results from SAMGEM

Note: z = Poverty Line   The respective standard errors are reported in parenthesis at 95% confidence limit

Table 7.11 FGT Poverty Indices under the Base Year and Different Trade Policy Options: Estate Sector

Household Group	Population Share (%)	Base Year (z=Rs. 1570)			SAFTA						Unilateral Trade Liberalisation					
					Short-Run (z=Rs.1560)			Long-Run (z=Rs.1552)			Short-Run (z=Rs.1504)			Long-Run (z=Rs.1494)		
		α =0 (%)	α =1 (%)	α =2 (%)	α =0 (%)	α =1 (%)	α =2 (%)	α =0 (%)	α =1 (%)	α =2 (%)	α =0 (%)	α =1 (%)	α =2 (%)	α =0 (%)	α =1 (%)	α =2 (%)
Total	**100.00**	**24.20** **(0.017)**	**4.93** **(0.004)**	**1.65** **(0.002)**	**23.36** **(0.017)**	**4.66** **(0.004)**	**1.56** **(0.002)**	**23.02** **(0.017)**	**4.48** **(0.004)**	**1.50** **(0.002)**	**17.31** **(0.015)**	**3.44** **(0.004)**	**1.17** **(0.002)**	**16.30** **(0.015)**	**3.27** **(0.004)**	**1.11** **(0.002)**
Decile 1	10	100 (0.00)	35.73 (0.018)	14.74 (0.019)	100 (0.00)	34.76 (0.018)	14.12 (0.019)	100 (0.00)	34.14 (0.018)	13.73 (0.019)	100 (0.00)	29.81 (0.019)	11.24 (0.019)	100 (0.00)	28.91 (0.020)	10.78 (0.019)
Decile 2	10	100 (0.00)	12.09 (0.005)	1.64 (0.001)	100 (0.00)	10.85 (0.005)	1.36 (0.001)	100 (0.00)	9.98 (0.005)	1.18 (0.001)	72.88 (0.057)	4.44 (0.005)	0.37 (0.005)	62.71 (0.063)	3.59 (0.004)	0.27 (0.001)
Decile 3	10	42.37 (0.064)	1.36 (0.002)	0.05 (0.000)	33.89 (0.061)	0.82 (0.002)	0.02 (0.000)	30.05 (0.059)	0.52 (0.001)	0.01 (0.000)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 4	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 5	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 6	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 7	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 8	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 9	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 10	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)

Source: Author's estimation from the CFS 2003/04 and Results from SAMGEM

Note: z = Poverty Line The respective standard errors are reported in parenthesis at 95% confidence limit

FGT decomposition by household groups indicate that, in the rural sector, almost all households belonging to the first decile and 60.14 per cent of the households in the second decile fall below the poverty line in the base year. However, in the short-run, under the SAFTA, all households in the first decile and 53.11 per cent of households in the second decile will fall below the poverty line. Under the unilateral trade liberalisation scenario this is expected to further reduce as figures indicate that all households in the first decile and 22.15 per cent of households belonging to the second decile will fall below the poverty line. Similar to the urban sector, poverty is expected to be reduced further in the long-run under these trade policy options.

Table 7.11 illustrates the poverty profile in the estate sector in Sri Lanka. From the estimated results, it is seen that in the base year poverty head count ratio (α=0), poverty gap (α=1) and poverty severity (α=2) in the estate sector is 24.20 per cent, 4.93 percent and 1.65 percent respectively. It is clear that poverty is highest in the estate sector in comparison to urban and rural sectors in Sri Lanka as indicated by the Kernel density functions in Figures 7.9 -11. The decomposition of FGT indices by household groups (see Table 7.11) indicates that the households belonging to the first three deciles fall below the poverty line in the base year, which means that 100 per cent of households in the first two deciles and 42.37 per cent of the households in the third deciles fall below the poverty line. Under the SAFTA, it is apparent that, in the short-run, the same situation prevails in the first two deciles, however, there is a fall in poverty in households belonging to the third deciles up to 33.89 per cent. However, under the unilateral trade liberalisation, it can be noted that poverty prevails only among the households in the first two deciles and all households in the third deciles are above the poverty line.

By examining the base year (2003/04) poverty profiles in Sri Lanka, it can be seen that poverty in terms of head count ratio (α=0) in the urban sector is the lowest (7.32 per cent) and estate sector is the highest (24.2 per cent) while in the rural sector is 16.02 per cent. DCS (2006/07) noted that the rural population consists of 82 per cent of the total population, reflecting its highest population share, thus the highest number of poor persons is recorded from the rural sector. This is also clear in Table 7.2, as the sample sizes have been selected according to the population size of the respective sectors. As noted in Table 7.11, although poverty in the estate sector is the highest among all three sectors, the estate sector population consists of less than 5 per cent of the total population in Sri Lanka. Overall, there is a higher incidence of poverty in rural provinces (including the estate sector) and the rural sector of Western province in Sri Lanka.

Economic growth in Sri Lanka after trade liberalisation in 1977 has largely been limited to the urban manufacturing and services sector located in the country's Western province, where the capital city is located, leaving agricultural households, especially those in remote provinces with little or no growth in consumption and income.

According to the Central Bank Annual Report of Sri Lanka (2004), the composition of GDP originating from agriculture declined during the last two decades and its contribution to GDP is just over 17 per cent, the share of the industry has been steady at 27-28 per cent, while the service sector is the dominant sector contributing about 54 per cent as a share of GDP. Further, the Central Bank Report explained that the share of employment in agriculture, industry and services was 30.2 per cent, 25 per cent and 44.8 per cent respectively in 2004. By comparing the output and employment structures, it is clear that labour productivity is very low in agriculture, where nearly a one-third of the workers are engaged in producing just one-sixth of the country's added value. Hence, agricultural productivity growth is fundamental for a reduction in poverty levels especially in the rural and estate sectors in Sri Lanka, as nearly 90 per cent of the poor live in the rural agricultural economy.

The World Bank (2007) noted that the estate sector households suffered from disadvantages similar to those of the rural poor households. These include remoteness, poor infrastructural facilities, low level and poor quality education and dependence on agriculture for livelihoods. The only difference between the rural poor and the estate sector households is in access to public health services, which is worse in the estate sector. Hence, it is apparent that one of the main reasons for the high incidence of poverty in the estate sector is associated with lack of mainstream economic infrastructure in such areas in the country.

Almost all countries in the world, including Sri Lanka, have committed themselves to attaining the targets embodied in the MDG by 2015. Eradicating extreme poverty and hunger constitutes the first MDG. For this reason, it is worthwhile to investigate the poverty level over the period 1990-2004 and examine the prospects of Sri Lanka attaining the first MDG of halving the incidence of consumption poverty between 1990 and 2015. Table 7.12 illustrates the poverty trend by sectors and also under different trade policy options as indicated by the poverty head count ratio. In calculating poverty head count ratio at the national level, minimum monthly per capita expenditure Rs. 1526 (see Section 7.4.2) is taken as the poverty line and this is adjusted by changing the CPI for Sri Lanka in calculating poverty head count index under the SAFTA and unilateral trade liberalisation at the national level. According to the results obtained from SAMGEM, under the SAFTA, the estimated national poverty line in the short-run and long-run would be Rs.1517 and Rs. 1512 respectively, and under the unilateral trade liberalisation, the poverty line in the short-run is estimated as Rs.1467 and in the long-run is Rs.1461.

Table 7.12 Poverty Trends by Sectors from 1990-2004 and Under Different Trande Policy Options

Sector	1990/91	2003/04* (Base Year)	SAFTA*		Unilateral Trade Liberalisation*		Target in 2015
	(%)	(%)	SR (%)	LR (%)	SR (%)	LR (%)	(%)
National	**26.1**	**18.3**	**17.7**	**17.4**	**14.3**	**14.2**	**13.1**
Urban	**16.1**	**7.3**	**7.1**	**6.9**	**5.0**	**4.8**	**8.1**
Rural	**29.4**	**16.2**	**15.3**	**14.9**	**12.2**	**11.1**	**14.7**
Estate	**20.5**	**24.2**	**23.4**	**23.0**	**17.3**	**16.3**	**10.2**

Source: Department of Census and Statistics (DCS), based on HIES 1990-91

*Note: Author's estimation from the CFS 2003/04 and Results from SAMGEM

As indicated in Table 7.12, poverty head count ratio in Sri Lanka has declined from 26.1 per cent in 1990/91 to 18.3 per cent in 2004 and this is expected to further decline under the SAFTA and unilateral trade liberalisation. As shown in Table 1.1 in Chapter 1, Sri Lanka had already achieved these targets by 2009/10 except in the estate sector. Hence, it can be seen that Sri Lanka has made a significant progress towards poverty reduction.

The calculated poverty indices (see Tables 7.9 to 7.11) under the SAFTA and unilateral trade liberalisation suggest that there is a reduction in poverty in urban, rural and estate sectors in Sri Lanka. In order to test the significance of the results indicated in Tables 7.9 to 7.11, a “t”statistics were calculated by taking the standard deviations reported in parenthesis for respective poverty indices. These values are reported in Appendix E.3. The critical “t” value, when α=0.025 from the “t” table is 1.96. As the calculated “t” values are greater than this critical “t” value, it can be concluded that the poverty indices reported in Tables 7.9 to 7.11 are significant at the five per cent significance level (95 per cent confidence limit).

7.6 Concluding Remarks

It is widely accepted that trade liberalisation accelerates economic growth which would lead to poverty reduction in developing countries. Sri Lanka has achieved positive economic growth rates over the period 1995-2009, except in 2001 due to the terrorist attacks on Sri Lanka’s international airport and military targets in the USA on September 11 and their aftermath. It is clear that there is a significant reduction in poverty of Sri Lanka over the period of 1990/91 and 2009/10. In applying the results obtained from the SAMGEM to analyse income inequality using S-Gini co-efficients in the DAD programme, the results suggest that the inequality in urban, rural and estates sectors in Sri Lanka, is reduced in overall as well as between different household groups under the SAFTA and unilateral trade liberalisation. It is also suggested that the inequality is highest in the urban and lowest in the estate sector. Furthermore, estimated FGT indices indicate that poverty is highest in the estate sector followed by the rural sector and urban sector. It is also expected that poverty in all three sectors would decline under the two trade policies and poverty reduction is higher under the unilateral trade liberalisation than under the SAFTA. Hence, it is obvious that Sri Lanka is progressing towards achieving the first MDG by 2015.

CHAPTER 8 SUMMARY, CONCLUSIONS AND FUTURE DIRECTIONS

8.1 Introduction

The central concern of this study is to analyse the impact of trade liberalisation in South Asia on key macroeconomic variables, trade, household income distribution, fiscal revenue and welfare of the South Asian economies. It also considers the impact of trade reforms in South Asia on poverty and inequality in Sri Lanka as the country is the pioneer in economic liberalisation in the South Asian region. The thesis was presented in eight chapters.

The introduction of the research problem, the motivation and scientific contribution of the research, the objectives and the methodology are explained in Chapter 1. Chapter 2 provides an overview of the South Asian economies including key economic indicators, trade and investment trends, regional and bilateral trading agreements between South Asian trading partners, and trade and investment policies. To find the link between trade liberalisation, economic growth, household income distribution and poverty, it requires both theoretical and empirical approaches, as well as the methodological review of the analysis of poverty in the CGE modelling framework and the poverty focused CGE models in developing countries. These aspects are examined in Chapter 3 of the thesis.

The theoretical framework of the SAMGEM is developed in Chapter 4. The main contributions of the thesis is the incorporation of the multi-household framework into the standard GTAP model by disaggregating the household sector in South Asian economies based on income classes, allowing, the model to follow the extended representative agent approach in poverty analysis. The important contributions in the SAMGEM are: incorporation of the LES specification to model private household consumption instead of the CDE form in the standard GTAP model and endogenising the poverty lines for South Asian economies using consumer price variations of a selected basic commodity bundle, thus allowing poverty lines to change after trade policy shocks.

Chapter 5 explained the database construction for the model. The main data sources used were the GTAP version 7 database which reflects the 2004 world economy and the household survey data of the respective South Asian economies. The GTAP version 7 database provides input-output tables for 113 countries. The input-output tables of the South Asian economies in the GTAP database were extended and organised according to the SAM framework (McDonald et al., 2007). The equations in SAMGEM are written using the TABLO language in linear form, and implemented the model using the GEMPACK software (Codsi G. and Pearson K.R., 1988).

Chapter 6 presented the results and discussion of trade policy simulations carried out using the SAMGEM in order to determine the link between trade liberalisation, economic growth and household income distribution in South Asian economies. Three policy simulations were carried out using the SAMGEM: SAFTA zero tariff agreement, South Asian customs union and unilateral trade liberalisation in South Asia. These simulations were run to determine the best trade policy option to maximise welfare of the member countries. The model was set up to capture the short-run and the long-run implications of different trade policy options considered for South Asia. In the short-run simulations, the capital stock in each industry is held fixed, while the real rental rate is varied. In the long-run, capital stock is free to adjust in such a way that a fixed real rental is maintained. In the short-run, labour market with perfect competition, the model determines the employment level while holding the real wage rate fixed. Whereas in the long-run, the aggregate employment is assumed to be fixed with the real wage rate determined endogenously. The chapter closes by outlining the sensitivity analysis on different elasticity values to test the robustness of the results generated by the model.

A detailed analysis of poverty and income inequality on the Sri Lankan households was undertaken in Chapter 7 using the DAD programme. This chapter briefly described various poverty and inequality measures, and also explained the method to incorporate poverty analysis into the SAMGEM using the household survey data. Following Decaluwe et al. (1999), this chapter derived various FGT poverty indices and inequality measures during pre and post-liberalisation periods. To compare base year scenario with the post-liberalisation situation for urban, rural and estate sector households, a probability density function was estimated using the Kernel method. The difference in density functions was estimated to reflect the change in poverty by comparing the base year and post-simulation values. A test of statistical significance was also performed to determine the validity of the poverty and inequality indicators.

The remainder of this concluding chapter is organised as follows: Section 8.2 provides the summary of main research findings; Section 8.3 discusses policy implications; the limitations of the study are discussed in Section 8.4; and suggestions for further research are identified in the final section.

8.2 Summary of Major Findings

This section reports the summary of major findings relating to macroeconomic effects, sectoral effects, household effects, fiscal revenue and welfare implications discussed in Chapter 6 to decide the best trade policy option for South Asia. Afterwards, the main findings relating to the impact of trade liberalisation in South Asia on poverty and income inequality of households in Sri Lanka are summarised.

8.2.1 The Impact of Different Trade Policy Options for South Asia

In probing the impact of trade liberalisation on key macroeconomic variables in the short-run, it was revealed that the highest gains in GDP and employment arise under the unilateral trade liberalisation followed by the customs union (except in Sri Lanka where there is marginal increase in real GDP) and the SAFTA. Tariff-cuts under the three trade reforms resulted in a reduction of domestic production costs and CPI; this in turn increased the competitiveness of domestic industries in local and international markets. Hence, it manifested the positive impacts on GDP and employment under all three policy options.

In the long-run, there are higher gains in GDP under the three policy options in South Asian economies except in Sri Lanka where there was a negative outcome under the customs union. The negative impact on Sri Lanka was due to an increase in protection in the manufacturing sector with a common external tariff of 13 per cent. The overall positive impact for the other South Asian economies is the reflection of the reduction in input cost and increase in labour productivity in the long-run. Therefore, as Davis (1996) explicated, trade liberalisation can contribute to economic growth in South Asian economies.

The results under the other important macroeconomic variables such as TOT indicated that, under the SAFTA, TOT deteriorates in the least developed economies (Bangladesh and Rest of South Asia) in the region while in India, Pakistan and Sri Lanka there is an improvement in TOT in the short-run. However, in the long-run, TOT improves only in two largest economies (India and Pakistan). The improvement in TOT was due to the rise in export prices relative to import prices whereas in smaller economies the reverse is the case. Under the customs union, TOT deteriorated in all South Asian economies except in Sri Lanka, in which case there is an improvement in TOT. This was due to a greater reduction in volume of imports relative to export volume and therefore export prices rise relative to import prices under this policy option. It was also noted that under unilateral trade liberalisation TOT declined in all South Asian economies as these economies involve more trading outside the regional trading partners. Hence, under the unilateral trade liberalisation, there was a greater expansion in volume of imports in all countries. Consequently, all these economies need to give up more of their exports to finance their import bills, causing deterioration in TOT.

The industry analysis revealed that the exports of agricultural goods and labour-intensive manufacturing goods increase more rapidly in all South Asian economies (except in Sri Lanka under the customs union) than the capital intensive manufacturing goods under the SAFTA and customs union trade policy options. India is a net exporter of agricultural goods under the SAFTA. The expansion of exports in labour intensive manufacturing industries occurred due to a reduction in cost of inputs and nominal wages in the short-run. Nevertheless, increase in exports in these industries are more pronounced in the long-run than in the short run as these industries reap the benefits of reduction in the input cost combined with efficient utilisation of capital and labour in expanding the output. Yet, in Sri Lanka, under the customs union, imports of most manufacturing goods declined considerably with a common external tariff rate of 13 per cent. This is because Sri Lanka is a low tariff country in comparison to other South Asian economies. Hence, from Sri Lanka's point of view, maintaining a 13 per cent common external tariff is not favourable for manufacturing industries which depend on imported intermediate inputs (for instance ready-made garment industry). Under unilateral trade liberalisation, imports of agricultural and manufacturing goods in all South Asian economies increased more rapidly than exports due to non-discriminatory trade liberalisation. Hence, all these economies are net importers under the unilateral trade liberalisation. For this reason, all South Asian economies experienced a negative trade balance under this policy option.

The projections on intra-regional trade indicated that a full implementation of the SAFTA will ensure the highest level of intra-regional trade followed by the customs union and unilateral trade liberalisation. Therefore, under the unilateral trade liberalisation, there is a potential for South Asian economies to trade more with the rest of the world (e.g. USA and EU). Even though findings revealed that the SAFTA does not boost intra-regional trade level significantly, one cannot conclude that SAFTA does not generate benefits to regional trading partners. This is because, there exists some evidence that official accounts of South Asia's international trade statistics are flawed due to the high incidence of informal trade between India and its neighbours. Hence, South Asian countries need to eliminate both tariff and non-tariff barriers as well as enhance trade facilitation in the region to reap the maximum benefits from the SAFTA.

In the household sector, nominal household income depends on both the nominal return to factors and factor employment. Under the SAFTA, unskilled labour in rural households benefit more than that of urban household in all South Asian economies and the urban richer households were expected to gain more from skilled labour and capital. In the short-run, an increase in labour income was due to increase in employment. To maintain the fixed real wages in the short-run, nominal wages must decline in line with the reduction in CPI. Capital income increases as a result of an increase in nominal rental rate while the capital stock is held fixed in the short-run. In the long-run, increase in labour income is the reflection of a rise in the nominal wages when labour employment is fixed. Capital owners will benefit due to a rise in capital stock when the nominal rental rate declined in line with CPI to maintain the fixed real rental rate. The government transfers to households decline under the SAFTA, particularly in the rural households compared to the urban households in all South Asian economies except in India and Pakistan. Increase in government transfers to Indian and Pakistani households was due to slight increase in CPI and price of savings contrary to the other regional trading partners. Overall, the long-run gains are greater than that of the short-run to all household groups under this policy. Hence, as predicted by the H-O theory, it can be concluded that income inequalities may narrow in all South Asian economies under the SAFTA policy.

Under the customs union, Indian households benefit mainly from skilled labour and capital in the short-run as a result of increased demand for capital intensive goods such as motor vehicles and parts, machinery and equipment, and transport equipment, by the South Asian regional partners and rest of the world. Additionally, low income household groups in the rural sector and the urban sector also benefit marginally from increased unskilled labour income due to increases in exports of labour intensive goods, thereby causing slight increases in employment of unskilled labour in the short-run. However, in the long-run, the models results showed that imports of agricultural goods increased more rapidly than exports, causing decreases in income from unskilled labour and capital. This is because unskilled labour and land owners earn more of their income from the agricultural sector. Hence, if India maintains a common external tariff of 13 per cent, income from unskilled workers and owners capital (including land) may be adversely affected in the long-run. Government transfers to households also declined under this policy due to a reduction in CPI and price of savings. Hence, in the long-run, income inequality may widen in India under the customs union.

Similar to India, owners of capital and skilled labour in Pakistan mainly benefit in the short-run under the customs union, due to higher import of agricultural and labour intensive manufacturing goods. In the long-run, income from all factors increases as result of expansion in both the agriculture and manufacturing sectors. There is a reduction in government transfers especially to rural sector households due to a greater fall in CPI under this policy option. Hence, in Pakistan, income inequality may narrow under the customs union with a common external tariff of 13 per cent in the long-run. Conversely, there was a negative impact on all sources of factor income accrued to Sri Lankan households under the customs union both in the short-run and long-run with a common external tariff of 13 per cent, mainly due to increases in the cost of imported intermediate goods used in the production of manufacturing goods. There is also a decline in government transfers to households due to reduction in CPI and price of savings. Therefore, the income inequality may be widening in Sri Lanka under this policy option.

Under the customs union, rural Bangladeshi households gained more from increases in unskilled labour income whereas urban households benefited more from increases in skilled labour income and capital both in the short run and long run. In addition, the government transfers to all households will decline due to a reduction in CPI and price of savings. Overall this policy favours Bangladeshi households by narrowing down income inequality. The rest of South Asia includes all small economies in the region, and households of such economies benefit more in the short run under the customs union policy than in the long-run. This is because these economies will be faced with higher competition exerted from the larger economies in the region as well as the rest of the world. Therefore, it is possible to see income inequality worsening in smaller economies in the region in the long-run.

Under unilateral trade liberalisation, household income from unskilled labour in India, Pakistan and Sri Lanka declined in the short-run. However, there has been a marginal increase in income from skilled labour and capital in India. Although employment increases, nominal wages decline substantially due to a large reduction in the CPI. On the other hand, household income from all sources in these economies increased in the long-run due to increase in the efficiency of resource allocation. With regard to least developed economies in the region (Bangladesh and Rest of South Asia), the findings reveal that household income from all sources increase both in the short-run and the long-run. Increase in income from labour in the short-run is due to a large increase in employment, which may offset the reduction in nominal wages. In the long-run, improvement in efficiency in utilisation of both capital and labour increases income from labour and capital. Additionally, unskilled labour in rural households benefits more while urban richer households gain more from skilled labour and capital in the long-run in all these economies. It is also noted that government transfers to all households declined due to a reduction in CPI. Thus, income disparities in all South Asian economies may fall under the unilateral trade liberalisation in the long-run.

The Real household consumption in all South Asian economies increases under all three trade policy options except in Sri Lanka where there is a decline under the customs union policy. Nominal consumption depends on change in disposable income whilst change in nominal income directly affects change in disposable income. Therefore, a change in nominal income influences change in nominal consumption and the reduction in CPI due to trade liberalisation causes an improvement in real consumption.

The fiscal revenue of all South Asian countries deteriorates under unilateral trade liberalisation due to non-discriminatory trade liberalisation. Under this policy, tariff revenue from imported goods declines substantially in all economies causing reductions in government revenue. In the case of customs union policy, there is a reduction in government revenue in Bangladesh and Rest of South Asia while there is a positive impact on government revenue in India and Sri Lanka in the short-run. The increase in government revenue in Sri Lanka was due to increase in price of imports with a common external tariff of 13 per cent while for India, total fiscal revenue increases due to an increase in volume of imports. Additionally, in Pakistan there is a marginal increase in fiscal revenue under the customs union in the long-run. Moreover, under the SAFTA, there is a reduction in government revenue in Sri

Lanka, Bangladesh and Rest of South Asia whereas there is a positive impact on government revenue in India and Pakistan as they trade less with the regional trading partners.

The estimated level of welfare as a percentage of total regional income indicated that smaller economies (Bangladesh and Rest of South Asia) gain more than larger economies in the region (India, Pakistan and Sri Lanka). Moreover, the long-run gains are higher for India, Pakistan and Sri Lanka when compared to the short-run gains. Nevertheless, smaller economies stand to gain more in the short-run than in the long-run under all three policy options due to high competition exerted from other trading partners in the world. It was also noted that unilateral trade liberalisation ensures the highest welfare gains to all South Asian economies, followed by the customs union (apart from Sri Lanka) and the SAFTA. Hence, the findings of the present study are consistent with those who hold the moderate view (Srinivansan and Canonero, 1993; Srinivansan, 1998) of the SAFTA who suggest that unilateral trade liberalisation would yield more gains for the region than from preferential trade liberalisation in South Asia.

8.2.2 The Poverty and Income Inequality Impacts of South Asian Trade Liberalisation on the Sri Lankan Economy

This section addresses the issues of poverty and income inequality for Sri Lanka by comparing the pre and post simulation policies of SAFTA, and unilateral trade liberalisation in South Asia because they predict a more favorable result for Sri

Lankan households. Lorenz curves for the base year showed that the inequality is highest in the urban sector compared to the rural and estate sectors followed by the rural sector and the estate sector. The two Lorenz curves under the SAFTA and unilateral trade liberalisation indicate a negative difference (between the pre and post simulation) for all households groups in urban, rural and estate sectors in Sri Lanka. This indicates that under these two trade policy options, income inequality is reduced in Sri Lanka while unilateral trade liberalisation showed a higher reduction in inequality than under the SAFTA. This is further confirmed by the estimated S-Gini coefficients which reflect that under the SAFTA and unilateral trade liberalisation there is a reduction in estimated S-Gini index. This long term effect of trade liberalisation is consistent with the H-O-S theorem. The U shape difference between Lorenz curves indicates that there is a redistribution of income from rich to poor households under the two trade policy options.

The poverty head count ratio in the base year is the highest for the estate sector while it is lowest in the urban sector. The decline in poverty in all three sectors under the two trade policies is evident in the FGT indices. The poverty reduction is higher under unilateral trade liberalisation than under the SAFTA. In Sri Lanka, poverty is predominant in the rural and the estate sectors and the results suggest that Sri Lanka can achieve significant progress towards poverty reduction as a result of implementing trade reforms.

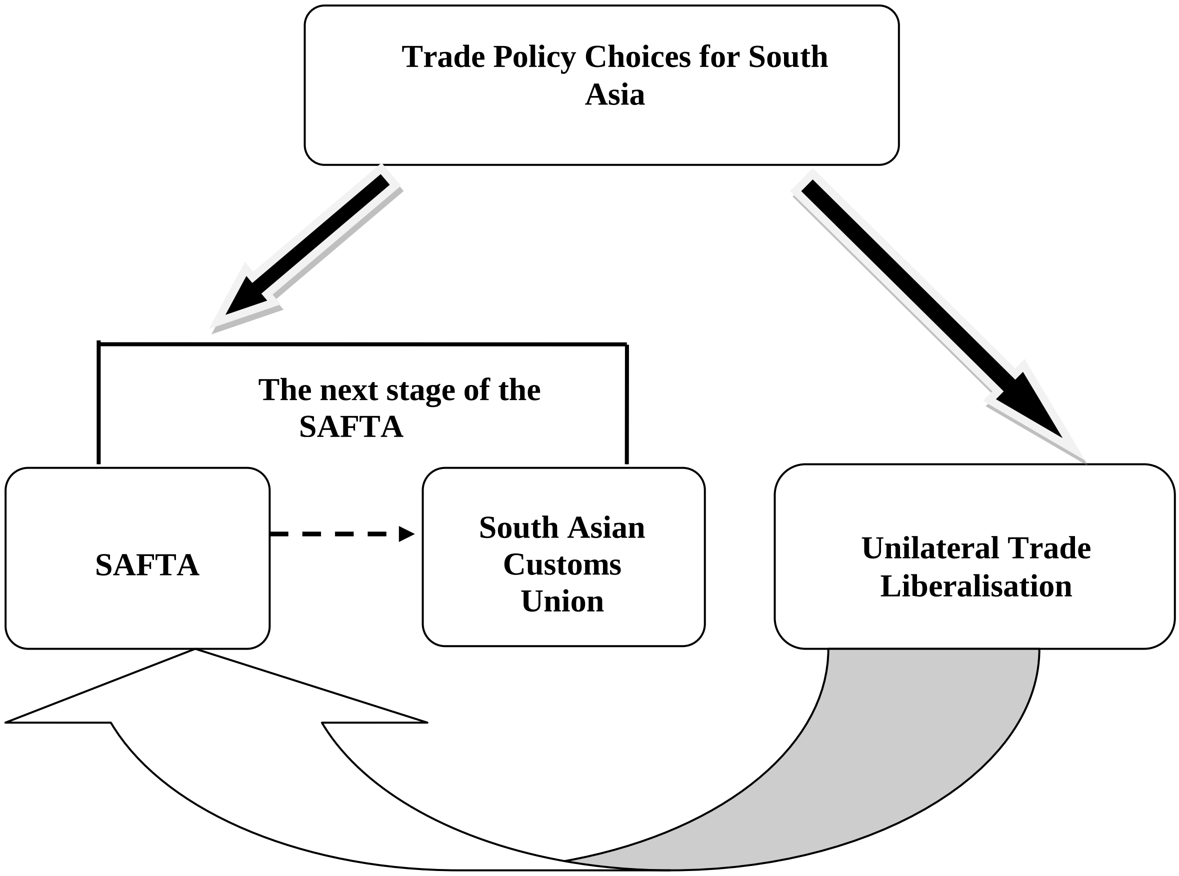
8.3 Policy Implications

The following policy recommendations may be useful for the governments of South Asian economies in deciding the best trade policy options for South Asian economies. The income distribution analysis may also help Sri Lankan policy makers in making appropriate decisions to minimise income inequality and poverty in Sri Lanka.

8.3.1 Best Trade Policy Options for South Asia

Welfare is predicted to be highest under the unilateral trade liberalisation for all trading partners, followed by the customs union (except in Sri Lanka) and the SAFTA. The intra-regional trade is higher under the customs union policy than the unilateral trade liberalisation approach but is the highest under the SAFTA. Although SAFTA does not bring significant welfare gains for member countries, it could bring spillover benefits (improvement in infrastructure, benefits of economies of scale and new technology) which are beyond those declared in the agreement. Therefore, SAFTA is preferable as a pathway to coordinating liberalisation in the region. As Pitigala (2005) noted, it is doable to continue the process of unilateral trade liberalisation in parallel to regional integration in South Asia, which will help to improve both extra-regional and intra-regional trade in the economies in South Asia. Figure 8.1 below portrays the proposed trade policy directions for South Asia.

Figure 8.1 Trade Policy Options for South Asia



Unilateral Trade Liberalisation to Strengthen the Trade Capacity in South Asia

The above diagram recommends that South Asian economies promote unilateral trade liberalisation in each individual economy. Since South Asian economies trade more with other industrialised countries (EU and USA) in the world, unilateral trade liberalisation may enhance the trade capacity in these economies. This will eventually enhance trade among regional trading partners and may help in boosting the intra-regional trade level. Being the largest economy in the region, India should initiate policies to accelerate regional economic co-operation in South Asia. The political conflicts between India and Pakistan should be resolved and these two economies should cooperate to make the SAFTA a success. For deeper integration levels like customs union, common external tariff rate should be a consensus for all regional trading partners. The 13 percent common external tariff rate is not in Sri Lanka's interest, so the Sri Lankangovernment needs to bargain for a reasonable common external tariff rate, which is favourable to the country.

Additionally, several policy recommendations can also be made to lessen poverty and income distribution gaps in South Asian economies in light of the trade policy directions discussed in this study. The results indicated that the three trade policies positively contribute to economic growth and that they do not conflict with the poverty reduction aims in South Asian economies. However, it is worth noting that, although trade liberalisation can help to reduce poverty, it may not be the magic bullet against poverty reduction (Khan, 2005). Therefore, other growth-enhancing reforms need to be pursued along with recommended trade policies to reap the maximum benefits of implementing such trade reforms to alleviate poverty in the region. In that vein, the following strategies can also be proposed for the governments of South Asian economies to reduce income distribution gaps and poverty in the region.

The development of industries will no doubt create more employment opportunities, thereby raising income levels of the citizens, which also helps to alleviate poverty in the region. The results demonstrate that the export and import of agricultural goods increase in all South Asian economies under the three policies but net agricultural export remains negative, except in India under the SAFTA. Hence, there is a need to make effective use of the land and large labour endowments to increase productivity and exports of the agricultural sector in order to reduce poverty, as a significant proporiton of the poor in the region depend on the agricultural sector. In 2009, the agricultural sector employed 55 per cent of the regional labour force but it only contributed 18 per cent of GDP (World Bank, 2010).

At present, the pattern of agricultural trade in the region focuses on a few traditional crops such as rice, wheat, cereals and grains. The results show increase in exports of vegetables, fruits, oil seed and vegetable oil, meat and fish, dairy products and other food products under the three policy options. In developing countries, increase in urbanisation and income growth is likely to increase demand for high value-added agricultural products (ready-to-eat food such as canned fruits, frozen vegetables etc.). South Asian economies can take advantage of this trend through diversification of the agricultural sector. As the World Bank has pointed out, the region also needs to improve and expand irrigation and water conservation systems to get good harvests, introduce modern farming technologies, improve investment climate, marketing infrastructure (improve rural roads to facilitate easy access to markets) and develop services to enhance market efficiency. Further, it is important to focus on building capacity to meet emerging challenges such as food safety and sanitary standards in these economies.

The manufacturing exports account for nearly 80 per cent of labour intensive items dominated by textile and wearing apparel, paper products, leather products, metal product in South Asian economies. The results indicate a greater potential for increasing exports of these products as a result of trade liberalisation.

The ready-made garment industry is one of the most important industries for all South Asian countries. However, these economies import textiles and other intermediate inputs from the East-Asian economies such as China, South Korea and Hong Kong in the process of manufacturing wearing apparel. Therefore, it is important to focus on developing the textile industry to establish a complementary trade structure and thereby increasing intra-regional trade. South Asia has a natural advantage in producing textiles, yarn, fabric and cotton, which are most important raw materials for the industry (for instance India, Pakistan and Bangladesh have strong base for raw materials in producing textiles). Since the region has abundant cheap labour to work in this industry, it is advantageous for textile entrepreneurs to modernise their plants to be competitive with the other textile manufacturers in the world. Also it is essential to train employees working in this industry to use new methods of knitting, sewing and weaving textiles

In most of the South Asian economies, food products, metal products, plastic and rubber products are manufactured by Small and Medium scale Enterprises (SME). Hence, the governments need to provide some assistance to SMEs by introducing new methods to produce value-adding products, finding markets for their products and assisting them to obtain credit facilities at concessionary terms. The results under the three trade policies demonstrate that, in the long-run, the relative cost of capital becomes lower compared to the cost of labour. Governments in South Asian economies therefore should encourage entrepreneurs who are engaged in the manufacturing sector to use more capital-intensive techniques to be cost competitive in the long-run.

The findings also indicate that there exists possible opportunities to export electricity and gas by Rest of South Asia and Bangladesh respectively. South Asian region comprise 22 per cent of the world population and more than half of the population lives without the use of commercial energy (Dhungel, 2008). In fact, this is a serious impediment to accelerate economic activities in these economies (India, Pakistan, Bangladesh and Nepal) as there is a low level of per capita energy consumption. Therefore, regional co-operation in energy supply is essential to help such economies to increase their access to low cost energy. For instance, Bhutan is in a great position to export hydroelectricity to other South Asian countries through India. Similarly, Bangladesh is endowed with gas reserves which can be utilised to address the energy crisis in South Asia.

The results show that there is a greater prospect of expanding export of services such as communication and r under the customs union and unilateral trade liberalisation in all South Asian economies than under the SAFTA policy. The services sector is rapidly growing in South Asia and accounts for 55 per cent of the contribution to regional GDP in 2009 (see Table 2.3). South Asian economies have a higher potential for developing tourism in the region, which in turn helps to enhance skills of the labour force and also generate employment opportunities. For instance, special tourism initiatives can be seen in India (diverse historical and cultural attractions, mountain ranges, beaches and wild life), Sri Lanka (Buddhist heritage, beaches, and waterfalls), Bhutan (high value added tourism) and Nepal (Buddhist heritage and majestic mountains)[34] to promote tourism in these countries. Also it is important to note that South Asian countries have a scope (India, Maldives, Nepal and mountain territories of Northern Pakistan) of promoting medical tourism and ecotourism, which have a greater potential to attract international tourists.

In addition, these economies should liberalise their financial markets, create conducive business environment and introduce methods to minimise transaction costs to encourage foreign participation in the ICT sector. This may also help to generate employment opportunities for various sections of the society from high-skilled to semi-skilled workers and also help industries to gain speedy access to the world market in trading their goods and services.

Another important finding of the study was the reduction in government revenue due to trade liberalisation. Therefore, recovering the revenue loss as a result of tariff reduction is one of the major concerns of many developing countries (Haque and Mukherjee, 2006). Hence, South Asian governments need to devise proper mechanisms to compensate their loss of total revenue following trade liberalisation.

[34] Centre for Policy Dialogue (2010), http://www.cpd.org.bd/

As McCulloch (2005) noted, these economies can introduce replacements taxes such as taxes on consumption (sales or value added taxes), income or capital. However, it is important to consider the impact of different replacement taxes on growth and distribution; as such taxes may adversely affect low-income groups which in turn increase poverty. Also it is necessary to strengthen the domestic tax administrative systems in order to collect tax revenue not only equitably but also in effective and efficient manner.

The results show that under the three trade policy options, there is a reduction in government transfers to all household groups in South Asian economies (expect in India and Pakistan under the SAFTA). The decreases in government transfers are greater in the case of rural poor households than that of urban richer households as the rural poor are more reliant on government transfers. Hence, appropriate safety nets are needed to mitigate the vulnerability of low-income households, especially in the rural sector. Babu (2003) pointed out that social safety nets should be designed targeting various objectives and, depending on such objectives, they can be classified into income transfers through cash, food related transfer programmes, prices subsidies, human capital related social safety nets, public work programmes and micro-credit programmes. As Winters (2000) noted, safety nets are better targeted compensatory policies to address poverty issues as they are not very distortionary of market forces. Further, Winters noted that the expenditure on safety nets is generally counter-cyclical and therefore governments need to ensure that the money does not dry up in times of greatest need. Even though these safety net progammes have been in place in most

South Asian economies, the progress on this front has been too slow. Hence, it is recommended that the Governments of South Asian economies design proper safety net programmes as a part of the context of trade liberalisation that may create short-term poverty and decide the amount to be spent on such programmes, method of raising funds for instance; reallocation from other expenditure, foreign grants, increase in tax revenue and loans.

The above mentioned policy recommendations would assist governments in South Asia to promote trade among the regional trading partners as well as countries outside the region, and also such policies may help to alleviate poverty in the region.

8.3.2 Policies to Reduce Poverty and Income Inequality Gap in Sri Lanka

Trade liberalisation in Sri Lanka has a number of favourable impacts. The Sri Lankan government and policy makers should therefore transfer the benefits of trade liberalisation to the less developed and economically backward regions in rural and estate sectors (Central, Sabaragamuwa, Uva and Southern provinces) where most of the poor people are living in the country.

Moreover, clear and focused initiatives are needed to enhance productivity in the agricultural sector accompanied by infrastructure development, which are especially important in the rural and estate sector provinces. In this case policy makers need to have a clear focus on the question of equity versus efficiency; that is, recognising the tradeoff between investing scarce resources in projects to uplift remote areas or investing in more profitable projects in urban growth centers.

McCulloch et al. (2001) explain that in order to yield stronger results from an open trade regime, such policies must be accompanied by appropriate complementary policies, such as education, security well being, infrastructure, financial and macroeconomic policies. They also described that the precise mix of trade and other policies which are needed will depend on the specific circumstances of each country. Hence, it is important that policy makers in Sri Lanka focus on the detailed pathways through which trade liberalisation can have a positive impact on the poor and distribute benefits from trade liberalisation more fairly among all parties in the country to eradicate inequality and poverty from Sri Lanka.

8.4 Limitations of the Study

There are at least two aspects of the present study that have limitations. They are: the database used for the empirical implementation of the model and the specifications of the theoretical structure of the model.

8.4.1 Database of the Model

The present study is mainly based on the GTAP version 7 database which reflects the world economy in 2004. Therefore, changes in the world economy in recent years (from 2005–2011) are not taken into account. The GTAP version 7 database was the latest database available at the time of model implementation which reflected the world economy and was therefore well suited to formulate a muti-country CGE model. In disaggregating the GTAP 7 database, the study employed the household survey data of South Asian economies and the survey years also chosen to be 2004/2005 as to be consistent with the GTAP 7 database.

In disaggregating the household income, five factors of the GTAP database have been aggregated into three factors: unskilled labour, skilled labour and capital and the capital include both land and natural resources. It is appropriate to consider income from land as a separate source of income as poor households in the rural sector draw a significant proportion of their income from land. However, there is no common basis to separate income from land pertaining to all South Asian economies; thus, it was taken as part of capital. Additionally, all unskilled labour and skilled labour types in the household survey data were aggregated into unskilled labour and skilled labour under different household groups. This is also due to lack of common basis for disaggregating different labour types that are common to all South Asian economies in the household survey data. Hence, the database of the model can be improved by allocating income from land into different household groups and disaggregating unskilled and skilled labour by occupational types.

Furthermore, the elasticity values used in the present study have not been econometrically estimated by using time series and cross-sectional data for South Asian economies. Rather, these values have been extracted mainly from the GTAP database and other related studies. One major limitation of this approach is that policy implications are likely to be altered with the varied values. Although the sensitivity analysis revealed that the results of the policy simulations were generally robust with respect to Armington elasticities and elasticity of substitution between primary factor inputs, one still needs to interpret the simulation results with caution.

8.4.2 Theoretical Structure of the Model

There are certain limitations related to the structure of the SAMGEM. Firstly, the analysis of different trade policies carried out in this study is comparative static in nature, which means that the model results show the difference between two alternative future situations. Such a static model does not edongenuously exemplify the adjustment path to a new equilibrium condition. Even by using detailed closures (with regard to assumptions about factor market, for instance with or without fixed usage of capital), it could only differentiate between short-run and long-run equilibrium. A model like SAMGEM, therefore, does not track variables over time, hence, it is unable to capture the effects of increasing returns to scale, technological externalities and spillovers which may contribute to long-run economic growth due to trade liberalisation. Conversely, in a dynamic model, all variables have time subscripts. This kind of model has the capability to capture each variable over time and will be able to trace both the short-run and long-run impacts of trade reforms on the growth path through the capital accumulation effects. Adopting a dynamic CGE model for South Asia to analyse the impact of different trade policy options on household income distribution and poverty would enable the determination of a transition path of changing household income and expenditure patterns over time, thus, determining the impacts of policy shocks appropriately. However, developing such a dynamic multi-country CGE model demands more data on savings and investments in all countries in the South Asian region and the rest of the world.

NTBs are assumed to remain absent in all policy simulations. Hence, in its present form, the model cannot estimate the impact of these NTBs unless they are converted into equivalent tariffs using some sort of approximation. Chapter 2 noted that most South Asian economies removed a large number of NTBs after they liberalised their economies in the 1990s. Thirdly, as in the standard GTAP model, SAMGEM does not contain nominal exchange rates and has a single global numéraire (McDonald et al., 2007). Therefore, introduction of equations to represent exchange rate implications would be an important extension of the model.

Finally, in predicting poverty and income inequality impacts of trade reforms, the present study employed the ERA approach which assumed that following a trade policy shock, the mean income of the particular household group changes while the variance remains fixed. This assumption disregards the variance of the intra-group distributions, hence, estimations may be biased. A better way to predict the poverty and income inequality impacts of trade reforms would be to follow the micro-simulation approach which considers the individual heterogeneities, which is more commonly used in a single country framework and has not yet been used in a multi-country CGE framework.

This sort of model needs econometric estimation of household behavioural equations, which in turn needs data at the individual household level for all South

Asian economies that are difficult to obtain. Despite these limitations, the present study makes some important contribution to the growing literature on impact of trade liberalisation on household income distribution and poverty in South Asian economies.

8.5 Directions for Future Research

A number of extensions can be proposed for future research. SAMGEM has been formulated in a static framework, which can capture only the economic impact of trade reforms for a single point in time, either short run or long run. The model could be modified by incorporating a dynamic structure which is extremely useful in determining the overall economic development growth path, thereby enabling South Asian policy makers to make valuable decisions, particularly relating to attracting more investments into the region, which would result in generating more employment opportunities and reducing poverty in the region.

Another direction of extending the model is to add imperfect competition into the factor market, mirroring the real world, particularly as labour markets are seldom perfectly competitive. This could be extended by incorporating earning differentials among various occupational groups; hence, the labour market modelling could be a new research area for the South Asian region. In a region like South Asia, there is abundant unskilled labour who continues to migrate from rural to urban areas seeking employment. Therefore, it is imperative to classify labour by the occupation in urban and rural areas and capture the impact of trade reforms on rural–urban migration.

Another aspect of extending the model is the analysis of poverty and inequality based on gender. Women in South Asian economies face triple discrimination of class, caste and gender (Upadhyaya, 2008). Hence, the model could be improved by taking gender inequality into consideration, which could analyse the mechanisms through which trade policy reforms affect poverty and how men and women experience poverty differently in different geographical areas in South Asian economies.

To conclude, formulating a multi-country CGE model for South Asia by incorporating the micro-simulation approach could provide a more comprehensive analysis of poverty and inequality in such economies. This kind of model would capture individual heterogeneity in terms of consumption preferences and sources of income, and hence, would be able to better capture the poverty and income equality effects of trade liberalisation in South Asia.

REFERENCES

Abayawardana, S., and Hussain, I. (2002). *Water Health and Poverty Linkages: A Case Study from Sri Lanka*. Paper presented at the Asian Development Bank Regional Consultancy Workshop on Water and Poverty, Dhaka.

Ackah, C., Bussolo, M., De Hoyos, R., Ferreira, F., and Medvedev, D. (2008). A New Dataset on Global Income Distribution. Retrieved from http://web.me.com/rafadehoyos/Rafael_de_Hoyos/Research_files/WB110_GATPN_CH01.pdf [Accessed 10-05-2010].

Adams, P. D. (2005). Interpretation of results from CGEmodels such as GTAP. *Journal of Policy Modeling, 27*(8), 941–959.

Adelman, I., and Robinson, S. (1977). Income Distribution Policy in Developing Countries: A Case Study of Korea: Stanford, Stanford University Press.

Adhikari, R., and Weeratunge, C. (2006). Textiles & clothing sector in South Asia: coping with post-quota challenges. *Multilateralism at Cross-roads: Reaffirming Development Priorities', South Asian Yearbook of Trade and Development*.

Agénor, P. R., Chen, D. H. C., and Michael, G. (2004). Linking Representative Household Models with Household Surveys for Poverty Analysis A Comparison of Alternative Methodologies *World Bank Policy Research, Working Paper No. 3343* Washinton D.C.

Aggarwal, A. (2008). Regional Economic Integration and FDI in South Asia : Prospects and Problems. Retrieved from http://www.icrier.org/pdf/Working_Paper_218.pdf [Accessed 08-07-2010]

Aghion, P., Caroli, E., and Garcia-Penalosa, C. (1999). Inequality and economic growth: the perspective of the new growth theories. *Journal of Economic Literature, 37*(4), 1615-1660.

Ahluwalia, I. J., (2004). Economic Cooperation in South Asia, Indian Council for Research on International Economic Relations (ICRIER), New Delhi, India. Retrieved from http://www.jbic.go.jp/en/research/report/research-paper/pdf/rp16_e09.pdf [Accessed 04-12-12].

Akhter, N. and E. Ghani (2010). "Regional Integration in South Asia: An Analysis of Trade Flows Using the Gravity Model." Pakistan Development Review 49(2): 105.

Alfaro, L. (2003). Foreign Direct Investment and Growth: Does the Sector Matter? *Harvard Business School, Working Paper.*: Harvard University.

Annabi, N., Cisse, F., and Cockburn, J. (2005). Trade Liberalisation, Growth and Poverty in Senegal: A Dynamic Microsimulation CGE Model Analysis (CIRPEE Working Paper 05-12,). Retrieved from http://www.cirpee.org/fileadmin/documents/Cahiers_2005/CIRPEE05-12.pdf [Accessed 04-10-2010]

Annabi, N., Khondker, B., Raihan, S., Cockburn, J., and Decaluwe, B. (2006). Implications of WTO Agreements and Unilateral Trade Policy Reforms for Poverty in Bangladesh: Short versus Long-Run Impacts. Retrieved from http://library1.nida.ac.th/worldbankf/fulltext/wps03976.pdf

Araar, A., and Duclos, J. Y. (2009). DAD: A software for poverty and distributive analysis. *Journal of Economic and Social Measurement, 34*(2), 175-189.

Aredo, D., Fekadu, B., and Kebede, S. W. (2011). Trade Liberalization and Poverty: A macro-micro Analysis in Ethiopia. Retrieved from http://www.diw.de/documents/vortragsdokumente/220/diw_01.c.375884.de/v_2011_kebede_trade_eea.pdf [Accessed 25-11-2011].

Armington, P. A. (1969). A Theory of Demand for Products Distinguished by Place of Production *IMF Staff Papers* (Vol. 16, pp. 159-178): IMF.

Armstrong, P., and Burger, C. (2009). Poverty, inequality and the role of social grants: An analysis using decomposition techniques. *Working Papers*.

Asian Development Bank. (2006). Asian Development Outlook, 2006. .

Asian Development Bank. (2007). Statistical Database System.

Athukorala, P. (2006). Product Fragmentation and Trade Patterns in East Asia. *Asian Economic Papers, 4*(3), 1-27.

Athukorala, P. (2012). Sri Lanka's Trade Policy: Reverting to Dirigisme?, Working Papers in Trade and Development, Australian National University, Retrieved from http://www.crawford.anu.edu.au [Accessed 30-11-2012].

Atkinson, A., and Sutherland, H. (1988). Tax Benefit Models. London: Suntory and Toyota International Centres for Economics and Related Disciplines.

Atkinson, A. B. (1970). On the Measurement of Inequality. *Journal of Economic Theory, 2*, 244-263.

Azariadis, C., and Stachurski, J. (2005). Poverty traps. *Handbook of economic growth, 1*, 295-384.

Babu, S. C. (2003). Social Safety Nets for Poverty Reduction in South Asia – Global Experiences. *Sri Lankan Journal of Agricultural Economics, 5*(1), 1-8.

Bandara, J. (1991). Computable General Equilibrium Models for Developing Policy Analysis in Less Developed Countries. *Journal of Economic Surveys, 5*(1), 3-68.

Bandara, J. (1989). *A Multi Sectoral General Equilibrium Model of the Sri Lanka Economy with an Application to the Effects of External Shocks.* (PhD), La Trobe University, Melbourne.

Bandara, J. S., and Wusheng, Y. (2003). How Desirable is the South Asian Free Trade Area? A Quantitative Economic Assessment. *The World Economy, 26*(9), 1293–1323.

Bandara, J. S. (2009). Trade and Poverty in South Asia: An Interpretive Survey. Discussion Papers in Economics.

Bandara, J. S. (2009). Playing with numbers: a critical evaluation of quantitative assessments of South Asian regional intergration. *Economic and Political Weekly*, 44(48), 67-75.

Bandara, J. S. (2011). “Trade and Poverty- Theory, Evidence and Policy Issues”, in Bandara, J.S., Athukorala, P., and Kelegama, S.(Eds) *Trade Liberalisation and Poverty in South Asia*, London: Routledge, 17-36.

Bangladesh Bureau of Statistics. (2004/2005). Household Expenditure Survey

Bannister, G. J., and Thugge, K. (2001). *International trade and poverty alleviation*: International Monetary Fund.

Barro, R. J. (2000). Inequality and Growth in a Panel of Countries. *Journal of Economic Growth, 5*(1), 5-32.

Basmann, R. L., Hayes, K. J., Slottje, D., and Johnson, J. (1990). A general functional form for approximating the Lorenz curve. *Journal of econometrics*, *43*(1), 77-90.

Bautista, R. M., and Thomas, F. (1997). Income Effects of Alternative Trade Policy Adjustments on Phillippine Rural Households: A General Equilibrium Analysis *IFPRI TDM Discussion Paper 22.*

Baxter, M., and King, R. G. (1993). Fiscal policy in general equilibrium. *The American Economic Review*, 315-334.

Bayar, A., and Smeets, B. (2009). Government Deficits in the European Union: An Analysis of Entry and Exit Dynamics. (Cesifo Working Paper No. 2703). Retrieved from www.CESifo-group.org/wp [Accessed 10-05-2010]

Baysan T, Panagariya A, and Pitigala N. (2006). Preferential Trading in South Asia,World Bank Policy Research, Working Paper – 3813. Retrieved from siteresources.worldbank.org/.../34004126.../SAFTApaper.pdf [Accessed 16-12-2011].

Bevan, D. L., Collier, P., and Gunning, J. W. (1987). Consequences of a commodity boom in a controlled economy: Accumulation and redistribution in Kenya 1975–83. *The World Bank Economic Review, 1*(3), 489-513.

Bhagwati, J. (1994). Free Trade: Old and New Challenges. *The Economic Journal, 104*(423), 231-246.

Bhagwati, J. N. (2008). *Termites in the Trading System: How Preferential Agreements Undermine Free Trade*. Oxford: Oxford University Press.

Boccanfuso, D., Decaluwe, B., and Savard, L. (2002). *Poverty, Income Distribution and CGE Modeling: Does the Functional Form of Distribution Matter*. CREFA, University of Laval.

Boccanfuso, D., and Savard, L. (2001). A methodological note on computing FGT indicators from CGE models: Citeseer.

Borraz, F., Ferrés, D., and Rossi, M. (2012). Assessment of the distributive impact of national trade reforms in Brazil. *Journal of Economic Inequality*, 1-21.

Bouët, A. (2008). The Expected Benefits from Trade Liberalization - Opening the Black Box of Global Trade Modelling. (Washington DC, IFPRI Food Policy Review 8.). Retrieved from http://www.ifpri.org/sites/default/files/publications/pv08.pdf [Accessed 05-05-2010].

Bouët, A., Mevel, S., and Thomas, M. (2010). Is SAFTA Trade Creating or Trade Diverting? A Computable General Equilibrium Assessment with a Focus on Sri Lanka. Retrieved from http://www.ifpri.org/sites/default/files/publications/ifpridp00950.pdf [Accessed 04-05-2011]

Bourguignon, F., Michel, G., and Miqueu, D. (1983). Short-Run Rigidities and Long Run Adjustments in a Computable General Equilibrium Model of Income Distribution and Development. *Journal of Development Economics, 13*(1-2), 21-43.

Bourguignon, F., and Morrison, C. (1990). Income Distribution, Development and Foreign Trade: A Cross-sectional Analysis. *European Economic Review, 34*(6), 1113-1132.

Bourguignon, F., Robilliard, A. S., and Robinson, S. (2003). Representative versus real households in the macroeconomic modelling of inequality. Retrieved from http://dial.prd.fr/dial_publications/PDF/Doc_travail/2003-10.pdf [Accessed 06-08-2010]

Bourguignon, F., and Spadaro, A. (2006). Microsimulation as a Tool for Evaluating Redistribution Policies: Society for the Study of Economic Inequility.

Brockmeier, M. (2001). A Graphical Exposition of the GTAP Model: Center for Global Trade Analysis, Purdue University, West Lafayette,IN.

Brown, Alan, and Deaton, A. (1972). Survey of Applied Economics: Models of Consumer Behaviour. *Economic Journal*(82), 1145–1236.

Burney, N. A., and Khan, A. H. (1991). Household Consumption Pattern in Pakistan: An Urban Rural Comparison Using Micro Data. *The Pakistan Development Review, 30*(2), 145-171.

Castro, R., and Devarajan, S. (2006). Unleashing Sri Lanka's Potential, Retrieved from www.cbsl.gov.lk/pics_n_docs/02_prs/_.../publec_20060629.doc [Accessed 30-11-2012].

Centre for Policy Dialogue. (2010). Human Development in South Asia 2009 Trade and Human Development. Retrieved from http://www.cpd.org.bd/downloads/SAHDR.pdf [Accessed 05-06-2011].

Centre of Policy Studies of Monash University.). Retrieved from http://www.monash.edu.au/policy/oranig.htm [Accessed 07-05-2010]

Champernowne, D. G. (1974). A comparison of measures of inequality of income distribution. *The Economic Journal*, *84*(336), 787-816.

Chaturvedi, S. (2007). Trade Facilitation Measures in South Asian FTAs: An Overview of Initiatives and Policy Approaches Retrieved from http://www.unescap.org/tid/artnet/pub/wp2807.pdf [Accessed 10-05-2010]

Chia, N., Wahba, S., and Whalley, J. (1994). Poverty-Reduction Targeting Programs: a General Equilibrium Approach. *Journal of African Economies*, *3*(2), 309-338.

Chinn, M. D., and Ito, H. (2006). Current Account Balances, Financial Development and Institutions: Assaying the World "Saving Glut" Retrieved from http://web.pdx.edu/~ito/CA_Chinn_Ito_25Jan07mdc.pdf [Accessed 08-06-2010].

Chitiga, M., Kandiero, T., and Mabugu, R. (2005). Computable general equilibrium micro-simulation analysis of the impact of trade policies on poverty in Zimbabwe. *Cahier de Researché PEP-MPIA*(2005-01).

Citro, C., and Hanushek, E. (1991). Improving Information for Social Policy Decision—The Uses of Microsimulation Modelling. Washington, D.C: National Academy Press.

Cockburn, J. (2001). Trade Liberalisation and Poverty in Nepal A Computable General Equilibrium Micro Simulation Analysis. Retrieved from http://www.crefa.ecn.ulaval.ca/cahier/0118.pdf [Accessed 04-10-2010]

Cockburn, J. (2005). Procedure for Conducting Poverty /Ditribution Analysis of CGE Simulation Results with DAD. Retrieved from http://www.pep-net.org/fileadmin/medias/pdf/non-parametric.pdf [Accessed 08-10-2010].

Cockburn, J., Corong, E., and Cororaton, C. (2010). Integrated Computable General Equilibrium (CGE) Micro-Simulation Approach. *International Journal of Microsimulation 3*(1), 60-71.

Codsi, G., and Pearson, K. R. (1988). GEMPACK: General-Purpose Software for Applied General Equilibrium and Other Economic Modellers. *Computer Science in Economics and Management*(1), 189-207.

Cogneau, D., and A.S., R. (2000). *Income Distribution, Poverty and Growth in Madagascar : Micro simulations in a General Equilibrium Framework* (Discussion Paper No: 61.).

Colombo, G. (2008). Linking CGE and Microsimulation Models: A Comparison of Different Approaches. Mannheim: Centre for European Economic Research.

Cornia, G. A. (2004). Changes in the Distribution of Income over the Last Two Decades: Extent, Sources and Possible Causes. *Rivista Italiana degli Economisti, 9*(3).

Cornia, G. A. (2011). Economic Integration, Inequality and Growth: Latin America vs. the European economies in transition. In U. N. Department of Economic and Social Affairs (Ed.): Department of Economic and Social Affairs, United Nations, New York.

Cororaton, C., and Corong, E. (2006). Agriculture-sector policies and poverty in the Philippines: A computable general-equilibrium (CGE) analysis. *Poverty and Economic Policy (PEP) Research Network Working Paper*(9).

Coudouel, A., J. S. Hentschel, et al. (2002). "Poverty measurement and analysis." PRFC Sourcebook

Das, D. K. (2007). South Asian free trade agreement: prospects of shallow regional integration.Retrieved from http://wwwarc.murdoch.edu.au/publications/wp/wp143.pdf [Accessed 08-07-2011]

Dash, K. (2009). Toward Free Trade In South Asia: Political And Economic Dimensions, from http://projectartemis.com/knowledge_network/ctrs_excellence/tgpec/newsletter/articles/_toward_free_trade_south_asia.htm [Accessed 10-06-2010].

Datt, G. (1992 and 1998). Computational Tools for Poverty Measurement and Analysis: International Food Policy Research Institute, Washington, DC.

Davis, D. R. (1996). Trade Liberalisation and Income Distribution. *National Bureau of Economic Research, Working Paper 5693.* Retrieved from http://www.nber.org/papers/w5693.pdf [Accessed 07-04-2010]

De Janvry, A., Sadoulet, E., and Fargeix, A. (1991). Politically feasible and equitable adjustment: Some alternatives for Ecuador. *World Development, 19*(11), 1577-1594.

Decaluwé, B., André, L., and David, B. (2010). Endogeneous Labour Supply with Several Occupasional Categories in a Bi-Regional CGE Model *Regional Studies, 44*(10), 1401-1414.

Decaluwe, B., Patry, A., Savard, L., and Theorbecke, E. (1999). General Equilibrium Approach for Poverty Analysis: mimeo, CREFA, Laval University and Department of Economics, Cornell University.

Decaluwe, B., Patry, A., Savard, L., and Thorbecke, E. (2000). Poverty Ananlysis within General Equilibrium Framework: Laval University, Department of Economics, Quebec, Canada.

Department of Census and Statistics. (1990-91, 1995-96, 2002 and 2006-07,2009-10). Household Income and Expenditure Survey (HIES). Colombo, Sri Lanka: Department of Census and Statistics

Department of Census and Statistics. (1990/91). Household Income and Expenditure Survey. Sri Lanka.

Department of Census and Statistics. (2006/07). Sri Lanka Demographic and Health Survey Retrieved from http://www.statistics.gov.lk/social/DHS%20Sri%20Lanka%20Preliminary%20Report.pdf [Accessed 06-09-2009]

Dercon, S. (2001). The Impact of Economic Reforms on Households in Rural Ethiopia 1989-95: World Bank, Washington.

DeRosa, D. A., and Govindan, K. (1996). Agriculture, Trade, and Regionalism in South Asia. *Journal of Asian Economics, 7*(2), 293–316.

Dervis, K., de Melo, J., and Robinson, S. (1982). General Equilibrium Models for Development Policy: London, Cambridge University Press.

Dhongde, S., and Research, W. I. f. D. E. (2004). *Decomposing spatial differences in poverty in Índia*: United nations university. World institute for development economics research (UNU-WIDER).

Dhungel, K. R. (2008). Regional Energy Trade in South Asia Problems and Prospects. *South Asia Economic Journal*, *9*(1), 173-193.

Dikhanov. (2005). Trends in Global Distribution, 1970-2000, and Scenarios for 2015. Washington D.C World Bank.

Dimaranan, B. V., McDougall, R. A., and Hertel, T. W. (2006). *GTAP 6 Data Base Documentation. Chapter 20: Behavioral Parameters.*: Purdue University, West Lafayette, IN.

Dixit, Avinash, and Norman, V. (1986). Gains from Trade without Lump-Sum Compensation. *Journal of International Economic*, *21*, 111-122.

Dixon, P., Horridge, M., Meagher, G., Naqvi, A., and Parmenter, B. R. (1996). The Theoretical Structure of Monash-MRF.

Dixon, P., Malakellis, M., and Meagher, T. (1995). *A Microsimulation/Applied General Equilibrium Approach to Analysing Income Distribution in Australia: Plans and Preliminary Illustration.* Paper presented at the The Industry Commission Conference on Equity, Efficiency and Welfare, Melbourne.

Dixon, P. B., and Parmenter, B. R. (1996). *Computable General Equilibrium Modelling for Policy Analysis and Forecasting, Handbook of the Computational Economics*: Monash University

Dixon, P. B., Parmenter, B. R., and Rimmer, R. J. (1981). Extending the ORANI Model of the Australian Economy: Adding Foreign Investment to a Miniature Version (pp. 79). University of Melbourne.

Dixon, P. B., Parmenter, B. R., Sutton, J., and Vincent, D. P. (1982). *ORANI: A Multisectoral Model of the Australian Economy*: North-Holland.

Dollar, D. (1992). Outward-oriented developing economies really do grow more rapidly: Evidence from 95 LDCs,1976–1985. *Economic Development and Cultural Change 40*, 523– 544.

Dollar, D., and Kraay, A. (2001). Growth is good for the poor. In Development Research Group (Ed.). Washington DC: The World Bank.

Dollar, D., and Kraay, A. (2002). Growth Is Good for the Poor. *Journal of Economic Growth*, *7*(3), 195-225.

Dollar, D., and Kraay, A. (2002). Trade, Growth, and Poverty. *Economic Journal 114*(493), 22-49.

Duclos J., Araar, A. E. F. C., and Fortin, C. (2002). DAD: Distributive analysis/Analyse Distributive, User's Manual. *Université Laval.[Links]*.

Duclos, J. Y., and Araar, A. (2006). *Poverty and equity: measurement, policy and estimation with DAD* (Vol. 2): Springer Verlag.

Edwards, S. (1998). Openness, Productivity and Growth: What Do We Really Know *Economic Journal, 108*(447), 383-398.

Edwards, S. (1993). Openness, trade liberalization, and growth in developing countries. *Journal of Economic Literature, 31*(3), 1358-1393.

Essama-Nssah, B. (2005). Simulating the Poverty Impact of Macroeconomic Shocks and Policies. Washington, D.C: The World Bank.

Evans, D. (2001). *Identifying Winners and Losers in Southern Africa from Global Trade Policy Reform: Integrating Findings from GTAP and Poverty Case Studies*. Paper presented at the Fourth Annual Conference on Global Economic Analysis, Purdue University, West Lafayette.

Ezaki, M., and Nguyen, T. D. (2008). Regional Economic Integration and Its impact on growth, income distribution and Poverty in East-Asia Nagoya: Graduate School of International Development, Nagoya University, Japan.

Fall, B. (2006). Modelling Poverty Reduction. *HIPC CBP Publication, 9*.

Federal Bureau of Statistics of Pakistan. (2004). Household Expenditure Survey.

Fiestas, I. (2005). The effects of trade liberalization on growth, poverty and inequality. Retrieved from http://www.cilae.org/en/publicaciones/NT0405.pdf [Accessed 08-06-2010]

Filho, J. B., and Horridge, J. M. (2004). Economic integration, Poverty and Regional Inequality in Brazil: CoPS/IMPACT General Working Paper.

Foster, J., Greer, J., and Thorbecke, E. (1984). A class of decomposable poverty measures. *Econometrica: Journal of the Econometric Society*, 761-766.

Friedman, J., and Levinsohn. (2002). The Distributional Impacts of Indonesia's Financial Crisis on Household Welfare: "A Rapid Response Methodology" *World Bank Economic Review, 16*(3), 397-423.

Gerber, J. (1999). *International Economics*: Addison Wesley Educational Publishers Inc.

Gilbert, J. (2008). Trade Policy, Poverty, and Income Distribution in CGE Models: An Application to SAFTA. 1-20. Retrieved from ftp://repec.bus.usu.edu/RePEc/usu/pdf/eri2008-02.pdf [Accessed 05-06-2010]

Gilbert, J., and Wahl, T. (2003). Labor market distortions and China s WTO Accession Package: An Applied General Equilibrium Assessment. *Journal of Comparative Economics, 31*(4), 774-794.

Giese, A. S., Kahley, W. J., & Riefler, R. F. (1990). Foreign direct investment: motivating factors and economic impact. Regional Science Perspectives, 20, 105-127.

Goldberg, P. K., and Pavcnik, N. (2004). Trade, Inequility and Poverty: What do we know? Evidence from Recent Trade Liberalisation Episodes in Developing Countries Retrieved from http://www.nber.org/papers/w10593 [Accessed 04-05-2010].

Greenaway, D., Morgan, W., and Wright, P. (1998). Trade reform, adjustment and growth: what does the evidence tell us? *The Economic Journal*, *108*(450), 1547-1561.

Gunetilleke, N., and Senanayake, D. (2004). Monetary Poverty Estimates in Sri Lanka: Selected Issues. Asian Development Bank: Asian Development Bank.

Gunatilleke, G., Abeyratne, S., Gunawardana, A., and Perera, M., (2009). Economic and Social Impact of the Financial Crisis on Households: A Case Study of Sri Lanka, MARGA Institute, Sri Lanka Centre for Development Studies, Colombo.Retrieved from www.socialprotectionasia.org/All.../Sirimal%20Abeyratne_ADB.pdf [Accessed 4-12-12].

Gupta, A., and Kapur, V. (2000). Microsimulation in Government Policy and Forecasting: Amsterdam: North-Holland.

Gupta, S., Bhattacharya, T., Agrawal, S., Xu, H., and Garg, M. (2010). Offshoring Dynamics: Implications for India as an Attractive Offshore Location. *International Journal of Indian Culture and Business Management, 3*(3), 307-322.

Haghiri, M. And Kerr, W.A. (2008). A New Model of Education in International Trade Policy, *International Journal of the World Universities Forum*, 2(1), 101-106.

Haque, M. E., and Mukherjee, A. (2006). Free Entry and Government Revenue Under Trade Liberalization Retrieved from https://editorialexpress.com/cgi-bin/conference/download.cgi?db_name=res2007&paper_id=425 [Accessed 03-06-2010].

Harding, A. (1993). Lifetime Income Distribution and redistribution: Applications of a Microsimulation Model: Amsterdam: North-Holland.

Harrison, Glenn, W., Rutherford, T. F., and David, G. T. (2000). Trade Liberalisation, Poverty and Efficient Equity, *Economic Working Paper B:81-02*: Moore School of Business, University of South Carolina

Hassan, M.K. (2001) 'Is SAARC A Viable Economic Bloc? Evidence from the Gravity Model', Journal of Asian Economics, 12 (2), 263-290.

Haughton, J. H., and Khandker, S. R. (2009). *Handbook on poverty and inequality*: World Bank Publications.

Herault, N. (2007). Trade Liberalisation, Poverty and Inequality in South Africa: A Computable General Equilibrium-Microsimulation Analysis. *The Economic Record 83*(262), 317–328.

Hertel, T. W. (Ed.). (1997). *Global Trade Analysis: Modeling and Applications.* Cambridge University Press: Cambridge University Press.

Hertel, T. W., Ivanic, M., Preckel, P. V., and Cranfield, J. A. L. (2003). *The Earnings Effects of Multilateral Trade Liberalization: Implications for Poverty in Developing Countries*. http://www.cgdev.org/doc/event%20docs/10.23.03%20GDN%20Conf/Hertel%20-%20The%20Earnings%20Effects%20of%20Multilateral%20Trade%20Liberalization.pdf [Accessed 04-05-2009]

Hertel, T. W., McDougall, R., and Dimaranan, B. (1997). *Behavioral parameters. Dans Global Trade Analysis: Modeling and Applications*: Cambridge University Press.

Hertel, T. W., Preckel, P. V., and Reimer, J. J. (2001). *Trade Policy, Food Price Variability, and the Vulnerability of Low-Income Households*. American Agricultural Economics Association, Chicago, Illinois,.

Hertel, T. W., and Reimer, J. (2005). Predicting the Poverty Impacts of Trade Reform. *Journal of International Trade & Economic Development, 14*(4), 377 – 405.

Hertel, T. W., and Tsigas, M. E. (1997). Structure of GTAP, Chapter 2 inGlobal Trade Analysis:Modelling and Applications. In T. W. Hertel (Ed.): Cambridge University Press.

Hirantha, S.W. (2004) 'From SAPTA to SAFTA: Gravity Analysis of South Asian Free Trade', Nottingham: University of Nottingham Faculty of Management (unpublished manuscript).

Horridge, J. M., and Filho, S. F. (2006). Economic Integration, Poverty and Regional Inequality in Brazil. 363–387. Retrieved from http://www.scielo.br/pdf/rbe/v60n4/a03v60n4.pdf [Accessed 07-05-2010].

Horridge, M., and Powell, A. (1984). Long-Run Closure of ORANI: A Proposal. University of Melbourne.

Huff, K., and Hertel, T. (2000). Decomposing welfare changes in the GTAP model.

Huff, K. M., Hanslow, K., Hertel, T. W., and Tsigas, M. (1997). GTAP Behaviour Parameters: Global Trade Analysis, Modelling and Applications. In T. W. Hertel (Ed.), (pp. 124-148): Cambridge University Press.

Huff, K. M., and Hertel, T. W. (2000). Decomposing welfare changes in the GTAP model: Purdue University, USA.

Ianchovichina, E., Nicita, A., and Soloaga, I. (2002). Trade Reform and Poverty: The Case of Mexico. *The World Economy, 25*(7), 945–972.

International Monitory Fund. (2008-2010). Data and Statistics. from International Monitory Fund

International Monitory Fund. (2009). Direction of Trade Statistics Year Book: International Monitory Fund.

Janvry, A. d., Sadoulet, E., and Fargeix, A. (1991). Adjustment and Equity in Ecuador: OECD Development Center, Paris.

Jaumotte, F., Lall, S., and Papageorgiou, C. (2009). Rising Income Inequality:Technology, or Trade and Financial Globalization? Retrieved from http://www.chrispapageorgiou.com/papers/MS12711-revision.pdf [Accessed 04-05-2011].

Jayanetti, S., and Tilakaratna, G. (2005). Impact of Trade Liberalization on Poverty and Houehold Welfare in Sri Lanka *Research Studies: Poverty and Social Welfare Series* Colombo: Institute of Policy Studies.

Jayaraman, T. K. (1978). *Economic Cooperation in the Indian Sub-continent – A Customs Union Approach*: New Delhi: Orient Longman.

Jomini, P., Zhang, X., and Osborne, M. (2009). The Armington-Heckscher-Ohlin model-an intuitive exposition.

Kakwani, N. (1986). *Analyzing redistribution policies: a study using Australian data*: Cambridge University Press.

Kakwani, N., and Subbarao, K. (1990). Rural Poverty and Its Alleviation in India. *Economic and Political Weekly, 31*(March), A2-A16.

Kelegama, S. (2010). Retrieved from http://www.ips.lk/news/index.html [Accessed 05-12-2011]

Kemal, A. R. (2004). SAFTA and Economic Cooperation. South Asian Journal 6(1), 1-21.

Kamal, A. R., Muleh-ud-Din and Ghani, E. (2005). Non-Agriculture Market Access Priorities for South Asia, Briefing Paper, CUTS International. Retrieved from http://www.cuts-international.org/pdf/No.3-NAMA.pdf [Accessed 5-12-12].

Khan, A. H. (2005). Poverty Impacts of Trade Liberalization in a Dual-Dual CGE Model: Illustrations for South Asia Retrieved from http://www.adbi.org/files/2005.12.09.cpp.modeling.poverty.impact.pdf [Accessed 08-09-2010]

Khan, A. H. (2008). Analyzing Poverty Impact of Trade Liberalization Policies in CGE Models: Theory and Some Policy Experiments in Agricultural and Non-agricultural Sectors in South Asia. Retrieved from http://mpra.ub.uni-muenchen.de/7609/1/CGE.PDF [Accessed 07-06-2011]

Khawaja, M. (2005). M Mowafi, M Khawaja. *Journal of Epidemiology and Community Health*, *59*, 260-264.

Khondker, B. H., and Raihan, S. (2004). *Welfare and poverty impacts of policy reforms in Bangladesh: A general equilibrium approach*.

Kitwiwattanachai, A. (2008). *Quantitative Impacts of Alternative East Asia Free Trade Areas: A CGE Assessment* (Doctor of Philosophy), University of Nottingham. Retrieved from http://www.nottingham.ac.uk/economics/ [Accessed 06-06-2009]

Krishna, P., Mitra, D., and Sundaram, A. (2010). Trade, Poverty and the Lagging Regions of South Asia. Retrieved from http://www.nber.org/papers/w16322.pdf [Accessed 08-05-2010]

Kumar, R., and Singh, M. (2009). India's role in South Asia trade and investment integration. *Working Papers on Regional Economic Integration*.

Kuznets, S. (1963). Quantitative Aspects of the Economic Growth of Nations. *Economic Development and Cultural Change*, *11*(2), 1-80.

Lensink, R., and Morrissey, O. (2001). *Foreign Direct Investment: Flows, Volatility and Growth*. Paper presented at the Development Economics Study Group Conference, University of Nottingham, UK. .

Levinsohn, James, Berry, S., and Friedman, J. (1999). Impacts of the Indonesian economic crisis : price changes and the poor. *NBER working paper 7194*.

Li, H., Squire, L., and Zou, H. (1998). Explaining International and Intertemporal Variations in Income Inequality. *Review of Development Economics*, *2*(3), 318-334.

Lloyd, P., and Zhang, X. G. (2006). The Armington Model. *Productivity Commission Staff Working Paper*.

Lloyd, P. J., and MacLaren, D. (2004). Gains and Losses from Regional Trading Agreements: A Survey. *Economic Record*, *80*(251), 445-497.

Lluch, C., Powell, A., and Williams, R. (1977). *Patterns in Household Demand and Savings*: Oxford University Press, London.

Lofgren, H. (1999). Trade Reform and Poor in Morocco : A Rural-Urban General Equilibrium Ananlysis of Reduced Protection: IFPRI TMD Discussion Paper 38.

Lotze, H. (1998). *Intergration and Transportation on European Agricultural and Food Markets: Policy Reform, European Union Enlargement, and Foreign Direct Investment.* (PhD), Humboldt University of Berlin. Retrieved from http://edoc.hu-berlin.de/dissertationen/agrar/lotze-hermann/PDF/Lotze.pdf [Accessed 07-08-2010]

Lundberg, M., and Squire, L. (2003). The Simultaneous Evolution of Growth and Inequality. *Economic Journal*, *113*(4), 326-344.

Majumder, A. (1986). Consumer Expenditure Pattern in India: A Comparison of the Almost Ideal Demand Systemand the Linear Expenditure System. *The Indian Journal of Statistics*, *48* (1), 115-143.

Mansur, M.H., (2006). *Bangladesh Tea in the International Market: Prospects and Challenges*, (MBA), Southern University, Retrieved from http://www.scribd.com/doc/16189200/8/MAJOR-COMPETITORS-IN-TEA-MARKET [Accessed 3-12-12]

Martin, M. (2001). Trade Policies, Developing Countries, and Globalization. Retrieved from http://siteresources.worldbank.org/INTRES/Resources/469232-1321568702932/2866_trade_martin.pdf [Accessed 06-05-2009]

Martin, W. (2001). Trade policies, Developing countries and Globalisation. In D. R. Group (Ed.). Washington DC World Bank.

McDougall, R. (2001). A New Regional Household Demand System for GTAP. Retrieved from http://www.agecon.purdue.edu/gtap/techpapr/index.htm [Accessed 06-12-2009].

McCulloch, N. (2005). The Impact of Trade Liberalization on Poverty. Retrieved from http://www.wilsoncenter.org/sites/default/files/ImpactofTrade_low.pdf [Accessed 06-02-2010]

McCulloch, N., and Calandrino, M. (2002). Poverty Dynamicsin Rural Sichuan between 1991 and 1995. Retrieved from http://www.pik-potsdam.de/research/research-domains/transdisciplinary-concepts-and-methods/project-archive/favaia/workspace/documents/world-development-volume-31-issue-3-special-issue-on-chronic-poverty-and-development-policy/pages611-628.pdf [Accessed 03-02-2010].

McCulloch, N., Winters, A., and Cirera, X. (2001). *Trade liberalization and poverty: A handbook*: Cambridge Univ Press.

McDonald, S., and Thierfelder, K. (2004). Deriving Global Social Accounting Matrix from GTAP version 5 data: Global Trade Analysis Project: Purdue University.

McDonald, S., Thierfelder, K., and Robinson, S. (2007). Globe: A SAM Based Global CGE Model using GTAP data. (14). Retrieved from http://www.usna.edu/EconDept/RePEc/usn/wp/usnawp14.pdf and http://www.cgemod.org.uk/glb_v1_tech.pdf [Accessed 05-03-2010]

Meagher, G. A. (1996). Forecasting changes in the distribution of income: an applied general equilibrium approach', in Harding, A. . *Microsimulation and Public Policy*, 361–384.

Meagher, G. A., and Agrawal, N. (1986). Taxation Reform and Income Distribution in Australia. *Australian Economic Review, 75*(Special Issue), 33 – 56.

Mehta, R., and Agarwal, P. (2003). WTO Non-agriculture Market Access Modalities : A Case Study of Impact on a Developing Country Retrieved from http://ictsd.org/downloads/2008/08/dpwto59.pdf [Accessed 02-10-2010]

Merz, J. (1991). Microsimulation—A Survey of Principles, Developments and Applications. *International Journal of Forecasting, 7*, 77–104.

Metzler, L. (1949). Tariffs, the terms of trade, and the distribution of national income. *Journal of Political Economy, 1*(7), 1-29.

Milanovic, B. (2002). True World Income Distribution, 1988 and 1993: First Calculations Based on Household Surveys Alone. *Economic Journal, 112*(476), 51–92.

Minabe, N. (1974). The Stolper-Samuelson Theorem and the Metzler Paradox. *Oxford Economic Papers, New Series, 26*(3), 329-333.

Milner, C., and Morrissey, O. (1999). Measuring Trade Liberalisation in Africa. In M. McGillivray and O. Morrissey (Eds.), *Evaluating Economic Liberalisation* (pp. 60–82): London:Macmillan,.

Minhas, B., Jain, L., Kansal, S., and Saluja, S. (1987). On the Choice of Appropriate Consumer Price Indices and Datasets for Estimating the Incidence Of Poverty in India. *Indian Economic Review, 12*, 19-49.

Minot, N., and Goletti, F. (2000a). Rice Market Liberalization and Poverty in Vietnam (pp. 114-113): International Food Policy Research Institute, Washington.

Minot, N., and Goletti, F. (2000b). Rice Market Liberalization and Poverty in Vietnam. Retrieved from http://www.ifpri.cgiar.org/sites/default/files/pubs/pubs/abstract/114/rr114toc.pdf [Accessed 07-05-2010]

Morrisson, C. (1991). Adjustment incomes and Poverty in Morocco. *World Development, 19*(11), 1633-1651.

Mukherji, I. N. (2004). Towards a Free Trade Area in South Asia: Charting a Feasible Course for Trade Liberalization with Reference to India's Role: New Delhi: Research and Information System for the Non-Aligned and Developing Countries.

Naranpanawa, R. M. A. K. B. (2005). *Trade Liberalisation and Poverty In a Computable General Equilibrium Model: The Sri Lankan Case.* (PhD), Griffith University. Retrieved from http://www4.gu.edu.au:8080/adt-root/uploads/approved/adt-QGU20070130.165943/public/02Whole.pdf [Accessed 05-04-2009].

Narayanan, B. G., and Walmsley, T. L. (2008). *Global Trade, Assistance, and Production: The GTAP 7 Data Base*: Centre for Global Trade Analysis, Purdue University.

National Sample Survey Organisation (NSSO) of India. (2004). Household Expenditure Survey

Newfarmer, R. (2004). SAFTA: Promise and Pitfalls of Preferential Trade Arrangement.Background paper for Global Economic Prospects World Bank, Washington, D.C.

Nguyen, M. T., Thanh, T. B., and (2005). The Effect of Trade Liberalisation on Income Distribution in Vietnam: Dynamic CGE Approach. Retrieved from http://www.apeaweb.org/confer/cruz09/papers/thanh-toan.pdf [Accessed 07-04-2011]

Nin, A., Lapar, M. L., and Ehui, S. (2003). *Globalization, Trade Liberalization and Poverty Alleviation in Southeast Asia: the Case of the Livestock Sector in Vietnam*. Paper presented at the 6th Annual Conference on Global Economic Analysis, Scheveningen, The Hague, The Netherlands.

Olau. (1989). Western Middle Power and Global Poverty Olau (Ed.) *The Determinants of the Aid Policies of Canada, Denmark, the Netherlands, Norway and Sweden*

Orcutt, G. (1957). A New Type of Socio-Economic System. *Review of Economic and Statistics, 58*(773–97).

Orcutt, G., Greenberger, M., Korbel, J., and Rivlin, A. (1961). Microanalysis of Socio-Economic Systems: A Simulation Study. New York: New York: Harper and Row.

Orcutt, G., Merz, J., and Quinke, H. (1986). Microanalytic Simulation Models to Support Social and Financial Policy. North-Holland: Amsterdam: North-Holland.

Panagariya, A. (2003). South Asia: Does Preferential Trade Liberalization Make Sense? *The World Economy., 26*(9), 1279-1291.

Panagariya, A. (2004). Preferential Trading in South Asia. Washington D.C World Bank. .

Parzen, E. (1962). On the Estimation of Probability Density and Model. *Annals of Mathematical Statistics, 27*, 1065-1076.

Pearson, K. R., and Arndt, C. (1998). Implementing systematic sensitivity analysis using GEMPACK. *GTAP Technical Papers*, 3.

Perera, M. S. S. (2009). The South Asian Free Trade Area: An Analysis of Different Policy Options for Sri Lanka. *Journal of Economic Integration, 24*(3), 530-562.

Philippe, Aghion, Eve, C., and Penalosa, E. G. (1999). Inequility and Economic Growth: The Perspective of the New Growth Theories. *Journal of Economic Literature, 37*, 1615-1660.

Philip, J. M. (2006). "The use of CGE models for the trade policies analysis and their impact on poverty: criticisms and proposals for improvements Model." Working Paper.

Pigato, M., Farah, K., Itakura, K., Jun, W., Martin, K., Murrell., and ., S. T. N. (1997). *South Asia's Integration into the World Economy* Washington, DC: World Bank. Washington, DC: World Bank.

Pitigala, N. (2005). What Does Regional Trade in South Asia Reveal about Future Trade Integration? Some Empirical Evidence *World Bank Policy Research*: World Bank, Washington DC.

Polette, J., and Robinson, M. (1997). Modelling the Impact of Microeconomic Policy on Australian Families: University of Canberra.

Pravakar, S. (2006). Foreign Direct Investment in South Asia:Policy, Trends, Impact and Determinants. Retrieved from http://www.econstor.eu/dspace/bitstream/10419/53445/1/521368502.pdf [Accessed 08-05-2010].

Pritchett, L. (1996). Measuring outward orientation: can it be done? *Journal of Development Economics, 49*(2), 307-335.

Rahman, M. K., Bhuyan, A. R., and Reza, S. (1981). The Trade Effects of a South Asian Customs Union: An Expository Study. *The Pakistan Development Review, 10*(1), 61–80.

Rajapakse, S. (2011). Estimation of a complete system of nonlinear Engel curves: further evidence from Box–Cox Engel curves for Sri Lanka. *Applied Economics, 43*, 371–385.

Ramkishen, S. R., and Graham, B. (2002). Trade Liberalization and Poverty :Where Do We Stand? Retrieved from http://www.adelaide.edu.au/cies/papers/0230.pdf [Accessed 07-05-2010].

Ratna, R. S., and Sidhu, G. (2007). Making SAFTA a Success: The Role of India. Retrieved from http://www.thecommonwealth.org/files/178426/FileName/SAFTA%20and%20India%20-%20Final%20doc1.pdf [Accessed 06-07-2010].

Ravallion, Martin, and Datt, G. (2002). Why Has Economic Growth been More Pro-Poor in Some States of India than Others. *Journal of Development Economics, 68*, 381–400.

Ravallion, Martin, and Lokshin, M. (2004). *Gainers and Losers from Trade Reform in Morocco*. Paper presented at the Seventh Annual Conference on Global Economic Analysis, Washington, DC.

Ravallion, M., and Chen, S. (1997). What can New Survey Data Tell us about recent Changes in Distribution and Poverty. *The World Bank Economic Review, 11*(2), 357-382.

Ravallion, M., and Huppi, M. (1991). Measuring Changes in Poverty: A Methodological Case Study of Indonesia during an Adjustment Period. *World Bank Economic Review, 5*(1), 57–82.

Ravallion, M., and Sen, B. (1996). When method matters: Monitoring poverty in Bangladesh. *Economic Development and Cultural Change*, *44*(4), 761-792.

Ravallion, M., and Walle, D. (1991). The Impact on Poverty of Food Pricing Reforms: A Welfare Analysis for Indonesia. *Journal of Policy Modeling, 13*(2), 281–299.

Regmi, A. (1999). Trade Liberalization and the South Asian Economies:Adjusting to the Challenges of Globalization. Retrieved from http://162.79.45.195/Briefing/GlobalFoodSecurity/PDF/gfa11d4TradeLiberalizationandSouthAsian.pdf [Accessed 07-08-2010].

Reimer, J. (2002). *Estimating the Poverty Impacts of Trade Liberalization*: Center for Global Trade Analysis and Department of Agricultural Economics,Purdue University

RIS (2005), "Regional Trading Arrangements in the World and Asia: Options for India", Policy Brief No.17, New Delhi.

Robilliard, A. S., Sophie, A., Bourguignon, F., and Robinson, S. (2003). *Examining the Social Impact of the Indonesian Financial Crisis using a Micro-Macro Model*. ABCDE-Europe 2003, (Workshop Session J) Effects of Globalization Factors on Poverty and Inequality in National Economies. .

Robinson, S., and Thierfelder, K. (2002). Trade liberalisation and regional integration: The Search for Large Numbers. *Australian Journal of Agricultural and Resource Economics, 46*(4), 585-604.

Rodrik, D. (2000). Comments on "Trade, Growth, and Poverty," by David Dollar and Aart Kraay. Retrieved from http://ksghome.harvard.edu/~.drodrik.academic.ksg/papers.html. [Accessed 07-05-2010].

Rodriguez, F., and Rodrik, D. (2001). Trade policy and economic growth: a skeptic's guide to the cross-national evidence: MIT PRess.

Rodrik, D. (1992). The rush to free trade in the developing world: Why so late? Why now? Will it last? : National Bureau of Economic Research.

Rodrik, D. (1998). Where did all the growth go? External shocks, social conflict, and growth collapses: National Bureau of Economic Research.

Rosenblatt, M. (1956). Remarks on Some Nonparametric Estimates of the Density Function. *Annals of Mathematical Statistics, 27*, 832-837.

Ryu, H. K., and Slottje, D. J. (1996). Two flexible functional form approaches for approximating the Lorenz curve. *Journal of econometrics, 72*(1), 251-274.

Sachs, J. D., and Warner, A. (1995). Economic Reform and the Process of Global Integration *Brookings Papers on Economic Activity* (Vol. 1, pp. 1-118).

Sánchez, M. V. (2008). Disentangling Welfare Effects of the Oil Price Boom in Oil-Importing Developing Countries. Retrieved from http://www.cepal.org/comercio/noticias/paginas/4/34614/Disentangling_Welfare_Effects_of_Rising_Oil_Prices.pdf [Accessed 08-06-2010].

Santos-Paulino, A., and Thirlwall, A. P. (2004). The impact of trade liberalisation on exports, imports and the balance of payments of developing countries. *The Economic Journal, 114*(493), F50-F72.

Savard, L. (2004a). Poverty and inequality analysis within a CGE framework: a comparative analysis of the representative agent and micro-simulation approaches. *Cahier de recherche/Working Paper 04, 12*.

Savard, L. (2004b). Poverty and Inequality Analysis within a CGE Framework: a Comparative Analysis of the Representative Agent and Micro-Simulation Approaches. Retrieved from http://www.cirpee.org/fileadmin/documents/Cahiers_2004/CIRPEE04-12.pdf [Accessed 04-01-2011]

Savard, L. (2005). Poverty and Inequality Analysis within a CGE Framework: A Comparative Analysis of the Representative Agent and Microsimulation Approaches. *Development Policy Review, 23*(3), 313-331.

Saw, J. G., Yang, M. C. K., and Mo, T. C. (1984). Chebyshev inequality with estimated mean and variance. *American statistician*, 130-132.

Scollay, R., and Gilbert, J. (2000). Measuring the gains from APEC trade liberalisation: An Overview of CGE assessments. *World Economy, 23*(2), 175-193.

Selim, R. (2010). Welfare and Poverty Impacts of Trade Liberalization: A Dynamic CGE Microsimulation Analysis. *International Journal of Microsimulation, 3*(1), 123-126.

Sen, A. K. (1976). Poverty: An Ordinal Approach to Measurement *Econometrica*, *44*, 219-231.

Siriwardana, M. (2003). Trade liberalisation in South Asia: Free Trade Area or Customs Union? *South Asia: Journal of South Asian Studies, 26*(3), 309-329.

Sothea, O. (2009). *Income Distribution and Poverty in a CGE Framework : A Proposed Methodology.* (PhD), Monash University,, Melbourne, Australia.

Srinivasan, T. N., and Canonero, G. (1995). *Preferential Trading Arrangements in South Asia: Theory, Empirics and Policy*. New Haven: Yale University. .

Stone, R. (1954). Linear Expenditure Systems and Demand Ananlysis: An Application to the Pattern of British Demand. *Economic Journal*(64), 511-527.

Stroud, A. H. (1957). Remarks on the disposition of points in numerical integration formulas. *Mathematical Tables and Other Aids to Computation, 11*(60), 257-261.

Summers, L. (1991). *Regionalism and the World Trading System*, in Federal Reserve Bank of Kansas City (ed.), Policy Implications of Trade and Currency Zones. United States.

Suranovic, S. (2006). *International Trade Theory and Policy*. USA: The International Economics Study Center, The George Washington University.

Taneja, N. (1999), Informal Trade in the SAARC Region, Indian Council for Research on International Economic Relations, Retrieved from http://www.icrier.org/pdf/wp47.pdf [Accessed 6-12-12].

Taneja, N., Sarvananthan, M., Karmacharya, B.K, and Pohit S. (2005). Informal Trade in India, Nepal and Sri Lanka. *Economic Development in South Asia in Mohsin Khan ed.* , 54-114.

Taylor, L., and Lysy, F. (1979). Vanishing Income Redistributions: Keynesian Clues about Model Surprises in the Short-Run. *Journal of Development Economics, 6*(1), 11-29.

The Central Bank of Sri Lanka. (2003/2004). Consumer Finance and Socio-Economic Survey Colombo: The Central Bank of Sri Lanka.

The Central Bank of Sri Lanka. (2010). Annual Report. Colombo, Sri Lanka: The Central Bank of Sri Lanka.

The Economic Commission for Africa Continental Free Trade Area. (2012). Assessing Regional Integration in Africa : Towards an African Continental Free Trade Area. Retrieved from http://uneca.africa-devnet.org/files/uneca_aria_v_june_2012.pdf [Accessed 6-12-12].

The World Bank. (2005). Attaining The Millennium Development Goals in Sri Lanka:How Likely and What Will It Take To Reduce Poverty, Child Mortality and Malnutrition, and to Increase School Enrollment and Completion? . Retrieved from http://siteresources.worldbank.org/INTSRILANKA/Resources/Sri-Lanka-MDG-Final.pdf [Accessed 08-02-2011].

The World Bank. (2007). Sri Lanka Poverty Assessment. World Bank, Washington D.C.

The World Bank. (2008,2009 and 2010). The World Bank World Development Report Washington DC: The World Bank.

The World Bank. (2010). The Logistic Performance Index: South Asia, Retrieved from http://siteresources.worldbank.org/INTTLF/Resources/515003-1276029788910/SAR_LPI2010_Brochure.pdf [Accessed 4-12-12].

The World Trade Organisation. (2008). World Trade Report. Switzerland.

Thorbecke, E. (1991). Adjustment Growth and Income Distribution in Indonesia and Equity in Indonesia. *World Development, 19*(11), 1595-1614.

Thorbecke, E. (2001). *Poverty Analysis and Measurement within a General Equilibrium Framework*. Paper presented at the Asia and Pacific Forum on Poverty:Reforming Policies and Institutions for Poverty Reduction, Asian Development Bank, Manila.

Trade and Human Development. Retrieved from http://www.cpd.org.bd/downloads/SAHDR.pdf [Accessed 03-03-2011].

Treasury, H. (2008). *Budget 2008: stability and opportunity, building a strong, sustainable future, economic and fiscal strategy report and financial statement and budget report*: The Stationery Office.

Tumbarello, P. (2006). Are Regional Trade Agreements in Asia Stumbling or Building Blocks? Some Implications for the Mekong Countries. Retrieved from http://www.imf.org/external/np/seminars/eng/2006/mekong/pt.pdf [Accessed 05-06-2010].

United Nations. (2010). The Millennium Development Goals Report.

United Nations Conference on Trade and Development. (1990-2010). Statstical Database

United Nations Development Programme. (2006). International Trade and Human Development Report. United Nations Development Programme, Vientiane Capital, Lao PDR.

United Nations Development Programme. (2008 and 2010). Human Development Report.

UNCTAD and ADB. (2008). Quantification of Benefits from Regional Cooperation in South Asia.

Upadhyaya, U. (2008). Ending Poverty and Inequality. Conference Paper, South Asian Woman Trade Unionists Conference at Kathmandu, Sep 20-22

Valenzuela, E., Anderson, K., and Hertel, T. (2008). Impacts of trade reform: sensitivity of model results to key assumptions. *International Economics and Economic Policy*, *4*(4), 395-420.

Van Ourti, T., and Clarke, P. (2008). *The bias of the Gini coefficient due to grouping: revisiting first-order corrections*: Tinbergen Institute.

Verikios, G., and Zhang, X. G. (2008). Modelling Changes in Infrastructure Industries and Their Effects on Income Distribution. Productivity Commission, Australia: Productivity Commission, Australia.

Verikios, G., and Zhang, X. G. (2010). Structural Change in the Australian Electricity Industry During the 1990s and the Effect on Household Income Distribution: Centre of Policy Studies and the Impact Project

Villasenor, J. A., and Arnold, B. C. (1989). Elliptical lorenz curves. *Journal of econometrics*, *40*(2), 327-338.

Weerahewa, J. (2009). Impact of Trade Facilitation Measures and Regional Trade Agreements on Food and Agricultural Trade in South Asia. Retrieved from http://www.unescap.org/tid/artnet/pub/wp6909.pdf [Accessed 07-02-2010].

Weerakoon, D., and Thennakoon, J. (2006), Linkage between Trade Liberalisation and Poverty: Sri Lanka, Institute of Policy Studies in Sri Lanka, Retrieved from http://www.cuts-citee.org/PDF/BACKGROUNDER-Final_Srilanka.pdf [Accessed 3-12-2012].

Whalley, J. (1975b). How Reliable is Partial Equilibrium Analysis. *The Review of Economic Studies, L VII*, 299-310.

Winters, A. L. (2000). Trade Liberalisation and Poverty. Retrieved from http://siteresources.worldbank.org/INTPOVERTY/Resources/WDR/winters2.pdf [Accessed 07-04-2010].

Winters, A. L. (2002). Trade Liberalisation and Poverty:What are the links? *World Economy*, *25*(9), 1339-1367.

Winters, A. L. (2004). Trade Liberalisation and Economic Performance: An Overview. *The EconomicJ ournal*, *114*, F 4-F21.

Winters, A. L., Mcculloch, N., and Mckay, A. (2004). Trade Liberalization and Poverty:The Evidence So Far. *Journal of Economic Literature*, *17*, pp. 72-115.

Winters, L. A. (1999). Trade, Trade Policy and Poverty: A Framework for Collecting and Interpreting the Evidence. Retrieved from http://scholar.google.com.ezproxy.une.edu.au/scholar?start=20&q=Trade+liberalisation+and+poverty&hl=en&as_sdt=2000 [Accessed 06-02-2010].

World Bank. (2004). Trade Policies in South Asia: An Overview (Vol. 2): World Bank, Washington DC.

World Bank. (2008). Statistical Database. from The World Bank

World Bank Development Prospects Group. (2004). Global Economic Prospects 2004 – Realising the Development Promise of the Doha Agenda: Washington, DC: World Bank.

World Trade Organisation. (2008). Statistical Database.

Yen, T., and Roe, T. L. (1986). Determinants of Rural and Urban Household Demand: An Analysis of Dominican Household Consumption (Vol. 86): Economic Development Center Department of Economics, Minneapolis, Department of Agricultural and Applied Economics, St. Paul.

Zhang, Q. (2003). DAD, An Innovative Tool for Income Distribution Analysis. *Journal of Economic Inequality*, *1*(1), 281–284.

Zheng, B. (1993). An Axiomatic Characterization of the Watts Index. *Economics Letters*, *42*, 81-86.

APPENDIX A

Table A 1 Simple Average Tariff Rates in South Asia: 1998/99–2005/06

	India			**Pakistan**			**Bangladesh**		**Sri Lanka**		**Nepal**	
	1998-1999	2002-2003	2004-2005	1998-1999	2004-2005	2005-2006	1998-1999	2004-2005	1998-1999	2004 Jan.	1998-1999	2002-2003
All Tariff Lines (%)												
Custom Duties (CD)	39.6	29.0	22.2	21.3	16.8	14.4	20.0	16.3	17.6	11.3	14.0	13.7
Other General Protective Taxes	-	6.0	0.0	-	0.0	-	-	3.3	-	2.1	-	2.5
Other Selective Protective Taxes	-	0.0	0.0	-	1.7	-	-	6.4	-	0.0	0.0	0.0
Total	**-**	**35.0**	**22.2**	**0.0**	**18.5**	**-**	**-**	**26.5**	**-**	**13.4**	**-**	**16.2**
General Maximum CD	45.0	30.0	30.0	35.0	25.0	-	40.0	25.0	35.0	27.5	80.0	25.0
Other Protective Taxes	-	6.0	0.0	0.0	-	-	-	4.0	-	3.5	-	3.0
General Maximum: CD+ other	**-**	**36.0**	**30.0**	**-**	**25.0**	**25.0**	**-**	**29.0**	**-**	**31.25**	**-**	**28.0**
Non-Agricultural Tariff												
Custom Duties	-	27.4	19.7	-	16.6	10.4	-	15.6	-	8.8	-	13.8
Other General Protective Taxes	-	5.9	0.0	-	0.0	-	-	3.9	-	1.9	-	2.8
Other selective import taxes	-	0.0	0.0	-	0.0	-	-	5.9	-	0.0	-	0.0
Total	-	**33.3**	**19.7**	-	**16.6**	-	-	**25.4**	-	**10.7**	-	**16.6**
General Maximum CD+ Others	-	36.0	20.0	-	25.0	-	-	29.0	-	31.3	-	28.0
							-				-	
Agricultural Tariff	-	40.6	40.1	-	18.1	15.6	-	19.7	-	24.6	-	13.5
Custom Duties	-	6.5	0.0	-	0.0	-	-	3.7	-	3.5	-	2.8
Other General Protective Taxes	-	0.0	0.0	-	0.0	-	-	8.7	-	0.0	-	0.0
Other selective import taxes	-	**47.1**	**40.1**	-	**18.1**	-	-	**32.1**	-	**28.1**	-	**16.3**
Total	-	100.0	100.0	-	25.0	-	-	25.0	-	27.5	-	25.0
Maximum CD							-				-	
Other General Protective Taxes	-	8.6	0.0	-	0.0	-	-	4.0	-	3.8	-	3.0
General Maximum CD+ Others		**108.6**	**100.0**	-	**25.0**	-	-	**29.0**	-	**31.3**	-	**28.0**

Source: World Bank (2004), Trade Policies in South Asia: An Overview, Washington, D.C, World Bank (2006), Pakistan: Growth and Export Competitiveness Note: Tariff data for Bhutan, Maldives and Afghanistan were not available for the years 1998-99- 2005-06.

Table A 2 Foreign Investment Policies in Sout Asia

	Country				
	India	**Pakistan**	**Bangladesh**	**Sri Lanka**	**Nepal**
Restricted Sectors	• Arms & ammunitions • Defence aircrafts & warships • Automatic energy • Railways	• Arms & ammunitions • High explosives • Radioactive substances • Security printing, currency & mint • New units of alcohol manufacturing, industrial alcohol is banned.	• Arms & ammunitions • Production of nuclear energy • Security printing & minting • Forestry in reserved forest areas • Railways	• Non bank money lending • Pawn broking • Retail trade with a capital investment of less than $1 million.	• Cottage Industries • Personal business services • Arms & ammunitions • Consultative services
100% Equity	For certain sectors, sectoral caps exist	Yes, for all sectors	Yes	Yes, except for few sectors such as telecom, education, mass transportation, mining etc.	Yes, except restrictive sectors.
Incentives	Yes, central government gives for R&D measures. State governments give a wide variety of incentives.	Incentives are industry specific but has local content requirement.	Yes. It varies depending upon the location of industries.	Yes, with export requirement and minimum investment.	Yes, with export requirement and local content requirement.
Restrictions in royalty or technology transfer payments.	No, but certain minimum conditions to be met such as lump sum payments not exceeding US$ 2 million etc.	No	No. The condition is that it should not exceed 6% of the previous year's sales.	No	No
Performance requirements	Yes, specific rules for automobile sectors.	No (only for eligibility of incentives).	No	No (only for eligibility of incentives).	No (only for eligibility of incentives).
Export	Yes	Yes, complete exemption of	Yes	No. Industrial Processing Zones	No

Processing Zone (EPZ) incentives.		taxation from federal, provincial & municipal bodies.		for better land allocation.	
Automatic Approval	Yes, by Reserve Bank of India (RBI)	Yes	Yes, by Board of Investment (BOI) & Bangladesh Export Processing Zone authority.	Yes, by Board of Investment (BOI).	No. Approval is given by Industrial Promotion Board (IPB).
National Treatment	Yes	Yes	Yes	Yes	Contract terms are given precedence over Napali law in investments valued at more than Napali rupees 500 million.
Multilateral Investment Guarantee (MIGA) signatory	Yes	Yes	Yes	Yes	Yes
Tax holidays	Yes	No, only customs duty & sales tax exemptions.	Yes	Yes	Income earned from exports is free from income tax.
Source: Adopted from S.K Das and Manoj Pant (2006),"FDI in South Asia: Do Incentives Work?: A Survey of Literature" ,International Studies Vol 43, No:1, January-March					

APPENDIX B

Table B 1 Regional Aggregation of the GTAP Database

No	GTAP Code	Aggregated Region	Member Regions
			(IND)
			(LKA)
3	PAK	Pakistan	Pakistan (PAK)
4			(BGD)
5			Afghanistan (XSA)
6			(USA)
7			(CAN)
8	EU	European Union	(AUT) (BEL) (DNK) (FIN) (FRA) (DEU) (GBR) (GRC) (IRL) (ITA) (LUX) (NLD) Hungary (HUN), (PRT) (ESP) (SWE), Cyprus(CYP), Czech Republic (CZE), Estonia(EST), Latvia (LVA), Lithuania (LTU), Malta (MLT), Poland (POL), Slovakia (SVK) and Slovenia (SVN).
9	ASE	ASEAN	(IDN) (MYS) (PHL) (SGP) (THA), (VNM), Cambodia (KHM), Lao People's Democratic Republic (LAO), Myanmar (MMR), Rest of Southeast Asia (XSE).
10	HIA	High Income Asia	(HKG) (KOR) (TWN)
11		Japan	Japan(JPN)
12		China	China (CHN)
13			Iran (IRN), Islamic Republic of
14	AUS_NZL	&	(AUS) and (NZL)
15	RUS_XSU	Russian Federation and Rest of Soviet Union	Russian Federation (RUS) and Rest of Former Soviet Union(XSU)
16	ROW	Rest of the World	Rest of Oceania(XOC) , Rest of East Asia (XEA), Mexico (MEX), Rest of North America (XNA), Argentina (ARG), Bolivia (BOL), Brazil (BRA), Chile (CHL), Colombia (COL), Ecuador (ECU), Paraguay (PRY), Peru (PER), Uruguay (URY), Venezuela (VEN), Rest of South America (XSM), Costa Rica (CRI), Guatemala (GTM), Nicaragua (NIC), Panama (PAN), Rest of Central America

			(XCA), Caribbean (XCB), Switzerland(CHE), Norway (NOR), Albania (ALB), Bulgaria (BGR), Rest of EFTA (XEF), Belarus (BLR), Croatia (HRV), Romania (ROU), Ukraine (UKR), Rest of Eastern Europe (XEE), Rest of Europe (XER), Kazakhstan (KAZ), Kyrgyzstan (KGZ), Armenia (ARM), Azerbaijan (AZE), Georgia (GEO), Turkey (TUR), Rest of Western Asia (XWE), Egypt (EGY), Morocco (MAR), Tunisia (TUN), Rest of North Africa (XNF), Nigeria (NGA), Senegal (SEN), Rest of Western Africa (XWF), Rest of Central Africa (XCF), Rest of South Central Africa (XAC), Ethiopia (ETH), Madagascar (MDG), Malawi (MWI), Mauritius (MUS), Mozambique (MOZ), Tanzania (TZA), Uganda (UGA), Zambia (ZMB), Zimbabwe (ZWE), Rest of Eastern Africa (XEC), Botswana (BWA), South Africa (ZAF) and Rest of South African CustomsUnion(XSC)

Source: The GTAP Version 7 Database (Purdue University: Centre for Global Trading Analysis, 2008)

Table B 2 Commodity (Sector) Aggregation of the GTAP Database

No.	GTAP Code	Aggregated Sector	Commodity/Service Category
1		Rice; Paddy and Processed	(PDR) (PCR)
2	WHT GRO	Wheat, Cereal Grains	Wheat (WHT), Cereal Grains nec (GRO)
3		Vegetables and fruits	(V_F)
4	OSD VOL	Oil seeds and vegetable oil	(OSD) (VOL)
5	PFB_OCR	Plant based fibers and crops	- (PFB) (OCR)
6	_SGR	Sugar	(C_B) (SGR)
7	RMK_MIL	Dairy Products and milk	(MIL) (RMK)
8		Fishing	(FSH)
9	CMT_OAP	Meat	(CMT) , (OMT) (OAP) Cattle, Sheep Goats, Horse (CTL)
10	OFD	Food Products nec	Food Products nec (OFD)
11			(B_T)
12			(TEX)
13			(WAP)
14	LEA_LUM	Leather, wood products	(LEA) (LUM)
15	PPP	Paper Products	Paper Products and Publishing (PPP)
16			(CRP)
17	I_S_NFM_FMP	Metal Products	Basic metal products (FMP), Metals nec. (NFM), Ferrous metals (I_S)
18	ELE	Electronic Equipment	Electronic Equipment (ELE)
19	OME	Machinery	Machinery and Equipment nec. (OMF)
20	OMF	Other Manufacturing	Manufactures nec.(OMF)
21	MVH_OTP	Motor Vehicle & Transports	(MVH) (OTN) Transport necessaries (OTP)
22	P_C_COA	Petroleum & Coal	Petroleum (P_C) & Coal Products (COA)
23	GAS_GDT	Gas	Gas (GAS), Gas Manufacturers & Distributors (GDT)
24	CMN_ROS	Tradeable Services	(CNS) (OFI) (ISR) (OBS) Communication (CMN), (ROS)

25	OSG_DWE	Non Tradeable Services	(OSG) and (DWE)
26	WOL_ NMM	Other Primary products	Wool, Silk worm, cocoons (WOL), Minerals nec. (OMN), Mineral product necessaries
27	TRD_CNS	Trade & Construction	Trade (TRD) & Construction
28	ELY_WTR	Electricity, water and air transport	Electricity (ELY), Water (WTR), Water transport (WTP), and Air transport (ATP)
29	OIL	Oil	Oil (OIL)
30	FRS	Natural Resources and Extracts	(FRS)

Source: The GTAP Version 7 Database (Purdue University: Centre for Global Trading Analysis, 2008)

Table B 3 Factor Aggregation

No	**GTAP Code**	**Description**	**Aggregated Factors**
1	UnSkLab	Unskilled Labour	Unskilled Labour (UnSkLab)
2	SkLab	Skilled Labour	Skilled Labour (SkLab)
3	Capital	Capital	Capital (Capital), Land (Land), and Natural Resources (NatlRes)

Source: The GTAP Version 7 Database (Purdue University: Centre for Global Trading Analysis, 2008)

Table B 4 SAMGEM Based on GTAP Model

This Table shows the model code for South Asia Multi-Country Computable General Equilibrium Model (SAMGEM) based on the standard GTAP model. The code is used for implementing the model in GEMPACK software package. Since the model code for the standard GTAP model is well documented this Appendix provides the modifications incorporated to the standard GTAP model in constructing the SAMGEM and some other equations in the standard GTAP model. First, in Section A, the relevant files and sets have been defined, followed by the model variables. In Section B, the database coefficients and the parameters are read into the model and various derivatives of the base data are calculated. Finally Sections C to P, provide the equations which describe the theory of the model.

Section A : Data files, Sets and Subsets

File SASETS # file with set specification #;
File BASEDATA # file containing all base data #;
File PARM # file containing behavioral parameters #;
File BASERATE # file containing tax rates#;
File ELAST # file containing elasticities#;

Set REG # regions in the model # ;
Set TRAD_COMM # traded commodities #;
Set MARG_COMM # margin commodities #;
Set NMRG_COMM # non-margin commodities # = TRAD_COMM - MARG_COMM;
Set CGDS_COMM # capital goods commodities #;
Set ENDW_COMM # endowment commodities #;
Set BASIC_COMMR #basic commodities in rural sector#
Set BASIC_COMMU #basic commodities in urban sector#

Set LAB # Labour categories # ;
Set CAPL # Capital # ;
Set PROD_COMM # produced commodities # = TRAD_COMM **union** CGDS_COMM;
Set DEMD_COMM # demanded commodities # = ENDW_COMM **union** TRAD_COMM;
Set NSAV_COMM # non-savings commodities # = DEMD_COMM **union** CGDS_COMM;
Set SOUA # South Asia # ;
Set ROW # Rest of the World#;
Set IND # India # ;
Set LKA # Sri Lanka # ;
Set PAK # Pakistan #;
Set BGD # Bangladesh # ;
Set HI # Household groups in India # ;
Set HS # Household groups in Sri Lanka #;
Set HP # Household groups in Pakistan #;
Set HB # Household groups in Bangladesh #;
Set SLR #Rural household groups in Sri Lanka#
Set SLU #Urban household groups in Sri Lanka#
Set SLE #Estate household groups in Sri Lanka#
Set INR #Rural household groups in India#
Set INU #Urban household groups in Inida#
Set PKR # Rural household groups in Pakistan#
Set PKU #Urban household groups in Pakistan#
Set BGR# Rural household groups in Bangladesh#
Set BGU #Urban household groups in Bangladesh#

Subset MARG_COMM **is subset of** TRAD_COMM;
Subset PROD_COMM **is subset of** NSAV_COMM;
Subset SOUA **is subset of** REG;
Subset ROW **is subset of** REG;
Subset IND **is subset of** SOUA;
Subset IND **is subset of** REG;
Subset LKA **is subset of** SOUA;
Subset LKA **is subset of** REG;
Subset PAK **is subset of** SOUA;
Subset PAK **is subset of** REG;
Subset BGD **is subset of** SOUA;
Subset BGD **is subset of** REG;
Subset LAB **is subset of** ENDW_COMM;
Subset CAPL **is subset of** ENDW_COMM;
Subset LAB **is subset of** NSAV_COMM;
Subset CAPL **is subset of** NSAV_COMM;

Section B: Variables and Coefficients

B.1 Quantity Variables

VARIABLE (all,i,NSAV_COMM)(all,r,REG) #Industry output of commodity i in region r#;	qo(i,r);
VARIABLE(all,i,ENDWS_COMM)(all,j,PROD_COMM)(all,r,REG) #Supply of sluggish endowment i used in j in region r#;	qoes(i,j,r);
VARIABLE (all,i,ENDW_COMM)(all,r,ROW) #Supply of endowments in ROW#;	qorw(i,r)
VARIABLE (all,i,ENDW_COMM)(all,b,HS)(all,r,LKA) # Supply of endowments in LKA#;	qosh(i,b,r)
VARIABLE (all,i,ENDW_COMM)(all,q,HI)(all,r,IND) # Supply of endowments in IND#;	qonh(i,q,r)
VARIABLE all,i,ENDW_COMM)(all,c,HP)(all,r,PAK) # Supply of endowments in PAK#;	qoph(i,c,r)
VARIABLE (all,i,ENDW_COMM)(all,d,HB)(all,r,BGD) # Supply of endowments in BGD#;	qobh(i,d,r)
VARIABLE(all,i,TRAD_COMM)(all,r,REG)(all,s,REG) #Export sales of I from r to s#;	qxs(i,r,s);
VARIABLE(all,i,TRAD_COMM)(all,r,REG)# Sales of i from r to international transport# ;	qst(i,r);
VARIABLE(all,i,TRAD_COMM)(all,r,REG) # domestic sales of commodity i in r # ;	qds(i,r)
VARIABLE(all,i,ENDW_COMM)(all,j,PROD_COMM)(all,r,REG) # demand for endowment i for use in j in region r # ;	qfe(i,j,r)
VARIABLE(all,j,PROD_COMM)(all,r,REG) # value-added in industry j of region r # ;	qva(j,r)
VARIABLE(all,i,TRAD_COMM)(all,j,PROD_COMM)(all,r,REG) # demand for commodity i for use in j in region r # ;	qf(i,j,r)
VARIABLE(all,i,TRAD_COMM)(all,j,PROD_COMM)(all,s,REG) #Industry demands for aggregate imports # ;	qfm(i,j,s)
VARIABLE(all,i,TRAD_COMM)(all,j,PROD_COMM)(all,s,REG) # Industry demands for domestic goods # ;	qfd(i,j,s)

VARIABLE(all,i,TRAD_COMM)(all,r,REG)# private hhld demand for commodity i in region r #	qp(i,r)
VARIABLE(all,i,TRAD_COMM)(all,r,REG) #government household demand for commodity i in region r#;	qg(i,r)
VARIABLE(all,i,TRAD_COMM)(all,s,REG)#private hhld demand for imports of i in region s# ;	qpm(i,s)
VARIABLE (all,i,TRAD_COMM)(all,s,REG) # private hhld demand for domestic i in region s #	qpd(i,s)
VARIABLE (all,i,TRAD_COMM)(all,b,HS)(all,s,LKA) # private hhld demand for domestic i in LKA# ;	qpdlk(i,b,s)
VARIABLE (all,i,TRAD_COMM)(all,q,HI)(all,s,IND) # private hhld demand for domestic i in IND # ;	qpdin(i,q,s)
VARIABLE (all,i,TRAD_COMM)(all,c ,HP)(all,s,PAK) # private hhld demand for domestic i in PAK # ;	qpdpk(i,c,s)
VARIABLE (all,i,TRAD_COMM)(all,d,HB)(all,s,BGD) # private hhld demand for domestic i in BGD # ;	qpdbg(i,d,s)
VARIABLE (all,i,TRAD_COMM)(all,s,ROW) # private hhld demand for domestic i in ROW # ;	qpdrw(i,s)
VARIABLE(all,i,TRAD_COMM)(all,b.HS)(all,s,LKA) #private hhld demand for imports of i in LKA # ;	qpmlk(i,b,s)
VARIABLE(all,i,TRAD_COMM)(all,q.HI)(all,s,IND) #private hhld demand for imports of i in IND # ;	qpmin(i,q,s)
VARIABLE(all,i,TRAD_COMM)(all,c.HP)(all,s,PAK) #private hhld demand for imports of i in PAK # ;	qpmpk(i,c,s)
VARIABLE(all,i,TRAD_COMM)(all,d.HB)(all,s,BGD) #private hhld demand for imports of i in BGD # ;	qpmpk(i,d,s)
VARIABLE(all,i,TRAD_COMM)(all,s,ROW) # government hhld demand for imports of i in ROW # ;	qgmrw(i,s)
VARIABLE (all,i,TRAD_COMM)(all,r,ROW) #Quantity of subsistence consumption-ROW#;	qsubrw(i,r)
VARIABLE (all,i,TRAD_COMM)(all,b,HS)(all,r,LKA) #Quantity of subsistence consumption-LKA#;	qsublk(i,b,r)
VARIABLE (all,i,TRAD_COMM)(all,q,HI)(all,r,IND) #Quantity of subsistence consumption_IND#;	qsubin(i,q,r)
VARIABLE (all,i,TRAD_COMM)(all,c,HP)(all,r,PAK) #Quantity of subsistence consumption-PAK#;	qsubpk(i,c,r)
VARIABLE (all,i,TRAD_COMM)(all,d,HB)(all,r,BGD) #Quantity of subsistence consumption_BGD#;	qsubgd(i,d,r)
VARIABLE (all,i,TRAD_COMM) (all,r,ROW) #Quantity of luxury consumption-ROW#;	qluxrw(i,r)

VARIABLE (all,i,TRAD_COMM)(all,b,HS)(all,r,LKA) #Quantity of luxury consumption-LKA#;	qluxlk(i,b,r)
VARIABLE (all,i,TRAD_COMM)(all,q,HI)(all,r,IND) #Quantity of luxury consumption-IND#;	qluxin(i,q,r)
VARIABLE (all,i,TRAD_COMM)(all,c,HP)(all,r,PAK) #Quantity of luxury consumption-PAK#;	qluxpk(i,c,r)
VARIABLE (all,i,TRAD_COMM)(all,d,HB)(all,r,BGD) #Quantity of luxury consumption-BGD#;	qluxbg(i,d,r)
VARIABLE (all,i,TRAD_COMM)(all,r,ROW) #Private consumption demand for composite goods-ROW#;	qprw(i,r)
VARIABLE (all,i,TRAD_COMM)(all,b,HS)(all,r,LKA) #Private consumption demand for composite goods-LKA#;	qplk(i,b,r)
VARIABLE (all,i,TRAD_COMM)(all,q,HI)(all,r,IND) #Private consumption demand for composite goods-IND#;	qpin(i,q,r)
VARIABLE (all,i,TRAD_COMM)(all,c,HP)(all,r,PAK) #Private consumption demand for composite goods-PAK#;	qppk(i,c,r)
VARIABLE (all,i,TRAD_COMM)(all,d,HB)(all,r,BGD) #Private consumption demand for composite goods-BGD#;	qpbg(i,d,r)
VARIABLE (all,r,ROW) #Real household consumption-ROW#;	xprw(r)
VARIABLE (all,b,HS)(all,r,LKA) #Real household consumption-LKA#;	xplk(b,r)
VARIABLE (all,q,HI)(all,r,IND) #Real household consumption-IND#;	xpin(q,r)
VARIABLE (all,c,HP)(all,r,PAK) #Real household consumption-PAK#;	xppk(c,r)
VARIABLE (all,d,HB)(all,r,BGD) #Real household consumption-BGD#;	xpbg(d,r)
VARIABLE(all,i,TRAD_COMM)(all,s,REG) # government hhld demand for domestic i in region s # ;	qgd(i,s)
VARIABLE(all,r,REG) # capital services = qo("capital",r) # ;	ksvces(r)
VARIABLE(all,r,REG) #Output of capital goods sector = qo("cgds",r) # ;	qcgds(r)
VARIABLE(all,r,REG) #regional demand for NET savings #;	qsave(r)
VARIABLE (all,r,REG) #Household savings in region r#;	qsaveh(r)
VARIABLE (all,r,REG) #Government savings in region r#;	qsaveg(r)
VARIABLE (all,r,ROW) #Household savings-ROW# ;	qsaverw(r)
VARIABLE (all,b,HS)(all,r,LKA) # Household savings by hhld groups-Sri Lanka# ;	qsavelk(b,r)
VARIABLE (all,q,HI)(all,r,IND) # Household savings by hhld groups-India# ;	qsavein(q,r)
VARIABLE (all,c,HP)(all,r,PAK) # Household savings by hhld groups-Pakistan# ;	qsavepk(c,r)

VARIABLE (all,d,HB)(all,r,BGD) #Household savings by hhld groups-Bangladesh#	qsavebg(d,r)
VARIABLE(all,i,TRAD_COMM)(all,s,REG)#aggregate imports of i in region s # ;	qim(i,s)
VARIABLE(all,i,TRAD_COMM)(all,s,REG)# aggregate imports of i in region s, cif weights # ; VARIABLE(all,i,TRAD_COMM)(all,r,REG) #aggregate exports of i from region r, fob weights # ;	qiw(i,s) qxw(i,r)
VARIABLE(all,r,REG) #volume of merchandise exports, by region # ;	qxwreg(r)
VARIABLE(all,r,REG) #volume of merchandise imports, by region # ;	qiwreg(r)
VARIABLE(all,i,TRAD_COMM)#volume of global merchandise exports by commodity# ;	qxwcom(i)
VARIABLE(all,i,TRAD_COMM) #volume of global merchandise imports by commodity # ;	qiwcom(i)
VARIABLE # volume of world trade # ;	qxwwld
VARIABLE(all,i,TRAD_COMM) #Quantity Index for world supply of good i # ;	qow(i)
VARIABLE(all,r,REG) #Beginning-of-period capital stock, in r # ;	kb(r)
VARIABLE(all,r,REG) #End-of-period capital stock, in r # ;	ke(r)
VARIABLE # Global supply of capital goods for NET investment # ;	globalcgds
VARIABLE #quantity of global shipping services provided # ;	qt
VARIABLE # demand in the omitted market--global demand for savings # ;	walras_dem
VARIABLE # supply in omitted market--global supply of cgds composite #;	walras_sup
VARIABLE(all,r,REG) #GDP quantity index#	qgdp(r)

B.2 Price Variables

VARIABLE (all,i,NSAV_COMM)(all,r,REG) # supply price of commodity i in region r # ;	ps(i,r)
VARIABLE(all,i,TRAD_COMM)(all,j,PROD_COMM)(all,r,REG) # firms' price for commodity i for use in j, in r # ;	pf(i,j,r)
VARIABLE(all,i,ENDW_COMM)(all,j,PROD_COMM)(all,r,REG) # firms' price for endowment commodity i in j of r # ;	pfe(i,j,r)
VARIABLE (all,j,PROD_COMM)(all,r,REG) # firms' price of VA in industry j of region r # ;	pva(j,r)
VARIABLE(all,i,TRAD_COMM)(all,j,PROD_COMM)(all,s,REG) # price index for imports of i by j in region s #;	pfm(i,j,s)
VARIABLE(all,i,TRAD_COMM)(all,j,PROD_COMM)(all,s,REG) # price index for domestic purchases of i by j in region s #;	pfd(i,j,s)
VARIABLE(all,i,TRAD_COMM)(all,r,REG)# private hhld price for commodity i in region r #;	pp(i,r)
VARIABLE (all,i,TRAD_COMM)(all,s,REG)# price of imports of i by private households in s # ;	ppm(i,s)

VARIABLE(all,i,TRAD_COMM)(all,s,REG) # price of domestic i to private households in s # ;	ppd(i,s)
VARIABLE(all,r,REG) # price index for govt hhld expenditures in region r # ;	pgov(r)
VARIABLE(all,r,REG) # price index for private household expenditures in region r # ;	ppriv(r)
VARIABLE (all,b,HS)(all,r,LKA) #Consumer price index-LKA#;	cpilk(b,r)
VARIABLE (all,q,HI)(all,r,IND) #Consumer price index-IND#;	cpiin(q,r)
VARIABLE (all,c,HP)(all,r,PAK) #Consumer price index-PAK#;	cpipk(c,r)
VARIABLE (all,d,HB)(all,r,BGD) #Consumer price index-BGD#;	cpibg(d,r)
VARIABLE (all,r,REG) # Trasfers-price#;	ptrf(r)
VARIABLE(all,i,TRAD_COMM)(all,r,REG) # government household price for commodity i in region r # ;	pg(i,r)
VARIABLE (all,i,TRAD_COMM)(all,s,REG) # price of imports of i by government households in s # ;	pgm(i,s)
VARIABLE (all,i,TRAD_COMM)(all,s,REG) # price of domestic i to government households in s # ;	pgd(i,s)
VARIABLE (all,i,NSAV_COMM)(all,r,REG) # market price of commodity i in region r # ;	pm(i,r)
VARIABLE (all,i,TRAD_COMM)(all,r,REG) # market price of composite import i in region r # ;	pim(i,r)
VARIABLE(all,i,TRAD_COMM)(all,r,REG) # world price of composite import i in region *r* # ;	piw(i,r)
VARIABLE (all,i,TRAD_COMM)(all,r,REG)# aggregate exports price index of i from region r #	pxw(i,r)
VARIABLE (all,r,REG) # price index of merchandise exports, by region # ;	pxwreg(r)
VARIABLE (all,r,REG) #Foreign Grants-price#;	pfgr(r)
VARIABLE (all,r,REG) # price index of merchandise imports, by region # ;	piwreg(r)
VARIABLE (all,i,TRAD_COMM)# price index of global merchandise exports by commodity # ;	pxwcom(i)
VARIABLE(all,i,TRAD_COMM) # price index of global merchandise imports by commodity # ;	piwcom(i)
VARIABLE # price index of world trade # ;	pxwwld
VARIABLE (all,i,TRAD_COMM) # World price index for total good i supplies #;	pw(i)
VARIABLE(all,i,ENDWS_COMM)(all,j,PROD_COMM)(all,r,REG) # market price of sluggish endowment used by j, in r # ;	pmes(i,j,r)
VARIABLE (all,i,TRAD_COMM)(all,r,REG)(all,s,REG) # domestic price for good i supplied from r to region s # ;	pms(i,r,s)
VARIABLE(all,i,TRAD_COMM)(all,r,REG)(all,s,REG) # FOB world price of commodity i supplied from r to s # ;	pfob(i,r,s)
VARIABLE(all,i,TRAD_COMM)(all,r,REG)(all,s,REG) # CIF world price of commodity i supplied from r to s #;	pcif(i,r,s)

VARIABLE # price of global shipping services provided # ;	pt
VARIABLE(all,r,REG) # rental rate on capital = ps("capital",r) # ;	rental(r)
VARIABLE (all, r, REG) # Current net rate of return on capital stock, in r # ;	rorc(r)
VARIABLE (all, r, REG) # Expected net rate of return on capital stock, in r # ;	rore(r)
VARIABLE # Global net rate of return on capital stock # ;	rorg
VARIABLE (all, r, REG) # price of capital goods supplied to savers # ;	psave(r)
VARIABLE (all, r, REG) # price of investment goods = ps("cgds",r) # ;	pcgds(r)
VARIABLE(all,r,REG) # Index of prices received for tradeables produced in r # ;	psw(r)
VARIABLE (all,r,REG) # Index of prices paid for tradeables used in region r #;	pdw(r)
VARIABLE (all,r,REG) # Trasfers-price#;	ptrf(r)
VARIABLE(all,r,REG) # terms of trade for region r: tot(r) = psw(r) - pdw(r) # ;	tot(r)
VARIABLE(all,i,TRAD_COMM)(all,r,REG) # ratio of domestic to imported prices in r # ;	pr(i,r)
VARIABLE (all,r,REG) # GDP price index # ;	pgdp(r)
Variable(orig_level=1.0)(all,i,ENDW_COMM)(all,r,REG) # ratio of return to primary factor i to CPI in r #;	pfactreal(i,r)

B.3 Nominal Variables (Value, income and utility variables)

VARIABLE (all,r,REG) # Regional household income in region r #;	y(r)
VARIABLE (all,r,REG) #Private household income in region r#;	yhhld(r)
VARIABLE (all,r,REG) #Government income#;	ygovt(r)
VARIABLE (all,i,ENDW_COMM)(all,r,ROW) # Total Household income of the rest of the world#;	yhrw(i,r)
VARIABLE (all,i,ENDW_COMM)(all,b,HS)(all,r,LKA) # Household income Sri Lanka# ;	yhsl(i,b,r)
VARIABLE (all,i,ENDW_COMM)(all,q,HI)(all,r,IND) # Household income India# ;	yhin(i,q,r)
VARIABLE (all,i,ENDW_COMM)(all,c,HP)(all,r,PAK) # Household income Pakistan# ;	yhpk(i,c,r)
VARIABLE (all,i,ENDW_COMM)(all,d,HB)(all,r,BGD)# Household income Bangladesh# ;	yhbg(i,d,r)
VARIABLE (all,i,ENDW_COMM)(all,r,ROW) # Net Household income of the rest of the world#;	ynhrw(i,r)

VARIABLE (all,b,HS)(all,r,LKA) # Net Household income Sri Lanka# ;	ynhsl(b,r)
VARIABLE(all,q,HI)(all,r,IND) # Net Household income India# ;	ynhin(i,q,r)
VARIABLE(all,c,HP)(all,r,PAK) # Net Household income Pakistan# ;	ynhpk(i,c,r)
VARIABLE(all,d,HB)(all,r,BGD)# Net Household income Bangladesh# ;	ynhbg(i,d,r)
VARIABLE (all,r,ROW) #Nominal luxury consumption-ROW#;	wluxrw(r)
VARIABLE (all,b,HS)(all,r,LKA) #Nominal luxury consumption-LKA#;	wluxlk(b,r)
VARIABLE (all,q,HI)(all,r,IND) #Nominal luxury consumption-IND#;	wluxin(q,r)
VARIABLE (all,c,HP)(all,r,PAK) #Nominal luxury consumption-PAK#;	wluxpk(c,r)
VARIABLE (all,d,HB)(all,r,BGD) #Nominal luxury consumption-BGD#;	wluxbg(d,r)
VARIABLE (all,r,REG) # value of merchandise exports, by region # ;	vxwreg(r)
VARIABLE (all,r,ROW) #Nominal household total consumption-ROW#;	wprw(r)
VARIABLE (all,b,HS)(all,r,LKA) #Nominal household total consumption-LKA#;	wplk(b,r)
VARIABLE (all,q,HI)(all,r,IND) #Nominal household total consumption-IND#;	wpin(q,r)
VARIABLE (all,c,HP)(all,r,PAK)#Nominal household total consumption-PAK#;	wppk(c,r)
VARIABLE (all,d,HB)(all,r,BGD) #Nominal household total consumption-BGD#;	wpbg(d,r)
VARIABLE (all,b,HS)(all,r,LKA) #Nominal govt. transfers to/from households-LKA#;	wgotrlk(b,r)
VARIABLE (all,q,HI)(all,r,IND) #Nominal govt. transfers to/from households-IND#;	wgotrin(q,r)
VARIABLE (all,c,HP)(all,r,PAK) #Nominal govt. transfers to/from households-PAK#;	wgotrpk(c,r)
VARIABLE (all,d,HB)(all,r,BGD)#Nominal govt. transfers to/from households-BGD#;	wgotrbg(d,r)
VARIABLE (all,r,ROW) #Nominal govt. transfers to/from households-ROW#;	wgotrrw(r)
VARIABLE (all,r,REG) #Nominal govt. transfers to/from households-REG#;	wgotrreg(r)
VARIABLE (all,i,ENDW_COMM)(all,r,ROW) # Income tax -rest of the world#;	ytrw(i,r)
VARIABLE (all,i,ENDW_COMM)(all,b,HS)(all,r,LKA)# Income tax -Sri Lanka# ;	ytsl(i,b,r)
VARIABLE (all,i,ENDW_COMM)(all,q,HI)(all,r,IND)# Income tax - India# ;	ytin(i,q,r)
VARIABLE (all,i,ENDW_COMM)(all,c,HP)(all,r,PAK) # Income tax- Pakistan# ;	ytpk(i,c,r)
VARIABLE (all,i,ENDW_COMM)(all,d,HB)(all,r,BGD)# Income tax - Bangladesh# ;	ytbg(i,d,r)
VARIABLE (all,r,ROW) # Disposable income-rest of the world#;	wdisrw(r)
VARIABLE (all,b,HS)(all,r,LKA) # Disposable income -Sri Lanka# ;	wdissl(b,r)
VARIABLE (all,q,HI)(all,r,IND) # Disposable income - India# ;	wdisin(q,r)

VARIABLE (all,c,HP)(all,r,PAK) # Disposable income- Pakistan# ;	wdispk(c,r)
VARIABLE (all,d,HB)(all,r,BGD) # Disposable income - Bangladesh# ;	wdisbg(d,r)
VARIABLE (all,r,ROW) #Nominal household total consumption-ROW#;	wtotrw(r)
VARIABLE (all,r,LKA) #Private consumption demand for composite goods-LKA#;	wtotlk(r)
VARIABLE (all,r,IND) #Private consumption demand for composite goods-IND#;	wtotin(r)
VARIABLE (all,r,PAK) #Private consumption demand for composite goods-PAK#;	wtotpk(r)
VARIABLE (all,r,BGD) #Private consumption demand for composite goods-BGD#;	wtotbg(r)
VARIABLE (all,r,REG)#Nominal net foreign grants-REG#;	wfogrreg(r)
VARIABLE (all,r,REG)#Govt. budget deficit/surplus-REG#;	govbreg(r)
VARIABLE (all,r,REG) # value of merchandise imports, by region, at world prices # ;	viwreg(r)
VARIABLE (all,i,TRAD_COMM)(all,s,REG) # value of merchandise regional imports, by commodity, cif # ;	viwcif(i,s)
VARIABLE (all,i,TRAD_COMM)(all,s,REG) # value of merchandise regional exports, by commodity, fob # ;	vxwfob(i,s)
VARIABLE (all,i,TRAD_COMM) # value of global merchandise exports by commodity # ;	vxwcom(i)
VARIABLE (all,i,TRAD_COMM) # value of global merchandise imports by commodity, at world prices # ;	viwcom(i)
VARIABLE # value of world trade # ;	vxwwld
VARIABLE (all,i,TRAD_COMM) # value of world supply of good i # ;	valuew(i)
VARIABLE (all,r,REG) # change in value of GDP # ;	vgdp(r)
VARIABLE (all,r,REG) # regional private household expenditure, in region r # ;	yp(r)
VARIABLE (all,r,REG) # per capita utility from private expend., in region r #;	up(r)
VARIABLE (all,r,REG) # per capita utility from gov't expend., in region r #;	ug(r)
VARIABLE (all,r,REG) # per capita utility from aggregate hhld expend., in region r # ;	u(r)
VARIABLE (CHANGE)(all,r,REG) # Equivalent Variation, $ US million # ;	EV(r)
VARIABLE (CHANGE) # Equivalent variation for the world # ;	WEV
VARIABLE (CHANGE)(all,r,REG) # Change in trade balance X - M, $ US million # ;	DTBAL(r)
VARIABLE (CHANGE)(all,i,TRAD_COMM)(all,r,REG) # Change in trade balance by commodity and by region, $ US million #;	DTBALi(i,r)
VARIABLE (change)(all,r,REG) # change in ratio of trade balance to regional income #;	DTBALR(r)

B.4 Technical Change Variables

VARIABLE (all,j, PROD_COMM) (all,r,REG) #output augmenting technical change in sector j of region r#	ao(j,r)
VARIABLE (all,i, ENDW_COMM) (all,j,PROD_COMM) #primary factor I augmenting technical change in sector j of region r#	afe(i,j,r)
VARIABLE (all,i,TRAD_COMM)(all,j,PROD_COMM)(all,r,REG) # composite interm. input i augmenting tech change in j of r # ;	af(i,j,r)
VARIABLE (all,j,PROD_COMM)(all,r,REG) # value added augmenting technical change in sector j of r #;	avaall(j,r)
VARIABLE (all,i,PROD_COMM)(all,r,REG) # Value added augmenting tech change in sector i of r # ;	ava(i,r)
VARIABLE (all,i,TRAD_COMM)(all,r,REG)(all,s,REG) # tech change parameter in shipping of i from region r to s # ;	atr(i,r,s)
VARIABLE (all,i,TRAD_COMM)(all,r,ROW) #Taste change subsistence demand-ROW#;	asubrw(i,r)
VARIABLE (all,i,TRAD_COMM)(all,b,HS)(all,r,LKA) #Taste change subsistence demand-LKA#;	asubsl(i,b,r)
VARIABLE (all,i,TRAD_COMM)(all,q,HI)(all,r,IND) #Taste change subsistence demand-IND#;	asubin(i,q,r)
VARIABLE (all,i,TRAD_COMM)(all,c,HP)(all,r,PAK) #Taste change subsistence demand-PAK#;	asubpk(i,c,r)
VARIABLE (all,i,TRAD_COMM)(all,d,HB)(all,r,BGD) #Taste change subsistence demand-BGD#;	asubgd(i,d,r)
VARIABLE (all,i,TRAD_COMM)(all,r,ROW) #Taste change supernumeria demand-ROW#;	aluxrw(i,r)
VARIABLE (all,i,TRAD_COMM)(all,b,HS)(all,r,LKA) #Taste change supernumeria demand-LKA#;	aluxlk(i,b,r)
VARIABLE (all,i,TRAD_COMM)(all,q,HI)(all,r,IND) #Taste change supernumeria demand-IND#;	aluxin(i,q,r)
VARIABLE (all,i,TRAD_COMM)(all,c,HP)(all,r,PAK) #Taste change supernumeria demand-PAK#;	aluxpk(i,c,r)
VARIABLE (all,i,TRAD_COMM)(all,d,HB)(all,r,BGD) #Taste change supernumeria demand-BGD#;	aluxbg(i,d,r)

B.5 Policy Variables

VARIABLE (all,i,NSAV_COMM)(all,r,REG) # output (or income) tax in region r # ;	to(i,r)
VARIABLE (all,i,ENDW_COMM)(all,j,PROD_COMM)(all,r,REG) # tax on primary factor i used by j in region r # ;	tf(i,j,r)

VARIABLE (all,i,TRAD_COMM)(all,r,REG) #tax on imported i purchased by private hhlds in r #;	tpm(i,r)
VARIABLE (all,i,TRAD_COMM)(all,r,REG) # tax on domestic i purchased by private hhld in r # ;	tpd(i,r)
VARIABLE (all,i,TRAD_COMM)(all,r,REG) # tax on imported i purchased by gov't hhld in r # ;	tgm(i,r)
VARIABLE (all,i,TRAD_COMM)(all,r,REG) # tax on domestic i purchased by government hhld in r # ;	tgd(i,r)
VARIABLE (all,i,TRAD_COMM)(all,j,PROD_COMM)(all,r,REG) # tax on imported i purchased by j in r # ;	tfm(i,j,r)
VARIABLE (all,i,TRAD_COMM)(all,j,PROD_COMM)(all,r,REG) # tax on domestic i purchased by j in r # ;	tfd(i,j,r)
VARIABLE (all,i,TRAD_COMM)(all,r,REG)(all,s,REG) # combined tax in r on good i bound for region s # ;	txs(i,r,s)
VARIABLE (all,i,TRAD_COMM)(all,r,REG)(all,s,REG) # import tax in s on good i imported from region r # ;	tms(i,r,s)
VARIABLE (all,i,TRAD_COMM)(all,s,REG) # variable import levy -- source generic # ;	tm(i,s)
VARIABLE (all,i,TRAD_COMM)(all,r,REG) # variable export tax (subsidy) -- destination generic # ;	tx(i,r)

B.6 Slack Variables

VARIABLE (all,j,PROD_COMM)(all,r,REG) # slack variable in the zero profit equation # ! This is exogenous, unless it requires to specify output in a given region exogenously!;	profitslack(j,r)
VARIABLE (all,r,REG) # slack variable in the expression for regional income # ! This is exogenous, unless it requires to fix regional income!;	incomeslack(r)
VARIABLE (all,i,ENDW_COMM)(all,r,REG) # slack variable in the endowment market clearing condition # ! This is exogenous, unless requires to fix the wage rate for one of the primary factors! ;	endwslack(i,r)
VARIABLE (all, r, REG) # slack variable for qcgds(r) # ! This is exogenous, unless it requires specifying the level of new capital goods in a region! ;	cgdslack(r)
VARIABLE (all,r,REG) # slack variable in region demand for savings # ! This is exogenous unless it requires to fix the level of savings in a region. ! ;	saveslack(r)
VARIABLE (all,r,REG) # slack variable to permit fixing of real govt purchases # ! This is exogenous unless it requires to fix the level of government purchases. ! ;	govslack(r)

VARIABLE (all,i,TRAD_COMM)(all,r,REG) # slack variable in the tradables market clearing condition # ! This is exogenous unless it requires to fix the price of tradables exogenously! ;	tradslack(i,r)
VARIABLE # slack variable in the omitted market # ! This is endogenous under normal, GE closure. If the GE links are broken, then this must be swapped with the numeraire, thereby forcing global savings to explicitly equal global investment. ! ;	walraslack

B7. List of Exogeneous Variables in the Model

All slack variables (except walraslack and govslack) and policy variables are exogeneous.

VARIABLE(all,r,REG) # regional population # ;	pop(r)
VARIABLE (orig_level=1.0) # world price index of primary factors #; ! Numeraire variable in the model!	pfactwld
VARIABLE (all,i,TRAD_COMM)(all,r,REG)(all,s,REG) # import i from region r augmenting tech change in region s #;	ams(i,r,s)
VARIABLE (all,m,TRAD_COMM) # tech change in mode m, worldwide #;	atm(m)
VARIABLE (all,i,TRAD_COMM) # tech change shipping of i, worldwide #;	atf(i)
VARIABLE (all,r,REG) # tech change shipping from region r #;	ats(r)
VARIABLE (all,r,REG) # factor input tech change in region r #;	afereg(r)
VARIABLE (all,r,REG) # intermediate tech change in region r #;	afreg(r)
VARIABLE (all,j,PROD_COMM) # output tech change of sector j, worldwide #;	aosec(j)
VARIABLE (all,r,REG) # output tech change in region r #;	aoreg(r)
VARIABLE (all,j,PROD_COMM) # value added tech change of sector j, worldwide #;	avasec(j)
VARIABLE (all,r,REG) # value added tech change in region r #;	avareg(r)
VARIABLE (all,m,MARG_COMM)(all,i,TRAD_COMM)(all,r,REG)(all,s,REG) # tech change in m's shipping of i from region r to s #;	atmfsd(m,i,r,s)
VARIABLE (all,i,TRAD_COMM)# intermediate tech change of input i, worldwide #;	afcom(i)
VARIABLE (all,j,PROD_COMM) # intermediate tech change of sector j, worldwide #;	afsec(j)
VARIABLE (all,i,ENDW_COMM)# factor input tech change of input i, worldwide #;	afecom(i)
VARIABLE (all,j,PROD_COMM) # factor input tech change of sector j, worldwide #;	afesec(j)

VARIABLE (all,j,PROD_COMM)(all,r,REG) # value added augmenting technical change in sector j of r #;	avaall(j,r)
VARIABLE (all,j,PROD_COMM)(all,r,REG) # output augmenting technical change in sector j of r #;	aoall(j,r)
VARIABLE (all,i,TRAD_COMM)(all,j,PROD_COMM)(all,r,REG) # intermediate input i augmenting tech change by j in r #;	afall(i,j,r)
VARIABLE (all,i,ENDW_COMM)(all,j,PROD_COMM)(all,r,REG) # primary factor i augmenting tech change sector j in r #;	afeall(i,j,r)
VARIABLE (all,r,REG)# input-neutral shift in utility function #;	au(r)
VARIABLE (all,r,REG)# private consumption distribution parameter #;	dppriv(r)
VARIABLE (all,r,REG)# government consumption distribution parameter #	dpgov(r)
VARIABLE (all,r,REG) # saving distribution parameter #;	dpsave(r)
VARIABLE (all,i,ENDW_COMM)#Endowment commodities in region r#;	qo (ENDW_COMM,r)
VARIABLE (all,r,ROW) #Number of households-ROW#;	qw(r)
VARIABLE (all,b,HS)(all,r,LKA) #Number of households-LKA#;	qb(b,r)
VARIABLE (all,q,HI)(all,r,IND) #Number of households-IND#;	qn(q,r)
VARIABLE (all,c,HP)(all,r,PAK) #Number of households-PAK#;	qc(c,r)
VARIABLE (all,d,HB)(all,r,BGD) #Number of households-BGD#;	qd(d,r)
VARIABLE (all,i,TRAD_COMM)(all,r,ROW) #Taste change shifter,subsistence demand-ROW#;	arw_s(i,r)
VARIABLE (all,i,TRAD_COMM)(all,b,HS)(all,r,LKA) #Taste change shifter,subsistence demand-LKA#;	alk_s(i,b,r)
VARIABLE (all,i,TRAD_COMM)(all,q,HI)(all,r,IND) #Taste change shifter,subsistence demand-IND#;	ain_s(i,q,r)
VARIABLE (all,i,TRAD_COMM)(all,c,HP)(all,r,PAK) #Taste change shifter,subsistence demand-PAK#;	apk_s(i,c,r)
VARIABLE (all,i,TRAD_COMM)(all,d,HB)(all,r,BGD) #Taste change shifter,subsistence demand-BGD#;	agd_s(i,d,r)
VARIABLE (all,r,ROW) # Shift term for consumption-ROW#;	f3totrw(r)
VARIABLE (all,b,HS)(all,r,LKA) # Shift term for consumption -Sri Lanka#;	f3totlk(b,r)
VARIABLE (all,q,HI)(all,r,IND) # Shift term for consumption - India# ;	f3totin(q,r)
VARIABLE (all,c,HP)(all,r,PAK) # Shift term for consumption- Pakistan# ;	f3totpk(c,r)
VARIABLE (all,d,HB)(all,r,BGD) # Shift term for consumption - Bangladesh# ;	f3totbg(d,r)
VARIABLE # Overall shift term for consumption-ROW#;	f3totrw_h

VARIABLE #Overall shift term for consumption -Sri Lanka#;	f3totlk_h
VARIABLE # Overall shift term for consumption - India#;	f3totin_h
VARIABLE # Overall shift term for consumption- Pakistan#;	f3totpk_h
VARIABLE # Overall shift term for consumption - Bangladesh#;	f3totbg_h
VARIABLE (all,b,HS)(all,r,LKA) #Real govt. transfers to/from households-LKA#;	qgotrlk(b,r)
VARIABLE (all,q,HI)(all,r,IND)#Real govt. transfers to/from households-IND#;	qgotrin(q,r)
VARIABLE (all,c,HP)(all,r,PAK) #Real govt. transfers to/from households-PAK#;	qgotrpk(c,r)
VARIABLE (all,d,HB)(all,r,BGD) #Real govt. transfers to/from households-BGD#;	qgotrbg(d,r)
VARIABLE (all,r,REG) #Real net foreign grants-REG#;	qfogrreg(r)
VARIABLE (all,r,ROW) #Real govt. transfers to/from households-ROW#;	qgotrrw(r)

B8. Coefficient and Parameters Read from the Database

All these coefficients are read from the MODELDATA, PARM, and ELAST data files.

Base revenues and expenditures at agents' prices	
COEFFICIENT(all,i,ENDW_COMM)(all,r,REG) #Total Household income of region r at agent's price#;	EVOA(i,r)
COEFFICIENT(all,i,ENDW_COMM)(all,r,ROW) #Total Household income of the rest of the world#;	HIRW(i,r)
COEFFICIENT (all,i,ENDW_COMM)(all,b,HS)(all,r,LKA) # Household income Sri Lanka# ;	HISL(i,b,r)
COEFFICIENT (all,i,ENDW_COMM)(all,q,HI)(all,r,IND) # Household income India# ;	HIIN(i,q,r)
COEFFICIENT (all,i,ENDW_COMM)(all,c,HP)(all,r,PAK) # Household income Pakistan# ;	HIPK(i,c,r)
COEFFICIENT (all,i,ENDW_COMM)(all,d,HB)(all,r,BGD) # Household income Bangladesh# ;	HIBG(i,d,r)
COEFFICIENT (all,i,ENDW_COMM)(all,r,REG) #Total Household income of region r at market price#;	EVOM(i,r)
COEFFICIENT (all,i,ENDW_COMM)(all,r,ROW) # Endowments at market prices rest of the world#;	EVOW(i,r)
COEFFICIENT (all,i,ENDW_COMM)(all,b,HS)(all,r,LKA) # Endowments at market prices Sri Lanka# ;	EVOS(i,b,r)
COEFFICIENT (all,i,ENDW_COMM)(all,q,HI)(all,r,IND) # Endowments at market prices India# ;	EVOI(i,q,r)

COEFFICIENT (all,i,ENDW_COMM)(all,c,HP)(all,r,PAK) # Endowments at market prices Pakistan# ;	EVOP(i,c,r)
COEFFICIENT (all,i,ENDW_COMM)(all,d,HB)(all,r,BGD) # Endowments at market prices Bangladesh# ;	EVOB(i,d,r)
COEFFICIENT (all,i,ENDW_COMM)(all,j,PROD_COMM)(all,r,REG) # producer expenditure on i by industry j, in region r, valued at agents' prices # ;	EVFA(i,j,r)
COEFFICIENT (all,r,REG) # expenditure on NET savings in region r valued at agents' prices # ;	SAVE(r)
COEFFICIENT (all,r,ROW) #Private household savings -ROW#;	SHRW(r)
COEFFICIENT (all,b,HS)(all,r,LKA) # Private household savings-LKA#;	SHSL(b,r)
COEFFICIENT (all,q,HI)(all,r,IND) # Private household savings -IND#;	SHIN(q,r)
COEFFICIENT (all,c,HP)(all,r,PAK) # Private household savings - PAK#;	SHPK(c,r)
COEFFICIENT (all,d,HB)(all,r,BGD) # Private household savings -BGD#;	SHBG(d,r)
COEFFICIENT (all,r,REG)#Government Savings#;	GSVE(r)
COEFFICIENT (all,r,REG) # expenditure on NET savings in region r valued at agent's prices #;	PRSAVE(r)
COEFFICIENT (all,b,HS)(all,r,LKA) #Govt. transfers to/from households-LKA#;	GTSL(b,r)
COEFFICIENT (all,q,HI)(all,r,IND) #Govt. transfers to/from households-IND#;	GTIN(q,r)
COEFFICIENT (all,c,HP)(all,r,PAK) #Govt. transfers to/from households-PAK#;	GTPK(c,r)
COEFFICIENT (all,d,HB)(all,r,BGD) #Govt. transfers to/from households-BGD#;	GTBG(d,r)
COEFFICIENT (all,r,ROW) #Govt. transfers to/from households-ROW#;	GTRW(r)
COEFFICIENT (all,r,REG) #Net foreign grants#;	FGRT(r)
COEFFICIENT (all,r,REG) #Govt.budget deficit/surplus in REG#;	GBUD(r)
COEFFICIENT (all,i,TRAD_COMM)(all,j,PROD_COMM)(all,r,REG) # purchases of domestic i for use in j in region r # ;	VDFA(i,j,r)
COEFFICIENT (all,i,TRAD_COMM)(all,j,PROD_COMM)(all,r,REG) # purchases of imported i for use in j in region r # ;	VIFA(i,j,r)
COEFFICIENT (ge 0) (all,i,TRAD_COMM)(all,b,HS)(all,r,LKA) # Consum.expenditure of hhlds on domestic goods in LKA #;	VASL(i,b,r)
COEFFICIENT (ge 0) (all,i,TRAD_COMM)(all,q,HI)(all,r,IND) # Consum. expenditure of hhlds on domestic goods in IND #;	VAIN(i,q,r)
COEFFICIENT (ge 0) (all,i,TRAD_COMM)(all,c,HP)(all,r,PAK) #Consum. expenditure of hhlds on domestic goods in PAK #	VAPK(i,c,r)
COEFFICIENT (ge 0) (all,i,TRAD_COMM)(all,d,HB)(all,r,BGD) #Consum. expenditure of hhlds on domestic goods in BGD #;	VABG(i,d,r)

COEFFICIENT (ge 0) (all,i,TRAD_COMM)(all,r,ROW) #Household consumption expenditure Rest of the World#;	VARW(i,r)
COEFFICIENT (ge 0) (all,i,TRAD_COMM)(all,b,HS)(all,r,LKA) # consum.expend. of hhlds on imported goods in Sri Lanka #;	VPSL(i,b,r)
COEFFICIENT (ge 0) (all,i,TRAD_COMM)(all,q,HI)(all,r,IND) # consum.expend. of hhlds on imported goods in India #;	VPIN(i,q,r)
COEFFICIENT (ge 0) (all,i,TRAD_COMM)(all,c,HP)(all,r,PAK) #consum. expend of hhlds on imported goods in Pakistan #;	VPPK(i,c,r)
COEFFICIENT (ge 0) (all,i,TRAD_COMM)(all,d,HB)(all,r,BGD) #consum. expend of hhlds on imported goods in Bangladesh #;	VPBG(i,d,r)
COEFFICIENT (ge 0) (all,i,TRAD_COMM)(all,r,ROW) #Household imports of the World #;	VPRW(i,r)
COEFFICIENT (all,i,TRAD_COMM)(all,r,REG) # government household expenditure on domestic i in r # ;	VDGA(i,r)
COEFFICIENT (all,i,TRAD_COMM)(all,r,REG) #government household expenditure on imported i # ;	VIGA(i,r)
COEFFICIENT (all, r, REG) # value of beginning-of-period capital stock, in region r # ;	VKB(r)
COEFFICIENT (all, r, REG) # value of capital depreciation, in r#;	VDEP(r)
Base revenues and expenditures at market prices	
COEFFICIENT (all,i,TRAD_COMM)(all,r,REG)(all,s,REG) # exports of commodity i from region r to destination s (tradables only) # ;	VXMD(i,r,s)
COEFFICIENT (all,i,TRAD_COMM)(all,r,REG) # exports of commodity i from region r for international transportation # ;	VST(i,r)
COEFFICIENT (all,i,ENDW_COMM)(all,j,PROD_COMM)(all,r,REG) # producer expenditure on i by industry j, in region r#;	VFM(i,j,r)
COEFFICIENT (all,i,TRAD_COMM)(all,j,PROD_COMM)(all,r,REG) # purchases of imports i for use in j in region r # ;	VIFM(i,j,r)
COEFFICIENT (all,i,TRAD_COMM)(all,j,PROD_COMM)(all,r,REG) # purchases of domestic i for use in j in region r # ;	VDFM(i,j,r)
COEFFICIENT (ge 0) (all,i,TRAD_COMM)(all,b,HS)(all,r,LKA) # consum.expend. of hhlds on imported in Sri Lanka at MP#;	VISL(i,b,r)
COEFFICIENT (ge 0) (all,i,TRAD_COMM)(all,q,HI)(all,r,IND) # consum.expend. of hhlds on imported goods in India at MP#;	VIIN(i,q,r)
COEFFICIENT (ge 0) (all,i,TRAD_COMM)(all,c,HP)(all,r,PAK) #consum. expend of hhlds on imported goods in Pakistan at MP#	VIPK(i,c,r)
COEFFICIENT (ge 0) (all,i,TRAD_COMM)(all,d,HB)(all,r,BGD) #consum. expend of hhlds on imported goods in Bangladesh at MP#	VIBG(i,d,r)
COEFFICIENT (ge 0) (all,i,TRAD_COMM)(all,r,ROW) #Household importd of Rest of the World at MP#;	VIRW(i,r)

COEFFICIENT (ge 0) (all,i,TRAD_COMM)(all,b,HS)(all,r,LKA) # consum.expend. of hhlds on domestic goods in Sri Lanka at MP#;	VDSL(i,b,r)
COEFFICIENT (ge 0) (all,i,TRAD_COMM)(all,q,HI)(all,r,IND) # consum.expend. of hhlds on domestic goods in India at MP#;	VDIN(i,q,r)
COEFFICIENT (ge 0) (all,i,TRAD_COMM)(all,c,HP)(all,r,PAK) #consum. expend of hhlds on domestic goods in Pakistan at MP#;	VDPK(i,c,r)
COEFFICIENT (ge 0) (all,i,TRAD_COMM)(all,d,HB)(all,r,BGD) #consum. expend of hhlds on domestic goods in Bangladesh at MP#;	VDBG(i,d,r)
COEFFICIENT (ge 0) (all,i,TRAD_COMM)(all,r,ROW) #Household consumption expenditure Rest of the World#;	VDRW(i,r)
COEFFICIENT (all,i,TRAD_COMM)(all,r,REG) # gov't household expenditure on i in r # ;	VIGM(i,r)
COEFFICIENT (all,i,TRAD_COMM)(all,r,REG) # government household expenditure on domestic i in r # ;	VDGM(i,r)
COEFFICIENT (all,i,TRAD_COMM)(all,r,REG)(all,s,REG) # imports of commodity i from region r to s, # ;	VIMS(i,r,s)
Base revenues and expenditures at world prices	
COEFFICIENT (all,i,TRAD_COMM)(all,r,REG)(all,s,REG) # exports of commodity i from region r to destination s valued fob (tradables only) # ;	VXWD(i,r,s)
COEFFICIENT (all,i,TRAD_COMM)(all,r,REG)(all,s,REG) # imports of commodity i from region r to destination s, valued cif (tradables only)#;	VIWS(i,r,s)
Technology, preference parameters and elasticities	
COEFFICIENT (all,i,TRAD_COMM) # the elasticity of substitution between domestic and imported goods in the Armington aggregation structure for all agents in all regions. # ;	ESUBD(i)
COEFFICIENT (all,j,PROD_COMM) # elst. of sub. among composite intermediate inputs in production #;	ESUBT(j)
COEFFICIENT (all,i,TRAD_COMM) # the elasticity of substitution among imports from different destinations in the Armington aggregation structure of all agents in all regions.#;	ESUBM(i)
COEFFICIENT (all,j,PROD_COMM) # elasticity of substitution between capital, labor, and possibly land, in the production of value-added in j#;	ESUBVA(j)
COEFFICIENT (all,i,ENDWS_COMM) # ETRAE is the elasticity of transformation for sluggish primary factor endowments. It is non-positive, by definition #;	ETRAE(i)
COEFFICIENT (all, r, REG) # RORFLEX is the flexibility of expected net rate of return on capital stock, in region r, with respect to investment. If a region's capital stock increases by 1%, then it is expected that the net rate of return on capital will decline by RORFLEX %#;	RORFLEX(r)

COEFFICIENT # RORDELTA is a binary coefficient which determines the mechanism of allocating investment funds across regions. When RORDELTA = 1, investment funds are allocated across regions to equate the change in the expected rates of return (i.e., rore(r)). When RORDELTA = 0, investment funds are allocated across regions to maintain the existing composition of capital stocks! ;	RORDELTA
COEFFICIENT (all,i,TRAD_COMM)(all,r,ROW) # Expenditure elasticities of the rest of the world #;	EPRW(i,r)
COEFFICIENT (all,i,TRAD_COMM)(all,b,HS)(all,r,LKA) # Expenditure elasticities of the Sri Lankan households# ;	EPSL(i,b,r)
COEFFICIENT (all,i,TRAD_COMM)(all,q,HI)(all,r,IND) # Expenditure elasticitie of the Indian households# ;	EPIN(i,q,r)
COEFFICIENT (all,i,TRAD_COMM)(all,c,HP)(all,r,PAK) # Expenditure elasticities of the Pakistani households#;	EPPK(i,c,r)
COEFFICIENT (all,i,TRAD_COMM)(all,d,HB)(all,r,BGD) # Expenditure elasticities of the Bangladeshi households# ;	EPBG(i,d,r)
COEFFICIENT (all,r,ROW) # Frisch parameter the rest of the world #;	FRRW(r)
COEFFICIENT (all,b,HS)(all,r,LKA) # Frisch parameter Sri Lankan households#;	FRSL(b,r)
COEFFICIENT (all,q,HI)(all,r,IND) # Frisch parameter Indian households# ;	FRIN(q,r)
COEFFICIENT (all,c,HP)(all,r,PAK) # Frisch parameter Pakistani households#;	FRPK(c,r)
COEFFICIENT (all,d,HB)(all,r,BGD) # Frisch parameter Bangladeshi households# ;	FRBG(d,r)

Derivatives of the base data and Model Equations

After the base data have been read, a variety of derivatives of these value flows can be defined. These derivatives are not directly stored in the database rather we need to write formulas to calculate them. Various share coefficients are also defined which need to write model equations.

Section C: Production Structure

- **Producer Expenditure**

COEFFICIENT(all,i,DEMD_COMM)(all,j,PROD_COMM)(all,r,REG)
VFA(i,j,r) # producer expenditure on i by industry j, in region r, at agents' prices # ;
FORMULA (all,i,ENDW_COMM)(all,j,PROD_COMM)(all,r,REG)
VFA(i,j,r) = EVFA(i,j,r) ;
FORMULA (all,i,TRAD_COMM)(all,j,PROD_COMM)(all,s,REG)
VFA(i,j,s) = VDFA(i,j,s) + VIFA(i,j,s) ;

COEFFICIENT (all,i,TRAD_COMM)(all,j,PROD_COMM)(all,s,REG)
FMSHR(i,j,s) # share of firms' imports in dom. composite, agent's prices #;
FORMULA (all,i,TRAD_COMM)(all,j,PROD_COMM)(all,s,REG)
FMSHR(i,j,s) = VIFA(i,j,s) / VFA(i,j,s);

- **Total Output Nest**

Equation AOWORLD
sector/region specific average rate of output augmenting tech change
(**all**,j,PROD_COMM)(**all**,r,REG)
ao(j,r) = aosec(j) + aoreg(r) + aoall(j,r);
Equation AVAWORLD
sector/region specific average rate of value added augmenting tech change
(**all**,j,PROD_COMM)(**all**,r,REG)
ava(j,r) = avasec(j) + avareg(r) + avaall(j,r);
Equation VADEMAND
sector demands for primary factor composite
(**all**,j,PROD_COMM)(**all,**r,REG)
qva(j,r)
= -ava(j,r) + qo(j,r) - ao(j,r) - ESUBT(j) * [pva(j,r) - ava(j,r) - ps(j,r) - ao(j,r)];
Equation AFWORLD
sector/region specific average rate of intermediates augmenting tech change
(**all**,i,TRAD_COMM)(**all**,j,PROD_COMM)(**all**,r,REG)
af(i,j,r) = afcom(i) + afsec(j) + afreg(r) + afall(i,j,r);

Equation INTDEMAND
industry demands for intermediate inputs, including cgds
(**all**,i,TRAD_COMM)(**all**,j,PROD_COMM)(**all**,r,REG)
qf(i,j,r) = - af(i,j,r) + qo(j,r) - ao(j,r) - ESUBT(j) * [pf(i,j,r) - af(i,j,r) - ps(j,r) - ao(j,r)];

- **Composite Intermediates Nest**

Equation INDIMP
industry j demands for composite import i (HT 31)
(**all**,i,TRAD_COMM)(**all**,j,PROD_COMM)(**all**,s,REG)
qfm(i,j,s) = qf(i,j,s) - ESUBD(i) * [pfm(i,j,s) - pf(i,j,s)];

Equation INDDOM
industry j demands for domestic good i (HT 32)
(**all**,i,TRAD_COMM)(**all**,j,PROD_COMM)(**all,**s,REG)
qfd(i,j,s) = qf(i,j,s) - ESUBD(i) * [pfd(i,j,s) - pf(i,j,s)];

Section D: Regional Income: Private Households Income and the Government Revenue

Regional income is allocated between private consumption expenditure, government consumption expenditure, and savings.

Expenditure of Regional Household

Regional household(h.h.) Expenditure = Income

```
                                 _/|\_
                               _/  |  \_
                             _/    |    \_
                           _/      |      \_
                         _/        |        \_
          Private h.h.             |           Government h.h.
          ( PRIVEXP )              |             ( GOVEXP )
            _/\_                   |                _/\_
          _/    \_                 |              _/    \_
         /        \                |             /        \
    Domestic    Imported        Savings      Domestic    Imported
     Goods        Goods        ( SAVE )        Goods       Goods
    ( VDPA )     ( VIPA )                    ( VDGA )    ( VIGA )
```

Private Household Income

- **Household Income from Endowment and Output**

```
COEFFICIENT(all,i,NSAV_COMM)(all,r,REG)
VOA(i,r)# value of commodity i output in region r.# ;
FORMULA (all,i,ENDW_COMM)(all,r,REG)
VOA(i,r) = EVOA(i,r);
FORMULA (all,i,ENDW_COMM)(all,r,ROW)
EVOA(i,r)=HIRW(i,r);
FORMULA (all,i,ENDW_COMM)(all,r,IND)
EVOA(i,r)=SUM(q,HI,HIIN(i,q,r));
FORMULA (all,i,ENDW_COMM)(all,r,LKA)
EVOA(i,r)=SUM(b,HS,HISL(i,b,r));
FORMULA (all,i,ENDW_COMM)(all,r,PAK)
EVOA(i,r)=SUM(c,HP,HIPK(i,c,r));
FORMULA (all,i,ENDW_COMM)(all,r,BGD)
EVOA(i,r)=SUM(d,HB,HIBG(i,d,r));
FORMULA (all,i,PROD_COMM)(all,r,REG)
VOA(i,r) = sum(j,DEMD_COMM, VFA(j,i,r));
COEFFICIENT(all,i,NSAV_COMM)(all,r,REG)
VOM(i,r)# value of commodity i output in region r at market prices# ;
FORMULA (all,i,ENDW_COMM)(all,r,REG)
VOM(i,r) = sum(j,PROD_COMM, VFM(i,j,r)) ;
FORMULA (all,i,ENDW_COMM)(all,r,ROW)
VOM(i,r)=EVOW(i,r);
FORMULA (all,i,ENDW_COMM)(all,r,LKA)
VOM(i,r)=sum(b,HS,EVOS(i,b,r));
FORMULA (all,i,ENDW_COMM)(all,r,IND)
VOM(i,r)=sum(q,HI,EVOI(i,q,r));
FORMULA (all,i,ENDW_COMM)(all,r,PAK)
VOM(i,r)=sum(c,HP,EVOP(i,c,r));
```

FORMULA (all,i,ENDW_COMM)(all,r,BGD)
VOM(i,r)=sum(d,HB,EVOB(i,d,r));
FORMULA (all,i,TRAD_COMM)(all,r,REG)
VOM(i,r) = VDM(i,r) + sum(s,REG, VXMD(i,r,s)) + VST(i,r) ;
FORMULA (all,h,CGDS_COMM)(all,r,REG)
VOM(h,r) = VOA(h,r) ;

Equation HHIRW
#Household income rest of the world#
(**all**,i,ENDW_COMM)(**all**,r,ROW)
yhrw(i,r)=qorw(i,r)+ps(i,r);

Equation HHISL
#Household income Sri Lanka#
(**all**,i,ENDW_COMM)(**all**,b,HS)(**all**,r,LKA)
yhsl(i,b,r)=qosh(i,b,r)+ps(i,r);

Equation HHIIN
#Household income India#
(**all**,i,ENDW_COMM)(**all**,q,HI)(**all**,r,IND)
yhin(i,q,r)=qonh(i,q,r)+ps(i,r);

Equation HHIPK
#Household income Pakistan#
(**all**,i,ENDW_COMM)(**all**,c,HP)(**all**,r,PAK)
yhpk(i,c,r)=qoph(i,c,r)+ps(i,r);

Equation HHIBD
#Household income Bangladesh#
(**all**,i,ENDW_COMM)(**all**,d,HB)(**all**,r,BGD)
yhbg(i,d,r)=qobh(i,d,r)+ps(i,r);

Equation HHIREGA
#Household income in region r#
(**all**,r,ROW)
sum(i,ENDW_COMM,HIRW(i,r)) * yhhld(r)=sum(i,ENDW_COMM,HIRW(i,r) * yhrw(i,r));

Equation HHIREGB
#Household income in region r#
(**all**,r,LKA)
sum(i,ENDW_COMM,sum(b,HS,HISL(i,b,r)))*yhhld(r)=
sum(i,ENDW_COMM,sum(b,HS,HISL(i,b,r)*yhsl(i,b,r)));

Equation HHIREGC
#Household income in region r#
(**all**,r,IND)
sum(i,ENDW_COMM,sum(q,HI,HIIN(i,q,r)))*yhhld(r)=
sum(i,ENDW_COMM,sum(q,HI,HIIN(i,q,r)*yhin(i,q,r)));

Equation HHIREGD
#Household income in region r#
(**all**,r,PAK)
sum(i,ENDW_COMM,sum(c,HP,HIPK(i,c,r)))*yhhld(r)=
sum(i,ENDW_COMM,sum(c,HP,HIPK(i,c,r)*yhpk(i,c,r)));

Equation HHIREGE
#Household income in region r#
(**all**,r,BGD)
sum(i,ENDW_COMM,sum(d,HB,HIBG(i,d,r)))*yhhld(r)=
sum(i,ENDW_COMM,sum(d,HB,HIBG(i,d,r)*yhbg(i,d,r)))

Equation ENDW_SUPPLY
eq'n distributes the sluggish endowments across sectors (HT 51)
(all,i,ENDWS_COMM)(all,j,PROD_COMM)(all,r,REG)
qoes(i,j,r) = qo(i,r) - endwslack(i,r) + ETRAE(i) * [pm(i,r) - pmes(i,j,r)];

- **Net Household Income**

Coefficient (ge 0)(all,r,REG)
VDEP(r) # value of capital depeciation in r #;
Coefficient (ge 0)(all,q,HI)(all,r,IND)
VEIN(q,r)# Depreciation by hhld in India#;
Coefficient (ge 0)(all,b,HS)(all,r,LKA)
VESL(b,r)#Depreciation by hhld in Sri Lanka#;
Coefficient (ge 0)(all,c,HP)(all,r,PAK)
VEPK(c,r)#Depreciation by hhld in Pakistan#;
Coefficient (ge 0)(all,d,HB)(all,r,BGD)
VEBG(d,r)#Depreciation by hhld in Bangladesh#;
Coefficient (ge 0)(all,r,ROW)
VERW(r) # Depreciation ROW#;
Formula (all,r,ROW)
VDEP(r)=VERW(r);
Formula (all,r,LKA)
VDEP(r)=sum(b,HS,VESL(b,r));
Formula (all,r,IND)
VDEP(r)=sum(q,HI,VEIN(q,r));
Formula (all,r,PAK)
VDEP(r)=sum(c,HP,VEPK(c,r));
Formula (all,r,BGD)
VDEP(r)=sum(d,HB,VEBG(d,r));
Coefficient (all,r,REG)
NHRG(r) # Net household income in region r #;
Coefficient (all,q,HI)(all,r,IND)
NHIN(q,r)# Net household income by hhld in India#;
Coefficient (all,b,HS)(all,r,LKA)
NHSL(b,r)# Net household incomeby hhld in Sri Lanka#;
Coefficient (all,c,HP)(all,r,PAK)
NHPK(c,r)#Net household income by hhld in Pakistan#;
Coefficient (all,d,HB)(all,r,BGD)
NHBG(d,r)#Net household income by hhld in Bangladesh#;
Coefficient (ge 0)(all,r,ROW)
NHRW(r) # Net household income ROW#;

Formula (all,q,HI)(all,r,IND)
NHIN(q,r)=sum(i,ENDW_COMM,HIIN(i,q,r))-VEIN(q,r);
Formula (all,b,HS)(all,r,LKA)
NHSL(b,r)=sum(i,ENDW_COMM,HISL(i,b,r))-VESL(b,r);
Formula (all,c,HP)(all,r,PAK)
NHPK(c,r)=sum(i,ENDW_COMM,HIPK(i,c,r))-VEPK(c,r);
Formula (all,d,HB)(all,r,BGD)

```
NHBG(d,r)=sum(i,ENDW_COMM,HIBG(i,d,r))-VEBG(d,r);
Formula (all,r,ROW)
NHRW(r)=sum(i,ENDW_COMM,HIRW(i,r))-VERW(r);

Formula (all,r,ROW)
   NHRG(r)=NHRW(r);
Formula (all,r,LKA)
   NHRG(r)=sum(b,HS,NHSL(b,r));
Formula (all,r,IND)
   NHRG(r)=sum(q,HI,NHIN(q,r));
Formula (all,r,PAK)
   NHRG(r)=sum(c,HP,NHPK(c,r));
Formula (all,r,BGD)
   NHRG(r)=sum(d,HB,NHBG(d,r));

Variable (all,r,REG)                      ynhhld(r)
    # regional household income in region r #;
Variable (all,b,HS)(all,r,LKA)            ynhslk(b,r)
   # Net Household income by hhld groups-Sri Lanka# ;
Variable (all,q,HI)(all,r,IND)            ynhind(q,r)
   # Net Household income by hhld groups-India# ;
Variable (all,c,HP)(all,r,PAK)            ynhpak(c,r)
    # Net Household income by hhld groups-Pakistan# ;
!SP!Variable(all,d,HB)(all,r,BGD)         ynhbgd(d,r)
   # Net Household income by hhld groups-Bangladesh# ;
!SP!Variable (all,r,ROW)                  ynhrw(r)
   # Total Household income of  the rest of the world#;
```

Equation NHIIND
#Net household income-IND#
(all,q,HI)(all,r,IND)
NHIN(q,r)*ynhind(q,r)=sum(i,ENDW_COMM,HIIN(i,q,r))*yhind(q,r)-VEIN(q,r)*
[pcgds(r) + kb(r)];

Equation NHILKA
#Net household income-LKA#
(all,b,HS)(all,r,LKA)
NHSL(b,r)*ynhslk(b,r)=sum(i,ENDW_COMM,HISL(i,b,r))*yhslk(b,r)-VESL(b,r)*
[pcgds(r) + kb(r)];

Equation NHIPAK
#Net household income-PAK#
(all,c,HP)(all,r,PAK)
NHPK(c,r)*ynhpak(c,r)=sum(i,ENDW_COMM,HIPK(i,c,r))*yhpak(c,r)-VEPK(c,r)*
[pcgds(r) + kb(r)];

Equation NHIBGD
#Net household income-BGD#
(all,d,HB)(all,r,BGD)
NHBG(d,r)*ynhbgd(d,r)=sum(i,ENDW_COMM,HIBG(i,d,r))*ynhbgd(d,r)-VEBG(d,r)*
[pcgds(r) + kb(r)];

Equation NHIRW
#Net household income-ROW#
(all,r,ROW)
NHRW(r)*ynhrw(r)=sum(i,ENDW_COMM,HIRW(i,r))*ynhrw(r)-VERW(r)*
[pcgds(r) + kb(r)];

Equation NHIREGA
#Net household income in region r#
(all,r,IND)
NHRG(r)*ynhhld(r)=sum(q,HI,NHIN(q,r)*ynhind(q,r));

Equation NHIREGB
(all,r,LKA)
NHRG(r)*ynhhld(r)=sum(b,HS,NHSL(b,r)*ynhslk(b,r));

Equation NHIREGC
(all,r,PAK)
NHRG(r)*ynhhld(r)=sum(c,HP,NHPK(c,r)*ynhpak(c,r));

Equation NHIREGD
(all,r,BGD)
NHRG(r)*ynhhld(r)=sum(d,HB,NHBG(d,r)*ynhbgd(d,r));

Equation NHIREGE
(all,r,ROW)
NHRG(r)*ynhhld(r)=NHRW(r)*ynhrw(r);

- **Household Transfers/to from**

COEFFICIENT (all,r,REG)
GTRS(r) # Govt. Transfers in region r #;
FORMULA (all,r,ROW)
GTRS(r) = GTRW(r);
FORMULA (all,r,LKA)
GTRS(r)=sum(b,HS,GTSL(b,r));
FORMULA (all,r,IND)
GTRS(r)=sum(q,HI,GTIN(q,r));
FORMULA (all,r,PAK)
GTRS(r)=sum(c,HP,GTPK(c,r));
FORMULA (all,r,BGD)
GTRS(r)=sum(d,HB,GTBG(d,r));

Equation E_wgotrrw
#Govt. transfers to/from households-ROW#
(all,r,ROW)
wgotrrw(r)=qgotrrw(r)+ptrf(r);

Equation E_wgotrlk
#Govt. transfers to/from households-LKA#
(all,b,HS)(all,r,LKA)
wgotrlk(b,r)=qgotrlk(b,r)+ptrf(r);

Equation E_wgotrin
#Govt. transfers to/from households-IND#
(all,q,HI)(all,r,IND)
wgotrin(q,r)=qgotrin(q,r)+ptrf(r);

Equation E_wgotrpk
#Govt. transfers to/from households-PAK#
(all,c,HP)(all,r,PAK)
wgotrpk(c,r)=qgotrpk(c,r)+ptrf(r);

Equation E_wgotrbg
#Govt. transfers to/from households-BGD#
(all,d,HB)(all,r,BGD)
wgotrbg(d,r)=qgotrbg(d,r)+ptrf(r);

Equation E_wgotrregA
#Govt. Transfers-ROW#
(all,r,ROW)
GTRS(r)*wgotrreg(r)=GTRW(r)*wgotrrw(r);

Equation E_wgotrregB
#Govt. Transfers-LKA#
(all,r,LKA)
GTRS(r)*wgotrreg(r)=sum(b,HS,GTSL(b,r)*wgotrlk(b,r));

Equation E_wgotrregC
#Govt. Transfers-IND#
(all,r,IND)
GTRS(r)*wgotrreg(r)=sum(q,HI,GTIN(q,r)*wgotrin(q,r));

Equation E_wgotrregD
#Govt. Transfers-PAK#
(all,r,PAK)
GTRS(r)*wgotrreg(r)=sum(c,HP,GTPK(c,r)*wgotrpk(c,r));

Equation E_wgotrregE
#Govt. Transfers-BGD#
(all,r,BGD)
GTRS(r)*wgotrreg(r)=sum(d,HB,GTBG(d,r)*wgotrbg(d,r));

- **Government Revenue**

COEFFICIENT (all,r,REG)
TINC(r)# income tax payments in r #;
COEFFICIENT (all,i,ENDW_COMM)(all,r,ROW)
TIRW(i,r) # Total income tax of the rest of the world#;
COEFFICIENT (all,i,ENDW_COMM)(all,b,HS)(all,r,LKA)
TISL(i,b,r) # Income tax paid by Sri Lankan households# ;
COEFFICIENT (all,i,ENDW_COMM)(all,q,HI)(all,r,IND)
TIIN(i,q,r) # Income tax paid by Indian households # ;
COEFFICIENT (all,i,ENDW_COMM)(all,c,HP)(all,r,PAK)
TIPK(i,c,r) # Income tax paid by Pakistani households# ;

```
COEFFICIENT (all,i,ENDW_COMM)(all,d,HB)(all,r,BGD)
TIBG(i,d,r) # Income tax paid by Bangladeshi households# ;

COEFFICIENT (all,i,ENDW_COMM)(all,r,REG)                    PTAX(i,r)
FORMULA (all,i,ENDW_COMM)(all,r,ROW)
   PTAX(i,r)=TIRW(i,r);
FORMULA (all,i,ENDW_COMM)(all,r,LKA)
   PTAX(i,r)=sum(b,HS,TISL(i,b,r));
FORMULA (all,i,ENDW_COMM)(all,r,IND)
   PTAX(i,r)=sum(q,HI,TIIN(i,q,r));
FORMULA (all,i,ENDW_COMM)(all,r,PAK)
   PTAX(i,r)=sum(c,HP,TIPK(i,c,r));
FORMULA (all,i,ENDW_COMM)(all,r,BGD)
   PTAX(i,r)=sum(d,HB,TIBG(i,d,r));
 FORMULA (all,r,REG)
   TINC(r) = sum(i,ENDW_COMM, PTAX(i,r));
COEFFICIENT (all,r,REG)
INDTAX(r)  # indirect tax receipts in r #;
COEFFICIENT (all,r,REG)
TPC(r)  #Taxes on private household consumption#;
COEFFICIENT (all,r,REG)
TGC(r)  #Taxes on public goods#;
COEFFICIENT (all,r,REG)
TIU(r)  # Firm’s taxes on intermediate inputs#;
COEFFICIENT (all,r,REG)
TFU(r)   # Factor taxes#;
COEFFICIENT (all,r,REG)
TOUT(r)  #Output taxes#;
COEFFICIENT (all,r,REG)
TEX(r)   #Export taxes#;
COEFFICIENT (all,r,REG)
TIM(r)   #Taxes on imported goods#;
COEFFICIENT (all,i,TRAD_COMM)(all,r,ROW)
DPTRW (i,r)   # indirect taxes on private domestic consumption in RW #;
COEFFICIENT (all,i,TRAD_COMM)(all,b,HS)(all,r,LKA)
DPTSL(i,b,r)     # indirect taxes on private domestic consumption in SL #;
COEFFICIENT (all,i,TRAD_COMM)(all,q,HI)(all,r,IND)
DPTIN(i,q,r)    # indirect taxes on private domestic consumption in IND #;
COEFFICIENT (all,i,TRAD_COMM)(all,c,HP)(all,r,PAK)
DPTPK(i,c,r)    # indirect taxes on private domestic consumption in PAK #;
COEFFICIENT (all,i,TRAD_COMM)(all,d,HB)(all,r,BGD)
DPTBG(i,d,r)    #indirect taxes on private domestic consumption in BGD #;
COEFFICIENT (all,i,TRAD_COMM)(all,r,REG)
DPTAX(i,r)   # tax on private consumption of domestic good i in region r #;
FORMULA (all,i,TRAD_COMM)(all,r,ROW)
   DPTRW(i,r) = VARW(i,r) - VDRW(i,r);
FORMULA (all,i,TRAD_COMM)(all,b,HS)(all,r,LKA)
   DPTSL(i,b,r)=VASL(i,b,r)-VDSL(i,b,r);
FORMULA (all,i,TRAD_COMM)(all,q,HI)(all,r,IND)
   DPTIN(i,q,r)=VAIN(i,q,r)-VDIN(i,q,r);
FORMULA (all,i,TRAD_COMM)(all,c,HP)(all,r,PAK)
   DPTPK(i,c,r)=VAPK(i,c,r)-VDPK(i,c,r);
FORMULA (all,i,TRAD_COMM)(all,d,HB)(all,r,BGD)
   DPTBG(i,d,r)=VABG(i,d,r)-VDBG(i,d,r);
FORMULA (all,i,TRAD_COMM)(all,r,ROW)
```

```
   DPTAX(i,r)=DPTRW(i,r);
FORMULA (all,i,TRAD_COMM)(all,r,LKA)
   DPTAX(i,r)=sum(b,HS,DPTSL(i,b,r));
FORMULA (all,i,TRAD_COMM)(all,r,IND)
   DPTAX(i,r)=sum(q,HI,DPTIN(i,q,r));
FORMULA (all,i,TRAD_COMM)(all,r,PAK)
   DPTAX(i,r)=sum(c,HP,DPTPK(i,c,r));
FORMULA (all,i,TRAD_COMM)(all,r,BGD)
   DPTAX(i,r)=sum(d,HB,DPTBG(i,d,r));


COEFFICIENT (all,i,TRAD_COMM)(all,r,REG)              PTAX(i,r)
# indirect taxes on private consumption of imported good i in region r #;
COEFFICIENT (all,i,TRAD_COMM)(all,r,ROW)
IPTRW (i,r)  # indirect taxes on private domestic consumption in RW #;
COEFFICIENT (all,i,TRAD_COMM)(all,b,HS)(all,r,LKA)
IPTSL(i,b,r)  #indirect  taxes on private domestic consumption in SL #;
COEFFICIENT (all,i,TRAD_COMM)(all,q,HI)(all,r,IND)
IPTIN(i,q,r)   # indirect taxes on private domestic consumption in IND #;

COEFFICIENT (all,i,TRAD_COMM)(all,c,HP)(all,r,PAK)
IPTPK(i,c,r)    # indirect taxes on private domestic consumption in PAK #;
COEFFICIENT (all,i,TRAD_COMM)(all,d,HB)(all,r,BGD)
IPTBG(i,d,r)    # indirect taxes on private domestic consumption in BGD #;
 FORMULA (all,i,TRAD_COMM)(all,r,ROW)
   IPTRW(i,r) = VPRW(i,r) - VIRW(i,r);
FORMULA (all,i,TRAD_COMM)(all,b,HS)(all,r,LKA)
   IPTSL(i,b,r)=VPSL(i,b,r)-VISL(i,b,r);
FORMULA (all,i,TRAD_COMM)(all,q,HI)(all,r,IND)
   IPTIN(i,q,r)=VPIN(i,q,r)-VIIN(i,q,r);
FORMULA (all,i,TRAD_COMM)(all,c,HP)(all,r,PAK)
   IPTPK(i,c,r)=VPPK(i,c,r)-VIPK(i,c,r);
FORMULA (all,i,TRAD_COMM)(all,d,HB)(all,r,BGD)
   IPTBG(i,d,r)=VPBG(i,d,r) -VIBG(i,d,r);

FORMULA (all,i,TRAD_COMM)(all,r,ROW)
   IPTAX(i,r)=IPTRW(i,r);
FORMULA (all,i,TRAD_COMM)(all,r,LKA)
   IPTAX(i,r)=sum(b,HS,IPTSL(i,b,r));
FORMULA (all,i,TRAD_COMM)(all,r,IND)
   IPTAX(i,r)=sum(q,HI,IPTIN(i,q,r));
FORMULA (all,i,TRAD_COMM)(all,r,PAK)
   IPTAX(i,r)=sum(c,HP,IPTPK(i,c,r));
FORMULA (all,i,TRAD_COMM)(all,r,BGD)
   IPTAX(i,r)=sum(d,HB,IPTBG(i,d,r));
COEFFICIENT (all,r,REG)
TPC(r)     # private consumption tax payments in r #;
FORMULA (all,r,REG)
   TPC(r) = sum(i,TRAD_COMM, DPTAX(i,r) + IPTAX(i,r));

 FORMULA (all,r,REG)
   GOVINC(r)=INDTAX(r)+TINC(r);
```

Equation TPCRATIORW
#change in ratio of consumer tax to INCOME in RW#
(**all**,r,ROW)
100.0 * INCOME(r) * del_taxrpc(r) + TPC(r) * y(r)
= **sum**(i,TRAD_COMM, VARW(i,r)* atpd(i,r)+ DPTRW(i,r) * **[**pm(i,r) + qpd(i,r)**]**)
+ **sum**(i,TRAD_COMM, VPRW(i,r) * atpm(i,r) + IPTRW(i,r) * **[**pim(i,r)+ qpm(i,r)**]**);

Equation TPCRATIOSL
#change in ratio of income tax to INCOME in LKA#
(**all**,r,LKA)
100*INCOME(r) *del_taxrpc(r) +TPC(r) * y(r)
=sum(i,TRAD_COMM,sum(b,HS,VASL(i,b,r)* atpd(i,r)+ DPTSL(i,b,r) * **[**pm(i,r) + qpd(i,r)**]**))
+ **sum**(i,TRAD_COMM,**sum**(b,HS,VPSL(i,b,r)*atpm(i,r) + IPTSL(i,b,r)
* **[**pim(i,r) + qpm(i,r)**]**));

Equation TPCRATIOIN
#change in ratio of income tax to INCOME in IND#
(**all**,r,IND)
100*INCOME(r) *del_taxrpc(r)+TPC(r) * y(r)
=**sum**(i,TRAD_COMM,**sum**(q,HI,VAIN(i,q,r)* atpd(i,r)+ DPTIN(i,q,r)
* **[**pm(i,r) + qpd(i,r)**]**))+**sum**(i,TRAD_COMM,**sum**(q,HI,VPIN(i,q,r) * atpm(i,r) + IPTIN(i,q,r)
* **[**pim(i,r) + qpm(i,r)**]**));

Equation TPCRATIOPK
#change in ratio of income tax to INCOME in PAK#
(**all**,r,PAK)
100*INCOME(r)*del_taxrpc(r)+TPC(r) * y(r)
=**sum**(i,TRAD_COMM,**sum**(c,HP,VAPK(i,c,r)* atpd(i,r)+ DPTPK(i,c,r)
* **[**pm(i,r) + qpd(i,r)**]**))+**sum**(i,TRAD_COMM,**sum**(c,HP,VPPK(i,c,r) * atpm(i,r) + IPTPK(i,c,r)
* **[**pim(i,r) + qpm(i,r)**]**));

Equation TPCRATIOBG
#change in ratio of income tax to INCOME in BGD#
(**all**,r,BGD)
100*INCOME(r) *del_taxrpc(r)+TPC(r)* y(r)
=**sum**(i,TRAD_COMM,**sum**(d,HB,VABG(i,d,r)* atpd(i,r)+ DPTBG(i,d,r) *
[pm(i,r) + qpd(i,r)**]**))+**sum**(i,TRAD_COMM,**sum**(d,HB,VPBG(i,d,r) * atpm(i,r) + IPTBG(i,d,r) *
[pim(i,r) + qpm(i,r)**]**));

Equation TINCRATIORW
#change in ratio of income tax to INCOME in RW#
(**all**,r,ROW)
100*INCOME(r) * del_taxrinc(r)+TINC(r)*y(r)
=**sum**(i,ENDW_COMM, HIRW(i,r)***[-to**(i,r)**]**+TIRW(i,r)***[**pm(i,r)+qorw(i,r)**]**);

Equation TINCRATIOSL
#change in ratio of income tax to INCOME in LKA#
(**all**,r,LKA)
100*INCOME(r) * del_taxrinc(r)+TINC(r)*y(r)
=**sum**(i,ENDW_COMM,**sum**(b,HS,HISL(i,b,r)***[-to**(i,r)**]**+TISL(i,b,r)***[**pm(i,r)+qosh(i,b,r)**]**));

Equation TINCRATIOIN
#change in ratio of income tax to INCOME in IND#
(**all**,r,IND)
100*INCOME(r) *del_taxrinc(r) +TINC(r)*y(r)
=**sum**(i,ENDW_COMM,**sum**(q,HI,HIIN(i,q,r)***[-to**(i,r)**]**+TIIN(i,q,r)***[**pm(i,r)+qonh(i,q,r)**]**));

Equation TINCRATIOPK
#change in ratio of income tax to INCOME in PAK#
(**all**,r,PAK)
100*INCOME(r) *del_taxrinc(r) +TINC(r)*y(r)
=**sum**(i,ENDW_COMM,**sum**(c,HP,HIPK(i,c,r)***[-to**(i,r)**]**+TIPK(i,c,r)***[**pm(i,r)+qoph(i,c,r)**]**));

Equation TINCRATIOBG
#change in ratio of income tax to INCOME in BGD#
(**all**,r,BGD)
100*INCOME(r)* del_taxrinc(r) +TINC(r)*y(r)
=**sum**(i,ENDW_COMM,**sum**(d,HB,HIBG(i,d,r)***[-to**(i,r)**]**+TIBG(i,d,r)***[**pm(i,r)+qobh(i,d,r)**]**));

Equation TIURATIO
change in ratio of tax payments on intermediate goods to regional income
(**all**,r,REG)
100.0 * INCOME(r) * del_taxriu(r) + TIU(r) * y(r) = sum(i,TRAD_COMM, sum(j,PROD_COMM,VDFA(i,j,r) * tfd(i,j,r) + DFTAX(i,j,r) * [pm(i,r) + qfd(i,j,r)])) + sum(i,TRAD_COMM, sum(j,PROD_COMM,VIFA(i,j,r) * tfm(i,j,r) + IFTAX(i,j,r) * [pim(i,r) + qfm(i,j,r)]));

Equation TGCRATIO
change in ratio of government consumption tax payments to regional income
(all,r,REG)
100.0 * INCOME(r) * del_taxrgc(r) + TGC(r) * y(r) = sum(i,TRAD_COMM,
VDGA(i,r) * tgd(i,r) + DGTAX(i,r) * [pm(i,r) + qgd(i,r)])
+ sum(i,TRAD_COMM,VIGA(i,r) * tgm(i,r) + IGTAX(i,r) * [pim(i,r) + qgm(i,r)]);

Equation TEXPRATIO
change in ratio of export tax payments to regional income
(all,r,REG)
100.0 * INCOME(r) * del_taxrexp(r) + TEX(r) * y(r) = sum(i,TRAD_COMM, sum(s,REG, VXMD(i,r,s) * [-tx(i,r) - txs(i,r,s)] + XTAXD(i,r,s) * [pfob(i,r,s) + qxs(i,r,s)]));

Equation TIMPRATIO
change in ratio of import tax payments to regional income
(all,r,REG)
100.0 * INCOME(r) * del_taxrimp(r) + TIM(r) * y(r) = sum(i,TRAD_COMM, sum(s,REG,VIMS(i,s,r) * [tm(i,r) + tms(i,s,r)] + MTAX(i,s,r) * [pcif(i,s,r) + qxs(i,s,r)]));

Equation GOVINCOME
#Government tax income#
(**all**,r,REG)
GOVINC(r)*ygovt(r)=100.0 * INCRG(r)*del_indtaxr(r) + INDTAX(r)*y(r)+100.0 * INCRG(r)* del_taxrinc(r) + TINC(r)*y(r);

- **Regional Income**

COEFFICIENT (all,r,REG)
INCRG(r) # level of expenditure, which equals NET income in region r (i.e. net of capital depreciation) ;
COEFFICIENT (all,r,REG)
HHLDRG(r) #Houeshold income in region r#;
COEFFICIENT (all,r,REG)
GOVINC(r)#Government Income in region r#;
COEFFICIENT (all,r,REG)
INCRG(r) #Total Regional Income net of depreciation#;
FORMULA (all,r,ROW)
HHLDRG(r)=sum(i,ENDW_COMM,HIRW(i,r));
FORMULA (all,r,LKA)
HHLDRG(r)=sum(i,ENDW_COMM,sum(b,HS,HISL(i,b,r)));
FORMULA (all,r,IND)
HHLDRG(r)=sum(i,ENDW_COMM,sum(q,HI,HIIN(i,q,r)));
FORMULA (all,r,PAK)
HHLDRG(r)=sum(i,ENDW_COMM,sum(c,HP,HIPK(i,c,r)));
FORMULA (all,r,BGD)
HHLDRG(r)=sum(i,ENDW_COMM,sum(d,HB,HIBG(i,d,r)))

FORMULA (all,r,REG)
INCRG(r)=HHLDRG(r)+GOVINC(r)-VDEP(r);

Equation REGINCOME
#Total regional income#
(**all**,r,REG)
INCRG(r)*y(r)
=HHLDRG(r)*yhhld(r)
-VDEP(r) * [pcgds(r) + kb(r)]
+ GOVINC(r)*ygovt(r)
+INCRG(r)*incomeslack(r);

Section E: Regional Savings

FORMULA (all,r,ROW)
PRSAVE(r)=SHRW(r);
FORMULA (all,r,LKA)
PRSAVE(r)=sum(b,HS,SHSL(b,r));
FORMULA (all,r,IND)
PRSAVE(r)=sum(q,HI,SHIN(q,r));
FORMULA (all,r,PAK)
PRSAVE(r)=sum(c,HP,SHPK(c,r));
FORMULA (all,r,BGD)
PRSAVE(r)=sum(d,HB,SHBG(d,r));

Coefficient (all,b,HS)(all,r,LKA)
SHRLK(b,r)#share weightes-savings LKA#;
Formula(all,b,HS)(all,r,LKA)
SHRLK(b,r)=SHSL(b,r)/sum(w,HS,SHSL(w,r));

```
Coefficient (all,q,HI)(all,r,IND)
SHRIN(q,r)#share weightes-savings IND#;
Formula(all,q,HI)(all,r,IND)
SHRIN(q,r)=SHIN(q,r)/sum(w,HI,SHIN(w,r));

Coefficient (all,c,HP)(all,r,PAK)
SHRPK(c,r)#share weightes-savings PAK#;
Formula(all,c,HP)(all,r,PAK)
SHRPK(c,r)=SHPK(c,r)/sum(w,HP,SHPK(c,r));

Coefficient (all,d,HB)(all,r,BGD)
SHRBG(d,r)#share weightes-savings BGD#;
Formula(all,d,HB)(all,r,BGD)
SHRBG(d,r)=SHBG(d,r)/sum(w,HP,SHBG(d,r))

FORMULA (all,r,REG)
SAVE(r)=PRSAVE(r)+GSVE(r);

Equation SAVINGROW
#Household savings-ROW#
(all,r,ROW)
   psave(r) + qsaverw(r)-ynhhld(r)=  dpsave(r);

Equation SAVINGLKA
# Household savings-LKA #
(all,b,HS)(all,r,LKA)
   psave(r) + qsavelk(b,r) - ynhslk(b,r) =  dpsave(r);


Equation SAVINGIND
# Household savings-IND #
(all,q,HI)(all,r,IND)
   psave(r) + qsavein(q,r) - ynhind(q,r) = dpsave(r);

Equation SAVINGPAK
# Household savings-PAK #
(all,c,HP)(all,r,PAK)
   psave(r) + qsavepk(c,r) - ynhpak(c,r) = dpsave(r);

Equation SAVINGBGD
# Household savings-PAK #
(all,d,HB)(all,r,BGD)
   psave(r) + qsavebg(d,r) - ynhbgd(d,r) = dpsave(r);
Equation SAVINGA
#Household savings in region r#
(all,r,ROW)
qsaveh(r)=qsaverw(r);

Equation SAVINGB
#Household savings in region r #
(all,r,LKA)
qsaveh(r)=sum(b,HS,SHRLK(b,r)*qsavelk(b,r));
```

Equation SAVINGC
#Household savings in region r #
(all,r,IND)
qsaveh(r)=sum(q,HI,SHRIN(q,r)*qsavein(q,r));

Equation SAVINGD
#Household savings in region r #
(all,r,PAK)
qsaveh(r)=sum(c,HP,SHRPK(c,r)*qsavepk(c,r));

Equation SAVINGE
#Household savings in region r #
(all,r,BGD)
qsaveh(r)=sum(d,HB,SHRBG(d,r)*qsavebg(d,r));

Equation SAVINGGOV
#Government savings#
(all,r,REG)
GSVE(r)*[qsaveg(r)+psave(r)] = GOVINC(r)*ygovt(r) - sum(i,TRAD_COMM, VGA(i,r) * [qg(i,r) + pg(i,r)]) -GTRS(r)*wgotrreg(r);

Equation SAVING
#Regional Savings#
(all,r,REG)
SAVE(r)*[qsave(r)+psave(r)]=PRSAVE(r)*[qsaveh(r)+psave(r)]
+GSVE(r)*[qsaveg(r)+psave(r)];

Section F: Private Household Consumption

- **Household Consumption Expenditure**

COEFFICIENT (all,i,TRAD_COMM)(all,r,REG)
VPA(i,r)# private household expenditure on commodity i in region r at agents' prices #;
FORMULA (all,i,TRAD_COMM)(all,r,ROW)
VIPA(i,r)=VPRW(i,r);
FORMULA (all,i,TRAD_COMM)(all,r,LKA)
VIPA(i,r)=sum(b,HS,VPSL(i,b,r));
FORMULA (all,i,TRAD_COMM)(all,r,IND)
VIPA(i,r)=sum(q,HI,VPIN(i,q,r));
FORMULA (all,i,TRAD_COMM)(all,r,PAK)
VIPA(i,r)=sum(c,HP,VPPK(i,c,r));
FORMULA (all,i,TRAD_COMM)(all,r,BGD)
VIPA(i,r)=sum(d,HB,VPBG(i,d,r));

COEFFICIENT (all,i,TRAD_COMM)(all,r,ROW) HCRW(i,r)
#Household consumption rest of the world#;
COEFFICIENT (all,i,TRAD_COMM)(all,b,HS)(all,r,LKA) HCSL(i,b,r)
#Household consumption Sri Lanka#;
COEFFICIENT (all,i,TRAD_COMM)(all,q,HI)(all,r,IND) HCIN(i,q,r)
#Household consumption India#;
COEFFICIENT (all,i,TRAD_COMM)(all,c,HP)(all,r,PAK) HCPK(i,c,r)
#Household consumption Pakistan#;

```
COEFFICIENT (all,i,TRAD_COMM)(all,d,HB)(all,r,BGD)             HCBG(i,d,r)
#Household consumption Bangladesh#;

FORMULA (all,i,TRAD_COMM)(all,r,ROW)
HCRW(i,r)=VARW(i,r)+VPRW(i,r);
FORMULA (all,i,TRAD_COMM)(all,b,HS)(all,r,LKA)
HCSL(i,b,r)=VASL(i,b,r)+VPSL(i,b,r);
FORMULA (all,i,TRAD_COMM)(all,q,HI)(all,r,IND)
HCIN(i,q,r)=VAIN(i,q,r)+VPIN(i,q,r);
FORMULA (all,i,TRAD_COMM)(all,c,HP)(all,r,PAK)
HCPK(i,c,r)=VAPK(i,c,r)+VPPK(i,c,r);
FORMULA (all,i,TRAD_COMM)(all,d,HB)(all,r,BGD)
HCBG(i,d,r)=VABG(i,d,r)+VPBG(i,d,r);


FORMULA (all,i,TRAD_COMM)(all,r,ROW)
 VPA(i,r) =HCRW(i,r);
FORMULA (all,i,TRAD_COMM)(all,r,LKA)
 VPA(i,r) =SUM(b,HS,HCSL(i,b,r));
FORMULA (all,i,TRAD_COMM)(all,r,IND)
 VPA(i,r) = SUM(q,HI,HCIN(i,q,r));
FORMULA (all,i,TRAD_COMM)(all,r,PAK)
 VPA(i,r) = SUM(c,HP,HCPK(i,c,r));
FORMULA (all,i,TRAD_COMM)(all,r,BGD)
 VPA(i,r) = SUM(d,HB,HCBG(i,d,r));

COEFFICIENT (all,r,REG)                                        PRIVEXP(r)
# private consumption expenditure in region r # ;
FORMULA (all,r,REG) PRIVEXP(r) = sum(i,TRAD_COMM,VPA(i,r)) ;
 COEFFICIENT (all,i,TRAD_COMM)(all,r,REG)
CONSHR(i,r) # share of private hhld consumption devoted to good i in r #;
COEFFICIENT (all,i,TRAD_COMM)(all,r,ROW)                       CONSHRW(i,r)
#share of private hhld consumption devoted to good i in ROW#;
COEFFICIENT (all,i,TRAD_COMM)(all,b,HS)(all,r,LKA)             CONSHSL(i,b,r)
#share of private hhld consumption devoted to good i in LKA#;

COEFFICIENT (all,i,TRAD_COMM)(all,q,HI)(all,r,IND)             CONSHIN(i,q,r)
#share of private hhld consumption devoted to good i in IND#;
COEFFICIENT (all,i,TRAD_COMM)(all,c,HP)(all,r,PAK)             CONSHPK(i,c,r)
#share of private hhld consumption devoted to good i in PAK#;
COEFFICIENT (all,i,TRAD_COMM)(all,d,HB)(all,r,BGD)             CONSHBG(i,d,r)
#share of private hhld consumption devoted to good i in BGD#;
FORMULA (all,i,TRAD_COMM)(all,r,ROW)
CONSHRW(i,r)=HCRW(i,r)/sum(k,TRAD_COMM,HCRW(k,r));
FORMULA (all,i,TRAD_COMM)(all,b,HS)(all,r,LKA)
CONSHSL(i,b,r)=HCSL(i,b,r)/sum(k,TRAD_COMM,sum(w,HS,HCSL(k,w,r)));
FORMULA (all,i,TRAD_COMM)(all,q,HI)(all,r,IND)
CONSHIN(i,q,r)=HCIN(i,q,r)/sum(k,TRAD_COMM,sum(w,HI,HCIN(k,w,r)));
FORMULA (all,i,TRAD_COMM)(all,c,HP)(all,r,PAK)
CONSHPK(i,c,r)=HCPK(i,c,r)/sum(k,TRAD_COMM,sum(w,HP,HCPK(k,w,r)));
FORMULA (all,i,TRAD_COMM)(all,d,HB)(all,r,BGD)
CONSHBG(i,d,r)=HCBG(i,d,r)/sum(k,TRAD_COMM,sum(w,HB,HCBG(k,w,r)));
```

```
FORMULA (all,i,TRAD_COMM)(all,r,ROW)
 CONSHR(i,r)=CONSHRW(i,r);
 FORMULA (all,i,TRAD_COMM)(all,r,LKA)
 CONSHR(i,r)=sum(b,HS,CONSHSL(i,b,r));
 FORMULA (all,i,TRAD_COMM)(all,r,IND)
 CONSHR(i,r)=sum(q,HI,CONSHIN(i,q,r));
FORMULA (all,i,TRAD_COMM)(all,r,PAK)
 CONSHR(i,r)=sum(c,HP,CONSHPK(i,c,r));
 FORMULA (all,i,TRAD_COMM)(all,r,BGD)
 CONSHR(i,r)=sum(d,HB,CONSHBG(i,d,r));
COEFFICIENT (all,r,ROW)                                  HORW(r)
#Consumption -ROW#;
COEFFICIENT (all,b,HS)(all,r,LKA)                        HOLK(b,r)
#Consumption -LKA#;
COEFFICIENT (all,q,HI)(all,r,IND)                        HOIN(q,r)
#Consumption -IND#;
COEFFICIENT (all,c,HP)(all,r,PAK)                        HOPK(c,r)
#Consumption -PAK#;
COEFFICIENT (all,d,HB)(all,r,BGD)                        HOBG(d,r)
#Consumption -BGD#;

FORMULA (all,r,ROW)
HORW(r)=sum(i,TRAD_COMM,HCRW(i,r));
FORMULA (all,b,HS)(all,r,LKA)
HOLK(b,r)=sum(i,TRAD_COMM,HCSL(i,b,r));
FORMULA (all,q,HI)(all,r,IND)
HOIN(q,r)=sum(i,TRAD_COMM,HCIN(i,q,r));
FORMULA (all,c,HP)(all,r,PAK)
HOPK(c,r)=sum(i,TRAD_COMM,HCPK(i,c,r));
FORMULA (all,d,HB)(all,r,BGD)
HOBG(d,r)=sum(i,TRAD_COMM,HCBG(i,d,r));
COEFFICIENT (all,i,TRAD_COMM)(all,r,ROW)                 BUGRW(i,r)
#Household budget shares-ROW#;
COEFFICIENT (all,i,TRAD_COMM)(all,b,HS)(all,r,LKA)       BUGKA(i,b,r)
# Household budget shares-LKA#;

COEFFICIENT (all,i,TRAD_COMM)(all,q,HI)(all,r,IND)       BUGND(i,q,r)
#Household budget shares-IND#;
COEFFICIENT (all,i,TRAD_COMM)(all,c,HP)(all,r,PAK)       BUGPK(i,c,r)
#Household budget shares- PAK#;
COEFFICIENT (all,i,TRAD_COMM)(all,d,HB)(all,r,BGD)       BUGGD(i,d,r)
#Household budget shares-BGD#;

FORMULA (all,i,TRAD_COMM)(all,r,ROW)
BUGRW(i,r)=EPRW(i,r)*CONSHRW(i,r);
FORMULA (all,i,TRAD_COMM)(all,b,HS)(all,r,LKA)
BUGKA(i,b,r)=EPSL(i,b,r)*CONSHSL(i,b,r);
FORMULA (all,i,TRAD_COMM)(all,q,HI)(all,r,IND)
BUGND(i,q,r)=EPIN(i,q,r)*CONSHIN(i,q,r);
FORMULA (all,i,TRAD_COMM)(all,c,HP)(all,r,PAK)
BUGPK(i,c,r)=EPPK(i,c,r)*CONSHPK(i,c,r);
FORMULA (all,i,TRAD_COMM)(all,d,HB)(all,r,BGD)
BUGGD(i,d,r)=EPBG(i,d,r)*CONSHBG(i,d,r);
COEFFICIENT (all,i,TRAD_COMM)(all,r,ROW)                 LUXRW(i,r)
#Luxury shares-ROW#;
```

```
COEFFICIENT (all,i,TRAD_COMM)(all,b,HS)(all,r,LKA)              LUXKA(i,b,r)
#Luxury shares-LKA#;
COEFFICIENT (all,i,TRAD_COMM)(all,q,HI)(all,r,IND)              LUXND(i,q,r)
#Luxury shares-IND#;
COEFFICIENT (all,i,TRAD_COMM)(all,c,HP)(all,r,PAK)              LUXPK(i,c,r)
#Luxury shares- PAK#;
COEFFICIENT (all,i,TRAD_COMM)(all,d,HB)(all,r,BGD)              LUXGD(i,d,r)
#Luxury shares-BGD#;


FORMULA (all,i,TRAD_COMM)(all,r,ROW)
LUXRW(i,r)=EPRW(i,r)/ABS[FRRW(r)];
FORMULA (all,i,TRAD_COMM)(all,b,HS)(all,r,LKA)
LUXKA(i,b,r)=EPSL(i,b,r)/ABS[FRSL(b,r)];
FORMULA (all,i,TRAD_COMM)(all,q,HI)(all,r,IND)
LUXND(i,q,r)=EPIN(i,q,r)/ABS[FRIN(q,r)];
FORMULA (all,i,TRAD_COMM)(all,c,HP)(all,r,PAK)
LUXPK(i,c,r)=EPPK(i,c,r)/ABS[FRPK(c,r)];
FORMULA (all,i,TRAD_COMM)(all,d,HB)(all,r,BGD)
LUXGD(i,d,r)=EPBG(i,d,r)/ABS[FRBG(d,r)];
UPDATE (change)(all,r,ROW)
FRRW(r)=FRRW(r)*[wprw(r)-wluxrw(r)]/100.0;
UPDATE (change)(all,b,HS)(all,r,LKA)
FRSL(b,r)=FRSL(b,r)*[wplk(b,r)-wluxlk(b,r)]/100.0;
UPDATE (change) (all,q,HI)(all,r,IND)
FRIN(q,r)=FRIN(q,r)*[wpin(q,r)-wluxin(q,r)]/100.0;
UPDATE (change) (all,c,HP)(all,r,PAK)
FRPK(c,r)=FRPK(c,r)*[wppk(c,r)-wluxpk(c,r)]/100.0;

UPDATE (change) (all,d,HB)(all,r,BGD)
FRBG(d,r)=FRBG(d,r)*[wpbg(d,r)-wluxbg(d,r)]/100.0;
UPDATE (change)(all,i,TRAD_COMM)(all,r,ROW)
EPRW(i,r)=EPRW(i,r)*[qluxrw(i,r)-qprw(i,r)+xprw(r)-wluxrw(r)]/100.0;
UPDATE (change)(all,i,TRAD_COMM)(all,b,HS)(all,r,LKA)
EPSL(i,b,r)=EPSL(i,b,r)*[qluxlk(i,b,r)-qplk(i,b,r)+xplk(b,r)-wluxlk(b,r)]/100;
UPDATE (change)(all,i,TRAD_COMM)(all,q,HI)(all,r,IND)
EPIN(i,q,r)=EPIN(i,q,r)*[qluxin(i,q,r)-qpin(i,q,r)+xpin(q,r)-wluxin(q,r)]/100;
UPDATE (change) (all,i,TRAD_COMM)(all,c,HP)(all,r,PAK)
EPPK(i,c,r)=EPPK(i,c,r)*[qluxpk(i,c,r)-qppk(i,c,r)+xppk(c,r)-wluxpk(c,r)]/100;
UPDATE (change)(all,i,TRAD_COMM)(all,d,HB)(all,r,BGD)
EPBG(i,d,r)=EPBG(i,d,r)*[qluxbg(i,d,r)-qpbg(i,d,r)+xpbg(d,r)-wluxbg(d,r)]/100;
```

- **Household domestic and Import consumption**

```
COEFFICIENT (all,i,TRAD_COMM)(all,s,REG)
PMSHR(i,s) # share of imports for priv hhld at agent's prices #;
FORMULA (all,i,TRAD_COMM)(all,s,REG)
PMSHR(i,s) = VIPA(i,s) / VPA(i,s);

 COEFFICIENT (all,i,TRAD_COMM)(all,s,ROW)
 MKTDMRW(i,s)#Market share of endow. i used by region r at mkt prices-RW#;
 FORMULA (all,i,TRAD_COMM)(all,s,ROW)
 MKTDMRW(i,s)=VDRW(i,s)/sum(w,TRAD_COMM,VDRW(w,s));
```

```
COEFFICIENT (all,i,TRAD_COMM)(all,b,HS)(all,s,LKA)
MKTDMSL(i,b,s)#Market share of endow. i used by region r at mkt prices-SL#;
FORMULA (all,i,TRAD_COMM)(all,b,HS)(all,s,LKA)
MKTDMSL(i,b,s)=VDSL(i,b,s)/sum(w,HS,VDSL(i,w,s));

COEFFICIENT (all,i,TRAD_COMM)(all,q,HI)(all,s,IND)
MKTDMIN(i,q,s)#Market share of endow. i used by region r at mkt prices-IND#;
FORMULA (all,i,TRAD_COMM)(all,q,HI)(all,s,IND)
MKTDMIN(i,q,s)=VDIN(i,q,s)/sum(w,HI,VDIN(i,w,s));
COEFFICIENT (all,i,TRAD_COMM)(all,c,HP)(all,s,PAK)
MKTDMPK(i,c,s)#Market share of endow. i used by region r at mkt prices-PAK#;
FORMULA (all,i,TRAD_COMM)(all,c,HP)(all,s,PAK)
MKTDMPK(i,c,s)=VDPK(i,c,s)/sum(w,HP,VDPK(i,w,s));

COEFFICIENT (all,i,TRAD_COMM)(all,d,HB)(all,s,BGD)
MKTDMBG(i,d,s)#Market share of endow. i used by region r at mkt prices-BGD#;
FORMULA (all,i,TRAD_COMM)(all,d,HB)(all,s,BGD)
MKTDMBG(i,d,s)=VDBG(i,d,s)/sum(w,HB,VDBG(i,w,s));

COEFFICIENT (all,i,TRAD_COMM)(all,s,ROW)
MKTIMRW(i,s)#Market share of endow. i used by region r at mkt prices-RW#;
FORMULA (all,i,TRAD_COMM)(all,s,ROW)
MKTIMRW(i,s)=VIRW(i,s)/sum(w,TRAD_COMM,VIRW(w,s));

COEFFICIENT (all,i,TRAD_COMM)(all,b,HS)(all,s,LKA)
MKTIMSL(i,b,s)#Market share of endow. i used by region r at mkt prices-SL#;
FORMULA (all,i,TRAD_COMM)(all,b,HS)(all,s,LKA)
MKTIMSL(i,b,s)=VISL(i,b,s)/sum(w,HS,VISL(i,w,s));


COEFFICIENT (all,i,TRAD_COMM)(all,q,HI)(all,s,IND)
MKTIMIN(i,q,s)#Market share of endow. i used by region r at mkt prices-IND#;
FORMULA (all,i,TRAD_COMM)(all,q,HI)(all,s,IND)
MKTIMIN(i,q,s)=VIIN(i,q,s)/sum(w,HI,VIIN(i,w,s));
COEFFICIENT (all,i,TRAD_COMM)(all,c,HP)(all,s,PAK)
MKTIMPK(i,c,s)#Market share of endow. i used by region r at mkt prices-PAK#;
FORMULA (all,i,TRAD_COMM)(all,c,HP)(all,s,PAK)
MKTIMPK(i,c,s)=VIPK(i,c,s)/sum(w,HP,VIPK(i,w,s));
COEFFICIENT (all,i,TRAD_COMM)(all,d,HB)(all,s,BGD)
MKTIMBG(i,d,s)#Market share of endow. i used by region r at mkt prices-BGD#;
FORMULA (all,i,TRAD_COMM)(all,d,HB)(all,s,BGD)
MKTIMBG(i,d,s)=VIBG(i,d,s)/sum(w,HB,VIBG(i,w,s));
```

Equation ASUBTRW
#Taste change subsistence consumption-ROW#
(**all**,i,TRAD_COMM)(**all**,r,ROW)
asubrw(i,r)=arw_s(i,r)-sum(k,TRAD_COMM,CONSHRW(k,r)*arw_s(k,r));

Equation ASUBTLKA
#Taste change subsistence consumption-LKA#
(**all**,i,TRAD_COMM)(**all**,b,HS)(**all,**r,LKA)
asubsl(i,b,r)=alk_s(i,b,r)-sum(k,TRAD_COMM,CONSHSL(k,b,r)*alk_s(k,b,r));

Equation ASUBTIND
#Taste change subsistence consumption-IND#
(**all**,i,TRAD_COMM)(**all**,q,HI)(**all,**r,IND)
asubin(i,q,r)=ain_s(i,q,r)-sum(k,TRAD_COMM,CONSHIN(k,q,r)*ain_s(k,q,r));

Equation ASUBTPAK
#Taste change subsistence consumption-PAK#
(**all**,i,TRAD_COMM)(**all**,c,HP)(**all**,r,PAK)
asubpk(i,c,r)=apk_s(i,c,r)-sum(k,TRAD_COMM,CONSHPK(k,c,r)*apk_s(k,c,r));

Equation ASUBTBGD
#Taste change subsistence consumption-BGD#
(**all**,i,TRAD_COMM)(**all**,d,HB)(**all**,r,BGD)
asubgd(i,d,r)=agd_s(i,d,r)-sum(k,TRAD_COMM,CONSHBG(k,d,r)*agd_s(k,d,r));

Equation SUBCRW
#Quantity of subsitence consumption-ROW#
(**all**,i,TRAD_COMM)(**all**,r,ROW)
qsubrw(i,r)=qw(r)+asubrw(i,r);

Equation SUBCLKA
#Quantity of subsitence consumption-LKA#
(**all**,i,TRAD_COMM)(**all**,b,HS)(**all**,r,LKA)
qsublk(i,b,r)=qb(b,r)+asubsl(i,b,r);

Equation SUBCIND
#Quantity of subsitence consumption-IND#
(**all**,i,TRAD_COMM)(all,q,HI)(all,r,IND)
qsubin(i,q,r)=qn(q,r)+asubin(i,q,r);

Equation SUBCPAK
#Quantity of substence consumption-PAK#
(**all**,i,TRAD_COMM)(**all**,c,HP)(**all**,r,PAK)
qsubpk(i,c,r)=qc(c,r)+asubpk(i,c,r);

Equation SUBCBGD
#Quantity of subsistence consumption-BGD#
(**all**,i,TRAD_COMM)(**all**,d,HB)(**all**,r,BGD)
qsubgd(i,d,r)=qd(d,r)+asubgd(i,d,r);

Equation QLUXURW
#Quantity of luxury consumption-ROW#
(all,i,TRAD_COMM)(**all**,r,ROW)
qluxrw(i,r)+pp(i,r)=wluxrw(r)+aluxrw(i,r);

Equation QLUXLKA
#Quantity of luxury consumption-LKA#
(**all**,i,TRAD_COMM)(**all**,b,HS)(**all**,r,LKA)
qluxlk(i,b,r)+pp(i,r)=wluxlk(b,r)+aluxlk(i,b,r);

Equation QLUXIND
#Quantity of luxury consumption-IND#
(**all**,i,TRAD_COMM)(**all**,q,HI)(**all**,r,IND)
qluxin(i,q,r)+pp(i,r)=wluxin(q,r)+aluxin(i,q,r);

Equation QLUXPAK
#Quantity of luxury consumption-PAK#
(**all**,i,TRAD_COMM)(**all**,c,HP)(**all**,r,PAK)
qluxpk(i,c,r)+pp(i,r)=wluxpk(c,r)+aluxpk(i,c,r);

Equation QLUXBGD
#Quantity of luxury consumption-BGD#
(**all**,i,TRAD_COMM)(**all**,d,HB)(**all**,r,BGD)
qluxbg(i,d,r)+pp(i,r)=wluxbg(d,r)+aluxbg(i,d,r);

Equation LUXTSRW
#Luxury taste shifter_ROW#
(**all**,i,TRAD_COMM)(**all**,r,ROW)
aluxrw(i,r)=asubrw(i,r)-sum(k,TRAD_COMM,BUGRW(k,r)*asubrw(k,r));

Equation LUXTSLK
#Luxury taste shifter_LKA#
(**all**,i,TRAD_COMM)(**all**,b,HS)(**all**,r,LKA)
aluxlk(i,b,r)=asubsl(i,b,r)-sum(k,TRAD_COMM,BUGKA(k,b,r)*asubsl(k,b,r));

Equation LUXTSIND
#Luxury taste shifter_IND#
(**all**,i,TRAD_COMM)(**all**,q,HI)(**all**,r,IND)
aluxin(i,q,r)=asubin(i,q,r)-sum(k,TRAD_COMM,BUGND(k,q,r)*asubin(k,q,r));

Equation LUXTSPAK
#Luxury taste shifter_PAK#
(**all**,i,TRAD_COMM)(**all**,c,HP)(**all**,r,PAK)
aluxpk(i,c,r)=asubpk(i,c,r)-sum(k,TRAD_COMM,BUGPK(k,c,r)*asubpk(k,c,r));

Equation LUXTSBGD
#Luxury taste shifter_BGD#
(**all**,i,TRAD_COMM)(**all**,d,HB)(**all**,r,BGD)
aluxbg(i,d,r)=asubgd(i,d,r)-sum(k,TRAD_COMM,BUGGD(i,d,r)*asubgd(k,d,r));

Equation NHOUSRW
#Household budget constraint-ROW#
(**all**,r,ROW)
wprw(r)=xprw(r)+ppriv(r);

Equation NHOUSLK
#Household budget constraint-LKA#
(**all**,b,HS)(**all**,r,LKA)
wplk(b,r)=xplk(b,r)+ppriv(r);

Equation NHOUSIN
#Household budget constraint-IND#
(**all**,q,HI)(**all**,r,IND)
wpin(q,r)=xpin(q,r)+ppriv(r);

Equation NHOUSPK
#Household budget constraint-PAK#
(**all**,c,HP)(**all**,r,PAK)
wppk(c,r)=xppk(c,r)+ppriv(r);

Equation NHOUSBG
#Household budget constraint-BGD#
(**all**,d,HB)(**all**,r,BGD)
wpbg(d,r)=xpbg(d,r)+ppriv(r);

Equation PRIVTRW
#Private consumption demand for composite goods-ROW#
(**all**,i,TRAD_COMM)(**all**,r,ROW)
qprw(i,r)=LUXRW(i,r)*qluxrw(i,r)+[1-LUXRW(i,r)]*qsubrw(i,r);

Equation PRIVTLKA
#Private consumption demand for composite goods-LKA#
(**all**,i,TRAD_COMM)(**all**,b,HS)(**all**,r,LKA)
qplk(i,b,r)=LUXKA(i,b,r)*qluxlk(i,b,r)+[1-LUXKA(i,b,r)]*qsublk(i,b,r);

Equation PRIVTIND
#Private consumption demand for composite goods-IND#
(**all**,i,TRAD_COMM)(**all**,q,HI)(**all**,r,IND)
qpin(i,q,r)=LUXND(i,q,r)*qluxin(i,q,r)+[1-LUXND(i,q,r)]*qsubin(i,q,r);

Equation PRIVTPAK
#Private consumption demand for composite goods-PAK#
(**all**,i,TRAD_COMM)(**all**,c,HP)(**all**,r,PAK)
qppk(i,c,r)=LUXPK(i,c,r)*qluxpk(i,c,r)+[1-LUXPK(i,c,r)]*qsubpk(i,c,r);

Equation PRIVTBGD
#Private consumption demand for composite goods-BGD#
(**all**,i,TRAD_COMM)(**all**,d,HB)(**all**,r,BGD)
qpbg(i,d,r)=LUXGD(i,d,r)*qluxbg(i,d,r)+[1-LUXGD(i,d,r)]*qsubgd(i,d,r);!SP end!

Equation REHOURW
#Real household consumption-ROW#
(**all**,r,ROW)
xprw(r)=sum(i,TRAD_COMM,CONSHRW(i,r)*qprw(i,r));

Equation REHOUSL
#Real household consumption-LKA#
(**all**,b,HS)(**all**,r,LKA)
xplk(b,r)=sum(i,TRAD_COMM,CONSHSL(i,b,r)*qplk(i,b,r));

Equation REHOUIN
#Real household consumption-IND#
(**all**,q,HI)(**all**,r,IND)
xpin(q,r)=sum(i,TRAD_COMM,CONSHIN(i,q,r)*qpin(i,q,r));

Equation REHOUPK
#Real household consumption-PAK#
(**all**,c,HP)(**all**,r,PAK)
xppk(c,r)=sum(i,TRAD_COMM,CONSHPK(i,c,r)*qppk(i,c,r));

Equation REHOUBG
#Real household consumption-BGD#
(**all**,d,HB)(**all**,r,BGD)
xpbg(d,r)=sum(i,TRAD_COMM,CONSHBG(i,d,r)*qpbg(i,d,r));

Equation PRIVDMNDSA
private consumption demands for composite commodities -ROW(HT 46)
(**all**,i,TRAD_COMM)(**all**,r,ROW)
qp(i,r)=CONSHRW(i,r)*qprw(i,r);

Equation PRIVDMNDSB
private consumption demands for composite commodities -LKA(HT 46)
(**all**,i,TRAD_COMM)(**all**,r,LKA)
qp(i,r)=sum(b,HS,CONSHSL(i,b,r)*qplk(i,b,r));

Equation PRIVDMNDSC
private consumption demands for composite commodities -IND(HT 46)
(**all**,i,TRAD_COMM)(**all**,r,IND)
qp(i,r)=sum(q,HI,CONSHIN(i,q,r)*qpin(i,q,r));

Equation PRIVDMNDSD
private consumption demands for composite commodities -PAK(HT 46)
(**all**,i,TRAD_COMM)(**all**,r,PAK)
qp(i,r)=sum(c,HP,CONSHPK(i,c,r)*qppk(i,c,r));

Equation PRIVDMNDSE
private consumption demands for composite commodities -BGD(HT 46)
(**all**,i,TRAD_COMM)(**all**,r,BGD)
qp(i,r)=sum(d,HB,CONSHBG(i,d,r)*qpbg(i,d,r));

Equation PHHLDDOMRW
#private consumption demand for domestic goods -RW#
(all,i,TRAD_COMM)(all,s,ROW)
qpdrw(i,s)=qprw(i,s)+ESUBD(i) * [pp(i,s) - ppd(i,s)];

Equation PHHLDDOMSL
#private consumption demand for doemstic goods -LKA #
(all,i,TRAD_COMM)(all,b,HS)(all,s,LKA)
qpdlk(i,b,s)=qplk(i,b,s)+ESUBD(i) * [pp(i,s) - ppd(i,s)];

Equation PHHLDDOMIN
#private consumption demand for domestic goods -IND #
(all,i,TRAD_COMM)(all,q,HI)(all,s,IND)
qpdin(i,q,s)=qpin(i,q,s)+ESUBD(i) * [pp(i,s) - ppd(i,s)];

Equation PHHLDDOMPK
#private consumption demand for domestic goods -PAK #
(all,i,TRAD_COMM)(all,c,HP)(all,s,PAK)
qpdpk(i,c,s)=qppk(i,c,s)+ESUBD(i) * [pp(i,s) - ppd(i,s)];

Equation PHHLDDOMBG
private consumption demand for domestic goods -BGD
(all,i,TRAD_COMM)(all,d,HB)(all,s,BGD)
qpdbg(i,d,s)=qpbg(i,d,s)+ESUBD(i) * [pp(i,s) - ppd(i,s)];

Equation PHHLDDOMA
private consumption demand for domestic goods in region r
(all,i,TRAD_COMM)(all,s,ROW)
qpd(i,s)=MKTDMRW(i,s)*qpdrw(i,s);

Equation PHHLDDOMB
private consumption demand for domestic goods in region r
(all,i,TRAD_COMM)(all,s,LKA)
qpd(i,s)=sum(b,HS,MKTDMSL(i,b,s)*qpdlk(i,b,s));

Equation PHHLDDOMC
private consumption demand for domestic goods in region r
(all,i,TRAD_COMM)(all,s,IND)
qpd(i,s)=sum(q,HI,MKTDMIN(i,q,s)*qpdin(i,q,s));

Equation PHHLDDOMD
private consumption demand for domestic goods in region r
(all,i,TRAD_COMM)(all,s,PAK)
qpd(i,s)=sum(c,HP,MKTDMPK(i,c,s)*qpdpk(i,c,s));

Equation PHHLDDOME
private consumption demand for domestic goods in region r
(all,i,TRAD_COMM)(all,s,BGD)
qpd(i,s)=sum(d,HB,MKTDMBG(i,d,s)*qpdbg(i,d,s));

Equation PHHLDAGRIMPRW
private consumption demand for aggregate imports-ROW
(all,i,TRAD_COMM)(all,s,ROW)
qpmrw(i,s) = qprw(i,s) + ESUBD(i) * [pp(i,s) - ppm(i,s)];

Equation PHHLDAGRIMPSL
private consumption demand for aggregate imports-LKA
(all,i,TRAD_COMM)(all,b,HS)(all,s,LKA)
qpmlk(i,b,s)=qplk(i,b,s)+ ESUBD(i) * [pp(i,s) - ppm(i,s)];

Equation PHHLDAGRIMPIN
private consumption demand for aggregate imports-IND
(all,i,TRAD_COMM)(all,q,HI)(all,s,IND)
qpmin(i,q,s)=qpin(i,q,s)+ ESUBD(i) * [pp(i,s) - ppm(i,s)];

Equation PHHLDAGRIMPPK
private consumption demand for aggregate imports-PAK
(all,i,TRAD_COMM)(all,c,HP)(all,s,PAK)
qpmpk(i,c,s)=qppk(i,c,s)+ ESUBD(i) * [pp(i,s) - ppm(i,s)];

Equation PHHLDAGRIMPBG
private consumption demand for aggregate imports-BGD
(all,i,TRAD_COMM)(all,d,HB)(all,s,BGD)
qpmbg(i,d,s)=qpbg(i,d,s)+ ESUBD(i) * [pp(i,s) - ppm(i,s)];

Equation PHHLDAGRIMPA
private consumption demand for aggregate imports
(all,i,TRAD_COMM)(all,s,ROW)
qpm(i,s)=MKTIMRW(i,s)*qpmrw(i,s);

Equation PHHLDAGRIMPB
private consumption demand for aggregate imports
(all,i,TRAD_COMM)(all,s,LKA)
qpm(i,s)=sum(b,HS,MKTIMSL(i,b,s)*qpmlk(i,b,s));

Equation PHHLDAGRIMPC
private consumption demand for aggregate imports
(all,i,TRAD_COMM)(all,s,IND)
qpm(i,s)=sum(q,HI,MKTIMIN(i,q,s)*qpmin(i,q,s));

Equation PHHLDAGRIMPD
private consumption demand for aggregate imports
(all,i,TRAD_COMM)(all,s,PAK)
qpm(i,s)=sum(c,HP,MKTIMPK(i,c,s)*qpmpk(i,c,s));

Equation PHHLDAGRIMPE
private consumption demand for aggregate imports
(all,i,TRAD_COMM)(all,s,BGD)
qpm(i,s)=sum(d,HB,MKTIMBG(i,d,s)*qpmbg(i,d,s));

Equation E_wtotrw
#Total nominal household consumption-ROW#
(all,r,ROW)
wtotrw(r)=HORW(r)*xprw(r)+ppriv(r);

Equation E_wtotlk
#Total nominal household consumption-LKA#
(all,r,LKA)
wtotlk(r)=sum(b,HS,COMLK(b,r)*xplk(b,r))+ppriv(r);

Equation E_wtotin
#Total nominal household consumption-IND#
(all,r,IND)
wtotin(r)=sum(q,HI,COMIN(q,r)*xpin(q,r))+ppriv(r);

Equation E_wtotpk
#Total nominal household consumption-PAK#
(all,r,PAK)
wtotpk(r)=sum(c,HP,COMPK(c,r)*xppk(c,r))+ppriv(r);

Equation E_wtotbg
#Total nominal household consumption-PAK#
(all,r,BGD)
wtotbg(r)=sum(d,HB,COMBG(d,r)*xpbg(d,r))+ppriv(r);

Equation E_ytrw
Income tax -rest of the world#
(all,i,ENDW_COMM)(all,r,ROW)
ytrw(i,r)=yhrw(i,r)+to(i,r);

Equation E_ytsl
#Income tax-Sri Lanka#
(all,i,ENDW_COMM)(all,b,HS)(all,r,LKA)
ytsl(i,b,r)=yhsl(i,b,r)+to(i,r);

Equation E_ytin
#Income tax-India#
(all,i,ENDW_COMM)(all,q,HI)(all,r,IND)
ytin(i,q,r)=yhin(i,q,r)+to(i,r);

Equation E_ytpk
#Income tax-Pakistan#
(all,i,ENDW_COMM)(all,c,HP)(all,r,PAK)
ytpk(i,c,r)=yhpk(i,c,r)+to(i,r);

Equation E_ytbg
#Income tax-Bangladesh#
(all,i,ENDW_COMM)(all,d,HB)(all,r,BGD)
ytbg(i,d,r)=yhbg(i,d,r)+to(i,r);

- **Household Disposable Income**

COEFFICIENT (all,r,ROW) DIRW(r)
Disposable income of the rest of the world#;
COEFFICIENT (all,b,HS)(all,r,LKA) DISL(b,r)
Disposable income Sri Lanka# ;
COEFFICIENT (all,q,HI)(all,r,IND) DIIN(q,r)
Disposable income India# ;
COEFFICIENT (all,c,HP)(all,r,PAK) DIPK(c,r)
Disposable income Pakistan# ;
COEFFICIENT (all,d,HB)(all,r,BGD) DIBG(d,r)
Disposable income Bangladesh# ;

FORMULA (all,r,ROW)
DIRW(r)=sum(i,ENDW_COMM,DISRW(i,r))+GTRW(r)-SHRW(r);
FORMULA (all,b,HS)(all,r,LKA)
DISL(b,r)=sum(i,ENDW_COMM,DISSL(i,b,r))+GTSL(b,r)-SHSL(b,r);
FORMULA (all,q,HI)(all,r,IND)
DIIN(q,r)=sum(i,ENDW_COMM,DISIN(i,q,r))+GTIN(q,r)-SHIN(q,r);
FORMULA (all,c,HP)(all,r,PAK)
DIPK(c,r)=sum(i,ENDW_COMM,DISPK(i,c,r))+GTPK(c,r)-SHPK(c,r);
FORMULA (all,d,HB)(all,r,BGD)
DIBG(d,r)=sum(i,ENDW_COMM,DISBG(i,d,r))+GTBG(d,r)-SHBG(d,r);

Equation E_wdissl
Disposable income -Sri Lanka#
(all,b,HS)(all,r,LKA)
DISL(b,r)*wdissl(b,r)
=HPSL(b,r)*yhslk(b,r)+GTSL(b,r)*hgotrlk(b,r)-INSL(b,r)*ytslk(b,r)
-SHSL(b,r)*[qsavelk(b,r)+psave(r)];

Equation E_wdisin
Dispoable income- India#
(all,q,HI)(all,r,IND)
DIIN(q,r)*wdisin(q,r)
=HPIN(q,r)*yhind(q,r)+GTIN(q,r)*hgotrin(q,r)-ININ(q,r)*ytind(q,r)
-SHIN(q,r)*[qsavein(q,r)+psave(r)];

Equation E_wdispk
Disposable income- Pakistan#
(all,c,HP)(all,r,PAK)
DIPK(c,r)*wdispk(c,r)
=HPPK(c,r)*yhpak(c,r)+GTPK(c,r)*hgotrpk(c,r)-INPK(c,r)*ytpak(c,r)
-SHPK(c,r)*[qsavepk(c,r)+psave(r)];

Equation E_wdisbg
Disposable income - Bangladesh#
(all,d,HB)(all,r,BGD)
DIBG(d,r)*wdisbg(d,r)
=HPBG(d,r)*yhbgd(d,r)+GTBG(d,r)*hgotrbg(d,r)-INBG(d,r)*ytbgd(d,r)
-SHBG(d,r)*[qsavebg(d,r)+psave(r)];

Equation E_f3totrw
#Consumption function-ROW#
(all,r,ROW)
wprw(r)=f3totrw(r)+f3totrw_h+wdisrw(r);

Equation E_f3totlk
#Consumption function-LKA#
(all,b,HS)(all,r,LKA)
wplk(b,r)=f3totlk(b,r)+f3totlk_h+wdissl(b,r);

Equation E_f3totin
#Consumption function-IND#
(all,q,HI)(all,r,IND)
wpin(q,r)=f3totin(q,r)+f3totin_h+wdisin(q,r);

Equation E_f3totpk
#Consumption function-PAK#
(all,c,HP)(all,r,PAK)
wppk(c,r)=f3totpk(c,r)+f3totpk_h+wdispk(c,r);

Equation E_f3totbg
#Consumption function-PAK#
(all,d,HB)(all,r,BGD)
wpbg(d,r)=f3totbg(d,r)+f3totbg_h+wdisbg(d,r);

Section G: Poverty Lines

Variable (all,h,SLR)(all,r,LKA) cllkar(h,r)
#Price index for rual sector -Sri Lanka#;

Variable (all,g,SLU)(all,r,LKA) cllkau(g,r)
#Price index for urban sector-Sri Lanka#;

Variable (all,l,SLE)(all,r,LKA) cllkae(l,r)
#Price index for estate sector-Sri Lanka#;

Variable (all,n,INR)(all,r,IND) clindr(n,r)
#Price index for rural sector-India#;

Variable (all,e,INU)(all,r,IND) clindu(e,r)
#Price index for urban sector-India#;

Variable (all,w,PKR)(all,r,PAK) clpakr(w,r)
#Price index for rural sector-Pakistan#;

Variable (all,v,PKU)(all,r,PAK) clpaku(v,r)
#Price index for urban sector-Pakistan#;

Variable (all,t,BGR)(all,r,BGD) clbgdr(t,r)
#price index for rural sector-Bangladesh#;

Variable (all,z,BGU)(all,r,BGD) clbgdu(z,r)
#Price index for urban sector-Bangladesh#;

Variable (all,h,SLR)(all,r,LKA) pllkar(h,r)
#Rural poverty line-Sri Lanka#;

Variable (all,g,SLU)(all,r,LKA) pllkau(g,r)
#Urban poverty line-Sri Lanka#;

Variable (all,l,SLE)(all,r,LKA) pllkae(l,r)
#Estate sector poverty line-Sri Lanka#;

Variable (all,n,INR)(all,r,IND) plindr(n,r)
#Rural poverty line-India#;

Variable (all,e,INU)(all,r,IND) plindu(e,r)
#Urban poverty line-India#;

Variable (all,w,PKR)(all,r,PAK) plpakr(w,r)
#Rural poverty line-Pakistan#;

Variable (all,v,PKU)(all,r,PAK) plpaku(v,r)
#Urban poverty line-Pakistan#;
Variable (all,t,BGR)(all,r,BGD) plbgdr(t,r)
#Rural poverty line-Bangladesh#;

Variable (all,z,BGU)(all,r,BGD) plbgdu(z,r)
#Urban poverty line-Bangladesh#;

! Here, SHRSL(i,h,r), SHUSL(i,g,r), SHESL(i,l,r), SHIRC(i,n,r), SHIRU(i,e,r), SRCPK(i,w,r), SHUPK(i,v,r) and SRCBG(i,t,r) and SHUBG(i,z,r) are the consumption shares calculated based on the basic commodities).!

Equation E_cllkar
(all,h,SLR)(all,r,LKA)
cllkar(h,r)=sum(i,BASIC_COMMR,SHRSL(i,h,r)*pp(i,r));

Equation E_cllkau
(all,g,SLU)(all,r,LKA)
cllkau(g,r)=sum(i,BASIC_COMMU,SHUSL(i,g,r)*pp(i,r));

Equation E_cllkae
(all,l,SLE)(all,r,LKA)
cllkae(l,r)=sum(i,BASIC_COMMR,SHESL(i,l,r)*pp(i,r));

Equation E_clindr
(all,n,INR)(all,r,IND)
clindr(n,r)=sum(i,BASIC_COMMR,SHIRC(i,n,r)*pp(i,r));

Equation E_clindu
(all,e,INU)(all,r,IND)
clindu(e,r)=sum(i,BASIC_COMMU,SHIRU(i,e,r)*pp(i,r));

Equation E_clpakr
(all,w,PKR)(all,r,PAK)
clpakr(w,r)=sum(i,BASIC_COMMR,SRCPK(i,w,r)*pp(i,r));

Equation E_clpaku
(all,v,PKU)(all,r,PAK)
clpaku(v,r)=sum(i,BASIC_COMMU,SHUPK(i,v,r)*pp(i,r));

Equation E_clbgdr
(all,t,BGR)(all,r,BGD)
clbgdr(t,r)=sum(i,BASIC_COMMR,SRCBG(i,t,r)*pp(i,r));

Equation E_clbgdu
(all,z,BGU)(all,r,BGD)
clbgdu(z,r)=sum(i,BASIC_COMMU,SHUBG(i,z,r)*pp(i,r));

Equation E_pllkar
(all,h,SLR)(all,r,LKA)
THRSL(h,r)*pllkar(h,r)=sum(i,BASIC_COMMR,HRSL(i,h,r))*cllkar(h,r);

Equation E_pllkau
(all,g,SLU)(all,r,LKA)
THUSL(g,r)*pllkau(g,r)=sum(i,BASIC_COMMU,HUSL(i,g,r))*cllkau(g,r);

Equation E_pllkae
(all,l,SLE)(all,r,LKA)
THESL(l,r)*pllkae(l,r)=sum(i,BASIC_COMMR,HESL(i,l,r))*cllkae(l,r);

Equation E_plindr
(all,n,INR)(all,r,IND)
THIRC(n,r)*plindr(n,r)=sum(i,BASIC_COMMR,HIRC(i,n,r))*clindr(n,r);

Equation E_plindu
(all,e,INU)(all,r,IND)
THIRU(e,r)*plindu(e,r)=sum(i,BASIC_COMMU,HIUC(i,e,r))*clindu(e,r);

Equation E_plpakr
(all,w,PKR)(all,r,PAK)
THRPK(w,r)*plpakr(w,r)=sum(i,BASIC_COMMR,HRPK(i,w,r))*clpakr(w,r);

Equation E_plpaku
(all,v,PKU)(all,r,PAK)
THUPK(v,r)*plpaku(v,r)=sum(i,BASIC_COMMU,HUPK(i,v,r))*clpaku(v,r);

Equation E_plbgdr
(all,t,BGR)(all,r,BGD)
(THRBG(t,r)+tiny)*plbgdr(t,r)=sum(i,BASIC_COMMR,HRBG(i,t,r))*clbgdr(t,r);

Equation E_plbgdu
(all,z,BGU)(all,r,BGD)
(THUBG(z,r)+tiny)*plbgdu(z,r)=sum(i,BASIC_COMMU,HUBG(i,z,r))*clbgdu(z,r);

Section H: Government Consumption

COEFFICIENT (all,i,TRAD_COMM)(all,r,REG) VGA(i,r)
government expenditure on commodity i in region r at agents' prices # ;
FORMULA (all,i,TRAD_COMM)(all,s,REG)
VGA (i,s) = VDGA(i,s) + VIGA(i,s) ;
COEFFICIENT (all,r,REG) GOVEXP(r)
government expenditure in region r# ;
FORMULA (all,r,REG) GOVEXP(r) = sum(i,TRAD_COMM, VGA(i,r)) ;
COEFFICIENT (all,i,TRAD_COMM)(all,s,REG)
GMSHR(i,s) # share of imports for gov't hhld at agent's prices #;
FORMULA (all,i,TRAD_COMM)(all,s,REG)
GMSHR(i,s) = VIGA(i,s) / VGA(i,s);

Equation GOVDMNDS
government consumption demands for composite commodities
(all,i,TRAD_COMM)(all,r,REG)
qg(i,r) - pop(r) = ug(r) - [pg(i,r) - pgov(r)];

Equation GHHLDAGRIMP
government consumption demand for aggregate imports (HT 43)
(all,i,TRAD_COMM)(all,s,REG)
qgm(i,s) = qg(i,s) + ESUBD(i) * [pg(i,s) - pgm(i,s)];

Equation GHHLDDOM
government consumption demand for domestic goods (HT 44)
(all,i,TRAD_COMM)(all,s,REG)
qgd(i,s) = qg(i,s) + ESUBD(i) * [pg(i,s) - pgd(i,s)];

Section I: Investment and Global Bank

Equation KAPSVCES
eq'n defines a variable for capital services
(all,r,REG)
ksvces(r) = sum(h,ENDWC_COMM, [VOA(h,r) / sum(k,ENDWC_COMM, VOA(k,r))] * qo(h,r));

Equation KAPRENTAL
eq'n defines a variable for capital rental rate
(all,r,REG)
rental(r) = sum(h,ENDWC_COMM, [VOA(h,r) / sum(k,ENDWC_COMM, VOA(k,r))] * ps(h,r));

Equation CAPGOODS
eq'n defines a variable for gross investment
(all,r,REG)
qcgds(r) = sum(h,CGDS_COMM, [VOA(h,r) / REGINV(r)] * qo(h,r));

Equation PRCGOODS
eq'n defines the price of cgds (HT 55)
(all,r,REG)
pcgds(r) = sum(h,CGDS_COMM, [VOA(h,r) / REGINV(r)] * ps(h,r));

Equation KBEGINNING
associates change in cap. services w/ change in cap. stock
(all,r,REG)
kb(r) = ksvces(r);

COEFFICIENT (all,r,REG)
INVKERATIO(r)
# ratio of gross investment to end-of-period capital stock in r #
FORMULA (all,r,REG)
INVKERATIO(r) = REGINV(r) / [VKB(r) + NETINV(r)];

Equation KEND
Ending capital stock equals beginning stock plus net investment.
(all,r,REG) ke(r) = INVKERATIO(r) * qcgds(r) + [1.0 - INVKERATIO(r)] * kb(r);

- **Rate of Return**

COEFFICIENT (all,r,REG)
GRNETRATIO(r) # ratio of GROSS/NET rates of return on capital in r #;
FORMULA (all,r,REG)
GRNETRATIO(r) = sum(h,ENDWC_COMM, VOA(h,r)) / [sum(h,ENDWC_COMM, VOA(h,r)) - VDEP(r)];

Equation RORCURRENT
current rate of return on capital in region r
(all,r,REG)
rorc(r) = GRNETRATIO(r) * [rental(r) - pcgds(r)];

Equation ROREXPECTED
expected rate of return depends on the current return and investment
(all,r,REG)
rore(r) = rorc(r) - RORFLEX(r) * [ke(r) - kb(r)];

- **Global Bank**

Equation RORGLOBAL
either gross investment or expected rate of return in region r
(all,r,REG)
RORDELTA * rore(r) + [1 - RORDELTA]
* [[REGINV(r) / NETINV(r)] * qcgds(r) - [VDEP(r) / NETINV(r)] * kb(r)]
= RORDELTA * rorg + [1 - RORDELTA] * globalcgds + cgdslack(r);

Equation GLOBALINV
either expected global rate of return or global net investment
RORDELTA * globalcgds + [1 - RORDELTA] * rorg
= RORDELTA * sum(r,REG,
[REGINV(r) / GLOBINV] * qcgds(r) - [VDEP(r) / GLOBINV] * kb(r))
+ [1 - RORDELTA] * sum(r,REG, [NETINV(r) / GLOBINV] * rore(r));

Section J: International Tansport Services

COEFFICIENT (all,i,TRAD_COMM)(all,r,REG)(all,s,REG)
VTFSD(i,r,s) # aggregate value of svces in the shipment of i from r to s #;
FORMULA (all,i,TRAD_COMM)(all,r,REG)(all,s,REG)
VTFSD(i,r,s) = sum(m,MARG_COMM, VTMFSD(m,i,r,s));

COEFFICIENT (all,m,MARG_COMM)
VTMUSE(m) # international margin services usage, by type #;
FORMULA(all,m,MARG_COMM)
VTMUSE(m) = sum(i,TRAD_COMM, sum(r,REG, sum(s,REG, VTMFSD(m,i,r,s))));
COEFFICIENT (all,m,MARG_COMM)
VTMPROV(m) # international margin services provision #;
FORMULA (all,m,MARG_COMM)
VTMPROV(m) = sum(r,REG, VST(m,r));
COEFFICIENT (all,r,REG)
VTRPROV(r) # international margin supply, by region #;
FORMULA (all,r,REG)
VTRPROV(r) = sum(m,MARG_COMM, VST(m,r));

COEFFICIENT
VT # international margin supply #;
FORMULA
VT = sum(m,MARG_COMM, sum(r,REG, VST(m,r)));

- **Demand for Global Transport**

Equation QTRANS_MFSD
bilateral demand for transport services
(all,m,MARG_COMM)(all,i,TRAD_COMM)(all,r,REG)(all,s,REG)
qtmfsd(m,i,r,s) = qxs(i,r,s) - atmfsd(m,i,r,s);
COEFFICIENT (all,m,MARG_COMM)(all,i,TRAD_COMM)(all,r,REG)(all,s,REG)
VTMUSESHR(m,i,r,s) # share of i,r,s usage in global demand for m #;
FORMULA (all,m,MARG_COMM)(all,i,TRAD_COMM)(all,r,REG)(all,s,REG)
VTMUSESHR(m,i,r,s) = VTFSD(i,r,s) / VT;
FORMULA (all,m,MARG_COMM: VTMUSE(m) <>
0.0)(all,i,TRAD_COMM)(all,r,REG)(all,s,REG)
VTMUSESHR(m,i,r,s) = VTMFSD(m,i,r,s) / VTMUSE(m);

Equation TRANS_DEMAND
global demand for margin m
(all,m,MARG_COMM)
qtm(m)
= sum(i,TRAD_COMM, sum(r,REG, sum(s,REG,VTMUSESHR(m,i,r,s) * qtmfsd(m,i,r,s))));

- **Supply of Transport Services**

Equation TRANSTECHANGE
generates flow-specific average rate of technical change
(all,m,MARG_COMM)(all,i,TRAD_COMM)(all,r,REG)(all,s,REG)
atmfsd(m,i,r,s) = atm(m) + atf(i) + ats(r) + atd(s) + atall(m,i,r,s);

Equation TRANSVCES
generate demand for regional supply of global transportation service (HT 61)
(all,m,MARG_COMM)(all,r,REG)
qst(m,r) = qtm(m) + [pt(m) - pm(m,r)];

Section K: International Trade

- **Demand for Imports**

Equation IMPORTDEMAND
regional demand for disaggregated imported commodities by source
(all,i,TRAD_COMM)(all,r,REG)(all,s,REG)
    qxs(i,r,s)
        = -ams(i,r,s) + qim(i,s) - ESUBM(i) * [pms(i,r,s) - ams(i,r,s) - pim(i,s)];

Section L: Pricing Equations

- **Prices relating to firms and production**
-
- **Equation** DMNDDPRICE

eq'n links domestic market and firm prices
(**all**,i,TRAD_COMM)(**all**,j,PROD_COMM)(**all**,r,REG)
    pfd(i,j,r) = tfd(i,j,r) + pm(i,r);

-

Equation DMNDIPRICES
eq'n links domestic market and firm prices
(**all**,i,TRAD_COMM)(**all**,j,PROD_COMM)(**all**,r,REG)
    pfm(i,j,r) = tfm(i,j,r) + pim(i,r);
Equation ICOMPRICE
industry price for composite commodities (HT 30)
(**all**,i,TRAD_COMM)(**all**,j,PROD_COMM)(**all**,r,REG)
    pf(i,j,r) = FMSHR(i,j,r) * pfm(i,j,r) + [1 - FMSHR(i,j,r)] * pfd(i,j,r);

Equation FACTORINCPRICES
eq'n links pre- and post-tax endowment supply prices
(all,i,ENDW_COMM)(all,r,REG)
    ps(i,r) = to(i,r) + pm(i,r);

COEFFICIENT(all,i,ENDW_COMM)(all,j,PROD_COMM)(all,r,REG)
    REVSHR(i,j,r);
FROMULA (all,i,ENDW_COMM)(all,j,PROD_COMM)(all,r,REG)
    REVSHR(i,j,r) = VFM(i,j,r) / sum(k,PROD_COMM, VFM(i,k,r));

Equation ENDW_PRICE
eq'n generates the composite price for sluggish endowments (HT 50)
(all,i,ENDWS_COMM)(all,r,REG)
    pm(i,r) = sum(k,PROD_COMM, REVSHR(i,k,r) * pmes(i,k,r));

- **Prices relating to private households**

Equation PHHLDINDEX
price index for private consumption expenditure
(**all**,r,REG)
    ppriv(r) = sum(i,TRAD_COMM, CONSHR(i,r) * pp(i,r));
Equation E_cpilk
#Consumer price index-LKA#
(all,b,HS)(all,r,LKA)
cpilk(b,r)=sum(i,TRAD_COMM,CONLK(i,b,r)*pp(i,r));

Equation E_cpiin
#Consumer price index-IND#
(all,q,HI)(all,r,IND)
cpiin(q,r)=sum(i,TRAD_COMM,CONIN(i,q,r)*pp(i,r));

Equation E_cpipk
#Consumer price index-PAK#
(all,c,HP)(all,r,PAK)
cpipk(c,r)=sum(i,TRAD_COMM,CONPK(i,c,r)*pp(i,r));

Equation E_cpibg
#Consumer price index-BGD#
(all,d,HB)(all,r,BGD)
cpibg(d,r)=sum(i,TRAD_COMM,CONBG(i,d,r)*pp(i,r));

Equation PCOMPRICE
private consumption price for composite commodities
(all,i,TRAD_COMM)(all,s,REG)
pp(i,s) = PMSHR(i,s) * ppm(i,s) + [1 - PMSHR(i,s)] * ppd(i,s);

COEFFICIENT (all,r,REG) SHTR(r)
#Share of savings on total consumption and savings#;
COEFFICIENT (all,r,REG) TSAC(r)
#Total savings and consumption#;
FORMULA(all,r,REG)
TSAC(r)=SAVE(r)+sum(i,TRAD_COMM,VPA(i,r));
FORMULA (all,r,REG)
SHTR(r)=SAVE(r)/TSAC(r);

Equation E_ptrf
Trasfers-price#
(all,r,REG)
ptrf(r)=SHTR(r)*psave(r)+[1-SHTR(r)]*ppriv(r);

- **Prices relating to government activities**

Equation GPRICEINDEX
definition of price index for aggregate gov't purchases
(all,r,REG)
pgov(r) = sum(i,TRAD_COMM, [VGA(i,r) / GOVEXP(r)] * pg(i,r));

Equation GHHDPRICE
eq'n links domestic market and government consumption prices
(all,i,TRAD_COMM)(all,r,REG)
pgd(i,r) = tgd(i,r) + pm(i,r);

Equation GHHIPRICES
eq'n links domestic market and government consumption prices
(all,i,TRAD_COMM)(all,r,REG)
pgm(i,r) = tgm(i,r) + pim(i,r);

```
Equation GCOMPRICE
# government consumption price for composite commodities  #
(all,i,TRAD_COMM)(all,s,REG)
   pg(i,s) =  GMSHR(i,s) * pgm(i,s) + [1 - GMSHR(i,s)] * pgd(i,s);
```

- **Prices relating to transport activites**

```
COEFFICIENT(all,m,MARG_COMM)(all,r,REG)
   VTSUPPSHR(m,r) # share of region r in global supply of margin m #;
FORMULA (all,m,MARG_COMM)(all,r,REG)
   VTSUPPSHR(m,r) = VTRPROV(r) / VT;
FORMUAL (all,m,MARG_COMM: VTMPROV(m) <> 0.0)(all,r,REG)
   VTSUPPSHR(m,r) = VST(m,r) / VTMPROV(m);

Equation PTRANSPORT
# generate price index for composite transportation services #
(all,m,MARG_COMM)
   pt(m) = sum(r,REG, VTSUPPSHR(m,r) * pm(m,r));
COEFFICENT
   VTUSE # international margin services usage #;
FORMULA
   VTUSE = sum(m,MARG_COMM, sum(i,TRAD_COMM, sum(r,REG, sum(s,REG,
VTMFSD(m,i,r,s)))));

COEFFICENT (all,m,MARG_COMM)(all,i,TRAD_COMM)(all,r,REG)(all,s,REG)
   VTFSD_MSH(m,i,r,s) # share of margin m in cost of getting i from r to s #;
FORMULA (all,m,MARG_COMM)(all,i,TRAD_COMM)(all,r,REG)
      (all,s,REG: VTFSD(i,r,s) > 0.0)
   VTFSD_MSH(m,i,r,s) = VTMFSD(m,i,r,s) / VTFSD(i,r,s);
FORMULA (all,m,MARG_COMM)(all,i,TRAD_COMM)(all,r,REG)
      (all,s,REG: VTFSD(i,r,s) = 0.0)
   VTFSD_MSH(m,i,r,s) = VTMUSE(m) / VTUSE;
Equation TRANSCOSTINDEX
#  generates flow-specific modal average cost of transport index  #
(all,i,TRAD_COMM)(all,r,REG)(all,s,REG)
   ptrans(i,r,s)  = sum(m,MARG_COMM, VTFSD_MSH(m,i,r,s) * [pt(m) - atmfsd(m,i,r,s)]);

COEFFICIENT (all,i,TRAD_COMM)(all,r,REG)(all,s,REG)
   VIWSCOST(i,r,s) # value of imports calculated as total cost of imports #;
FORMULA(all,i,TRAD_COMM)(all,r,REG)(all,s,REG)
   VIWSCOST(i,r,s) = VXWD(i,r,s) + VTFSD(i,r,s);
COEFFICIENT (all,i,TRAD_COMM)(all,r,REG)(all,s,REG)
   FOBSHR(i,r,s) # FOB share in VIW #;
FORMULA (all,i,TRAD_COMM)(all,r,REG)(all,s,REG)
   FOBSHR(i,r,s) = VXWD(i,r,s) / VIWSCOST(i,r,s);

COEFFICIENT (all,i,TRAD_COMM)(all,r,REG)(all,s,REG)
   TRNSHR(i,r,s) # transport share in VIW #;
FORMULA (all,i,TRAD_COMM)(all,r,REG)(all,s,REG)
   TRNSHR(i,r,s) = VTFSD(i,r,s) / VIWSCOST(i,r,s);
```

- **World Prices**

Equation FOBCIF
eq'n links FOB and CIF prices for good i shipped from region r to s
(all,i,TRAD_COMM)(all,r,REG)(all,s,REG)
pcif(i,r,s) = FOBSHR(i,r,s) * pfob(i,r,s) + TRNSHR(i,r,s) * ptrans(i,r,s);

Equation EXPRICES
eq'n links agent's and world prices
(all,i,TRAD_COMM)(all,r,REG)(all,s,REG)
pfob(i,r,s) = pm(i,r) - tx(i,r) - txs(i,r,s);

Equation MKTPRICES
eq'n links domestic and world prices)
(all,i,TRAD_COMM)(all,r,REG)(all,s,REG)
pms(i,r,s) = tm(i,s) + tms(i,r,s) + pcif(i,r,s);

- **Prices relating to imports**

COEFFICIENT(all,i,TRAD_COMM)(all,r,REG)(all,s,REG)
MSHRS(i,r,s) # share of imports from r in import bill of s at mkt prices #;
FORMULA (all,i,TRAD_COMM)(all,r,REG)(all,s,REG)
MSHRS(i,r,s) = VIMS(i,r,s) / sum(k,REG, VIMS(i,k,s));

Equation DPRICEIMP
price for aggregate imports
(all,i,TRAD_COMM)(all,s,REG)
pim(i,s) = sum(k,REG, MSHRS(i,k,s) * [pms(i,k,s) - ams(i,k,s)]);

Equation PRICETGT
eq'n defines target price ratio to be attained via the variable levy
(all,i,TRAD_COMM)(all,s,REG)
pr(i,s) = pm(i,s) - pim(i,s);

- **Prices relating to savings and investment**

Equation SAVEPRICE
savings price
(all,r,REG)
psave(r)
= pcgds(r)
+ sum(s,REG, [[NETINV(s) - SAVE(s)] / GLOBINV] * pcgds(s)) + psaveslack(r);

Equation PRICGDS
# eq'n generates a price index for the aggregate global cgds composite (HT 60) #
pcgdswld = sum(r,REG, [NETINV(r) / GLOBINV] * pcgds(r));

Section M: Market Clearing Conditions

- **Market clearing condition for domestic sales and imports**

Value of the Domestic Sales
COEFFICIENT (all,i,TRAD_COMM)(all,r,REG)
VDM(i,r)# domestic sales of commodity i in region r valued at market prices (tradables only) # ;

```
COEFFICIENT (all,i,TRAD_COMM)(all,r,REG)
VDPM (i,r)  #private household expenditure on domestic i in r # ;
FORMULA (all,i,TRAD_COMM)(all,r,ROW)
   VDPM(i,r)=VDRW(i,r);
FORMULA (all,i,TRAD_COMM)(all,r,LKA)
   VDPM(i,r)=sum(b,HS,VDSL(i,b,r));
FORMULA (all,i,TRAD_COMM)(all,r,IND)
   VDPM(i,r)=sum(q,HI,VDIN(i,q,r));
FORMULA (all,i,TRAD_COMM)(all,r,PAK)
   VDPM(i,r)=sum(c,HP,VDPK(i,c,r));

FORMULA (all,i,TRAD_COMM)(all,r,BGD)
   VDPM(i,r)=sum(d,HB,VDBG(i,d,r));
FORMULA (all,i,TRAD_COMM)(all,r,REG)
VDM(i,r) = VDPM(i,r) + VDGM(i,r) + sum(j,PROD_COMM, VDFM(i,j,r))
 COEFFICIENT (all,i,TRAD_COMM)(all,j,PROD_COMM)(all,r,REG)
   SHRDFM(i,j,r) # share of dom. prod. i used by sector j in r at mkt prices #;
FORMULA (all,i,TRAD_COMM)(all,j,PROD_COMM)(all,r,REG)
   SHRDFM(i,j,r) = VDFM(i,j,r) / VDM(i,r);

COEFFICIENT (all,i,TRAD_COMM)(all,r,REG)
   SHRDPM(i,r) # share of domestic prod. of i used by private hhlds in r #;
 FORMULA (all,i,TRAD_COMM)(all,r,REG)
   SHRDPM(i,r) = VDPM(i,r) / VDM(i,r);
COEFFICIENT (all,i,TRAD_COMM)(all,r,REG)
   SHRDGM(i,r) # share of imports of i used by gov't hhlds in r #;
FORMULA (all,i,TRAD_COMM)(all,r,REG)
   SHRDGM(i,r) = VDGM(i,r) / VDM(i,r);
```

Equation MKTCLDOM

```
# eq'n assures market clearing for domestic sales  #
(all,i,TRAD_COMM)(all,r,REG)
   qds(i,r)
      = sum(j,PROD_COMM, SHRDFM(i,j,r) * qfd(i,j,r))
      + SHRDPM(i,r) * qpd(i,r)
      + SHRDGM(i,r) * qgd(i,r);

COEFFICIENT (all,i,TRAD_COMM)(all,r,REG)
   SHRDM(i,r) # share of domestic sales of i in r #;
FORMULA (all,i,TRAD_COMM)(all,r,REG)
   SHRDM(i,r) = VDM(i,r) / VOM(i,r);

COEFFICIENT (all,m,MARG_COMM)(all,r,REG)
   SHRST(m,r) # share of sales of m to global transport services in r #;
FORMULA (all,m,MARG_COMM)(all,r,REG)
   SHRST(m,r) = VST(m,r) / VOM(m,r);

COEFFICIENT (all,i,TRAD_COMM)(all,r,REG)(all,s,REG)
   SHRXMD(i,r,s) # share of export sales of i to s in r #;
FORMULA (all,i,TRAD_COMM)(all,r,REG)(all,s,REG)
   SHRXMD(i,r,s) = VXMD(i,r,s) / VOM(i,r);
COEFFICIENT (all,i,TRAD_COMM)(all,r,REG)
   VIM(i,r) # value of imports of commodity i in r at domestic market prices #;
FORMULA (all,i,TRAD_COMM)(all,r,REG)
   VIM(i,r) = sum(j,PROD_COMM, VIFM(i,j,r)) + VIPM(i,r) + VIGM(i,r);
```

```
COEFFICIENT (all,i,TRAD_COMM)(all,j,PROD_COMM)(all,r,REG)
   SHRIFM(i,j,r) # share of import i used by sector j in r  #;
FORMULA (all,i,TRAD_COMM)(all,j,PROD_COMM)(all,r,REG)
   SHRIFM(i,j,r) = VIFM(i,j,r) / VIM(i,r);
COEFFICIENT (all,i,TRAD_COMM)(all,r,REG)
   SHRIPM(i,r) # share of import i used by private hhlds in r #;
FORMULA (all,i,TRAD_COMM)(all,r,REG)
   SHRIPM(i,r) = VIPM(i,r) / VIM(i,r);
COEFFICIENT (all,i,TRAD_COMM)(all,r,REG)
   SHRIGM(i,r) # the share of import i used by gov't hhlds in r #;
FORMULA (all,i,TRAD_COMM)(all,r,REG)
   SHRIGM(i,r) = VIGM(i,r) / VIM(i,r);
```

Equation MKTCLIMP
eq'n assures mkt clearing for imported goods entering each region
(all,i,TRAD_COMM)(all,r,REG)
   qim(i,r)
      = sum(j,PROD_COMM, SHRIFM(i,j,r) * qfm(i,j,r))
      + SHRIPM(i,r) * qpm(i,r)
      + SHRIGM(i,r) * qgm(i,r);

```
COEFFICIENT (all,i,ENDWM_COMM)(all,j,PROD_COMM)(all,r,REG)
   SHREM(i,j,r) # share of mobile endowment i used by sector j at mkt prices #;
FORMULA (all,i,ENDWM_COMM)(all,j,PROD_COMM)(all,r,REG)
   SHREM(i,j,r) = VFM(i,j,r) / VOM(i,r);
```

- **Market clearing for margin and non margin commodities**

Equation MKTCLTRD_MARG
eq'n assures market clearing for margins commodities)
(all,m,MARG_COMM)(all,r,REG)
   qo(m,r)   = SHRDM(m,r) * qds(m,r) + SHRST(m,r) * qst(m,r) + sum(s,REG, SHRXMD(m,r,s) * qxs(m,r,s))
      + tradslack(m,r);

Equation MKTCLTRD_NMRG
eq'n assures market clearing for the non-margins commodities
(all,i,NMRG_COMM)(all,r,REG)
   qo(i,r) = SHRDM(i,r) * qds(i,r) + sum(s,REG, SHRXMD(i,r,s) * qxs(i,r,s)) + tradslack(i,r);

Market clearing condition for endowments
Equation MKTCLENDWM
eq'n assures mkt clearing for perfectly mobile endowments in each r
(all,i,ENDWM_COMM)(all,r,REG)
   qo(i,r) = sum(j,PROD_COMM, SHREM(i,j,r) * qfe(i,j,r)) + endwslack(i,r);

Equation MKTCLENDWS
eq'n assures mkt clearing for imperfectly mobile endowments in each r
(all,i,ENDWS_COMM)(all,j,PROD_COMM)(all,r,REG)
   qoes(i,j,r) = qfe(i,j,r);

Equation MKTCLENDWM
eq'n assures mkt clearing for perfectly mobile endowments in each r
(**all**,i,ENDWM_COMM)(**all**,r,REG)
qo(i,r) = **sum**(j,PROD_COMM, SHREM(i,j,r) * qfe(i,j,r)) + endwslack(i,r);

Equation SUPPLYENDW
#share the jobs in region -RW#
(**all**,i,ENDW_COMM)(**all**,r,ROW)
qorw(i,r)=qo(i,r);

Equation SUPPLYENSL
#share the jobs in region -SL#
(all,i,ENDW_COMM)(all,r,LKA)
qosh(i,b,r)=qo(i,r);

Equation SUPPLYENIN
#share the jobs in region -IND#
(**all**,i,ENDW_COMM)(**all**,r,IND)
qonh(i,q,r)=qo(i,r);

Equation SUPPLYENPK
#share the jobs in region -PAK#
(**all**,i,ENDW_COMM)(**all**,r,PAK)
qoph(i,c,r)=qo(i,r);

Equation SUPPLYENBG
#share the jobs in region -BGD#
(**all**,i,ENDW_COMM)(**all**,r,BGD)
qobh(i,d,r)=qo(i,r);

Section N: Walras' Law

Equation WALRAS_S
# Extra eq'n computes change in supply in the omitted market. #
walras_sup = pcgdswld + globalcgds;

Equation WALRAS_D
Extra eq'n computes change in demand in the omitted market.
GLOBINV * walras_dem = sum(r,REG, SAVE(r) * [psave(r) + qsave(r)]);

Equation WALRAS
# Check Walras' Law. Value of "walraslack" should be zero #
walras_sup = walras_dem + walraslack;

Section O: Summary Indices

Real factor prices
Equation REALRETURN
eq'n defines the real rate of return to primary factor i in region r
(all,i,ENDW_COMM)(all,s,REG)
pfactreal(i,s) = pm(i,s) - ppriv(s);

Equation REALRETURN
eq'n defines the real rate of return to primary factor i in region r
(all,i,ENDW_COMM)(all,s,REG)
   pfactreal(i,s) = pm(i,s) - ppriv(s);

Gross Domestic Product (GDP)
COEFFICIENT(all,r,REG)
   GDP(r) # Gross Domestic Product in region r #;
FORMULA(all,s,REG)
   GDP(s)
      = sum(i,TRAD_COMM, VPA(i,s))
      + sum(i,TRAD_COMM, VGA(i,s))
      + sum(k,CGDS_COMM, VOA(k,s))
      + sum(i,TRAD_COMM, sum(r,REG, VXWD(i,s,r)))
      + sum(m,MARG_COMM, VST(m,s))
      - sum(i,TRAD_COMM, sum(r,REG, VIWS(i,r,s)));

Equation VGDP_r
change in value of GDP
(all,r,REG)
   GDP(r) * vgdp(r)
      = sum(i,TRAD_COMM, VGA(i,r) * [qg(i,r) + pg(i,r)])
      + sum(i,TRAD_COMM, VPA(i,r) * [qp(i,r) + pp(i,r)])
      + REGINV(r) * [qcgds(r) + pcgds(r)]
      + sum(i,TRAD_COMM, sum(s,REG, VXWD(i,r,s) * [qxs(i,r,s) + pfob(i,r,s)]))
      + sum(m,MARG_COMM, VST(m,r) * [qst(m,r) + pm(m,r)])
      - sum(i,TRAD_COMM, sum(s,REG,
         VIWS(i,s,r) * [qxs(i,s,r) + pcif(i,s,r)]));

Equation PGDP_r
GDP price index
(all,r,REG)
   GDP(r) * pgdp(r)
      = sum(i,TRAD_COMM, VGA(i,r) * pg(i,r))
      + sum(i,TRAD_COMM, VPA(i,r) * pp(i,r))
      + REGINV(r) * pcgds(r)
      + sum(i,TRAD_COMM, sum(s,REG, VXWD(i,r,s) * pfob(i,r,s)))
      + sum(m,MARG_COMM, VST(m,r) * pm(m,r))
      - sum(i,TRAD_COMM, sum(s,REG, VIWS(i,s,r) * pcif(i,s,r)));

Equation QGDP_r
GDP quantity index
(all,r,REG)
   GDP(r) * qgdp(r)
      = sum(i,TRAD_COMM, VGA(i,r) * qg(i,r))
      + sum(i,TRAD_COMM, VPA(i,r) * qp(i,r))
      + REGINV(r) * qcgds(r)
      + sum(i,TRAD_COMM, sum(s,REG, VXWD(i,r,s) * qxs(i,r,s)))
      + sum(m,MARG_COMM, VST(m,r) * qst(m,r))
      - sum(i,TRAD_COMM, sum(s,REG, VIWS(i,s,r) * qxs(i,s,r)));

Trade Balance and Terms of Trade

Equation TRADEBAL_i
computes change in trade balance by commodity and by region
(all,i,TRAD_COMM)(all,r,REG)
DTBALi(i,r)= [VXW(i,r) / 100] * vxwfob(i,r) - [VIW(i,r) / 100] * viwcif(i,r);

Equation TRADEBALANCE
computes change in trade balance (X - M), by region
(all,r,REG)
DTBAL(r) = [VXWREGION(r) / 100] * vxwreg(r) - [VIWREGION(r) / 100] * viwreg(r);
COEFFICIENT (all,i,TRAD_COMM)(all,r,REG)
VXW(i,r) # value of exports by comm. i and region r at FOB prices #;
FORMULA (all,m,MARG_COMM)(all,r,REG)
VXW(m,r) = sum(s,REG, VXWD(m,r,s)) + VST(m,r);
FORMULA (all,i,NMRG_COMM)(all,r,REG)
VXW(i,r) = sum(s,REG, VXWD(i,r,s));

COEFFICIENT (all,r,REG)
VXWREGION(r) # value of exports by region r at FOB prices #;
FORMULA (all,r,REG)
VXWREGION(r) = sum(i,TRAD_COMM, VXW(i,r));

COEFFICIENT (all,i,TRAD_COMM)(all,s,REG)
VIW(i,s) # value of commodity imports i into s at CIF prices #;
FORMULA (all,i,TRAD_COMM)(all,s,REG)
VIW(i,s) = sum(r,REG, VIWS(i,r,s));
COEFFICIENT (all,r,REG)
VIWREGION(r) # value of commodity imports by region r at CIF prices #;
FORMULA (all,r,REG)
VIWREGION(r) = sum(i,TRAD_COMM, VIW(i,r));
COEFFICIENT (all,r,REG)
TBAL(r) # trade balance for region r #;
FORMULA (all,r,REG)
TBAL(r) = VXWREGION(r) - VIWREGION(r);
Equation DTBALRATIO
change in ratio of trade balance to regional income
(all,r,REG)
100 * INCOME(r) * DTBALR(r) = 100 * DTBAL(r) - TBAL(r) * y(r);

Terms of Trade

Equation REGSUPRICE
estimate change in index of prices received for tradeables i produced in r
(all,r,REG)
VXWREGION(r) * psw(r) = sum(i,TRAD_COMM, sum(s,REG, VXWD(i,r,s) * pfob(i,r,s)))
+ sum(m,MARG_COMM, VST(m,r) * pm(m,r));
Equation REGDEMPRICE
estimate change in index of prices paid for tradeable products used in r
(all,r,REG)
VIWREGION(r) * pdw(r) = sum(i,TRAD_COMM, sum(k,REG, VIWS(i,k,r) * pcif(i,k,r)));

Equation TOTeq
terms of trade equation computed as difference in psw and pdw
(all,r,REG)
 tot(r) = psw(r) - pdw(r);

Equivalent variation (EV)
The model uses similar equations apprears in the standrad GTAP model in calculating utility and welare and hence they do not report detail in this appendix.
Coefficient (all,r,REG)
 INCOMEEV(r) # regional income, for EV calc. #;
Formula (all,r,REG)
INCRG(r)=INCOME(r)
Formula (initial) (all,r,REG)
 INCOMEEV(r) = INCRG(r);

Equation EVREG
regional EV
(all,r,REG)
 EV(r) = [INCOMEEV(r) / 100] * yev(r);
Variable (change)
 WEV # equivalent variation for the world #;
Equation EVWLD
# EV for the world #
 WEV = sum(r,REG, EV(r));

Section P: Checking Benchmark Consistency of Data

Variable (all,r,REG)
checky(r)#Balancing condition for income#;

Equation E_checky
#Balancing condition for income#
(all,r,REG)
INCOME(r) * checky(r) = INCOME(r) * y(r) - PRIVEXP(r) * yp(r) -
-GOVEXP(r)*yg(r)-SAVE(r) * [qsave(r)+psave(r)];

Coefficient (all,r,REG)
CHINC(r)#Balancing condition for income#;
Formula (all,r,REG)
CHINC(r) = INCOME(r)- PRIVEXP(r)-GOVEXP(r)- SAVE(r);

Coefficient (all,r,REG) BOP(r)
! Balance of payments in region r. This should equal zero. ! ;
FORMULA (all,r,REG)
 BOP(r) = sum(i,TRAD_COMM, sum(s,REG, VXWD(i,r,s))) + sum(m,MARG_COMM,
 VST(m,r))+ sum(i,CGDS_COMM, VOA(i,r)) - VDEP(r)
 - sum(i,TRAD_COMM, sum(k,REG, VIWS(i,k,r))) - SAVE(r) ;

```
Coefficient  CHKSAVE
       ! Check on the equality of global savings and investment. ! ;
FORMULA
 CHKSAVE = sum(k,REG, SAVE(k))
          - sum(k,REG, sum(i,CGDS_COMM, VOA(i,k)) - VDEP(k)) ;
Write CHKSAVE  to file Summary header "CHSA" longname
"Check on the equality of global savings and investment";

Coefficient  (all,i,TRAD_COMM)(all,s,REG)
      CHKMKTCLDOM(i,s)
! Checking the accounting on traded commodities supply and demand!;
FORMULA  (all,i,TRAD_COMM)(all,s,REG)
 CHKMKTCLDOM(i,s) = sum(r,REG, VIMS(i,r,s))
        - sum(j,PROD_COMM, VIFM(i,j,s)) - VIPM(i,s) - VIGM(i,s) ;

Coefficient  (all,i,ENDW_COMM)(all,r,REG)   CHKMKTCLENDW(i,r)
! Checking the accounting on endowment commodities supply and demand!;
FORMULA  (all,i,ENDW_COMM)(all,r,REG)
     CHKMKTCLENDW(i,r) = VOM(i,r) - sum(j,PROD_COMM, VFM(i,j,r)) ;

Coefficient (all,j,PROD_COMM)(all,r,REG)   PROFITS(j,r)
             ! Preliminary estimate of profits in j of r. !  ;
FORMULA      (all,j,PROD_COMM)(all,r,REG)
        PROFITS(j,r) = VOA(j,r) - sum(i,DEMD_COMM, VFA(i,j,r));

Coefficient  (all,s,REG)    SURPLUS(s)
          ! Economic surplus in region s.  This should equal zero. ! ;
FORMULA          (all,r,REG)
  SURPLUS(r) =  sum(i,ENDW_COMM, VOA(i,r))
 - VDEP(r)
 + sum(i,NSAV_COMM, VOM(i,r) - VOA(i,r))
 + sum(j,PROD_COMM, sum(i,ENDW_COMM, VFA(i,j,r) - VFM(i,j,r)))
 + sum(i,TRAD_COMM, VIPA(i,r) - VIPM(i,r))
 + sum(i,TRAD_COMM, VDPA(i,r) - VDPM(i,r))
 + sum(i,TRAD_COMM, VIGA(i,r) - VIGM(i,r))
 + sum(i,TRAD_COMM, VDGA(i,r) - VDGM(i,r))
 + sum(j,PROD_COMM, sum(i,TRAD_COMM, VIFA(i,j,r) - VIFM(i,j,r)))
 + sum(j,PROD_COMM, sum(i,TRAD_COMM, VDFA(i,j,r) - VDFM(i,j,r)))
 + sum(i,TRAD_COMM, sum(s,REG, VXWD(i,r,s) - VXMD(i,r,s)))
 + sum(i,TRAD_COMM, sum(s,REG, VIMS(i,s,r) - VIWS(i,s,r)))
 - sum(i,TRAD_COMM, VPA(i,r) + VGA(i,r)) - SAVE(r) ;
```

APPENDIX C

Table C 1 Consumption Shares from Household Survey Data: Sri Lanka

No:	GTAP Industry Classification	Rural Sector Income Deciles 1	2	3	4	5	6	7	8	9	10	Total
1	PDR_ PCR	0.092	0.097	0.100	0.100	0.100	0.104	0.103	0.099	0.103	0.102	1.000
2	WHT_GRO	0.070	0.074	0.082	0.107	0.092	0.096	0.108	0.111	0.117	0.143	1.000
3	V_F	0.070	0.073	0.067	0.084	0.090	0.099	0.108	0.120	0.129	0.160	1.000
4	OSD_VOL	0.083	0.083	0.083	0.086	0.090	0.096	0.099	0.111	0.111	0.157	1.000
5	PFB_OCR	0.084	0.087	0.075	0.094	0.095	0.101	0.107	0.109	0.119	0.130	1.000
6	C_B_SGR	0.090	0.090	0.094	0.094	0.098	0.104	0.104	0.106	0.106	0.114	1.000
7	RMK_MIL	0.043	0.043	0.061	0.070	0.084	0.104	0.110	0.143	0.147	0.194	1.000
8	FSH	0.057	0.062	0.071	0.079	0.086	0.104	0.113	0.123	0.134	0.171	1.000
9	CMT_OMT_CTL_OAP	0.050	0.039	0.052	0.057	0.071	0.089	0.114	0.121	0.150	0.257	1.000
10	OFD	0.085	0.084	0.097	0.079	0.094	0.098	0.103	0.106	0.115	0.139	1.000
11	B_T	0.082	0.084	0.085	0.089	0.099	0.099	0.102	0.111	0.106	0.143	1.000
12	TEX	0.042	0.047	0.060	0.060	0.080	0.085	0.109	0.109	0.179	0.228	1.000
13	WAP	0.039	0.040	0.043	0.054	0.068	0.088	0.104	0.132	0.177	0.256	1.000
14	LEA_LUM	0.046	0.032	0.044	0.055	0.072	0.121	0.078	0.144	0.158	0.250	1.000
15	PPP	0.016	0.024	0.024	0.033	0.073	0.073	0.089	0.138	0.203	0.325	1.000
16	CRP	0.050	0.056	0.056	0.063	0.081	0.088	0.100	0.125	0.150	0.231	1.000
17	I_S_NFM_FMP	0.000	0.000	0.032	0.045	0.057	0.067	0.089	0.221	0.201	0.288	1.000
18	ELE	0.029	0.024	0.062	0.040	0.020	0.064	0.129	0.140	0.155	0.337	1.000
19	OME	0.012	0.024	0.108	0.133	0.060	0.072	0.072	0.084	0.133	0.301	1.000
20	OMF	0.066	0.055	0.064	0.069	0.073	0.090	0.092	0.109	0.133	0.249	1.000
21	MVH_OTN_OPT	0.033	0.032	0.032	0.051	0.042	0.094	0.090	0.108	0.140	0.378	1.000
22	P_C_COA	0.017	0.008	0.015	0.023	0.031	0.048	0.084	0.110	0.155	0.509	1.000
23	GAS_GDT	0.012	0.012	0.012	0.017	0.040	0.058	0.092	0.173	0.202	0.382	1.000
24	CMN_OFI_ISR_OBS_ROS	0.053	0.019	0.024	0.027	0.036	0.068	0.069	0.107	0.157	0.440	1.000
25	OSG_DWE	0.046	0.039	0.048	0.053	0.068	0.093	0.090	0.125	0.164	0.275	1.000
26	WOL_OMN_NMM	0.048	0.048	0.060	0.060	0.096	0.096	0.096	0.133	0.133	0.229	1.000
27	TRD_CNS	0.042	0.104	0.031	0.031	0.031	0.073	0.073	0.104	0.167	0.344	1.000
28	ELY_WTR_WTP_ATP	0.043	0.043	0.052	0.057	0.068	0.093	0.106	0.128	0.152	0.258	1.000
29	OIL	0.161	0.144	0.133	0.111	0.100	0.083	0.083	0.072	0.061	0.050	1.000
30	FRS	0.103	0.101	0.108	0.103	0.103	0.108	0.099	0.099	0.099	0.077	1.000

Source: Author’s calculations from Consumer Finances and Socio Economic Survey conducted by the Central Bank of Sri Lanka in 2003/2004

No:	GTAP Industry Classification	Urban Sector										Total
		Income Deciles										
		1	2	3	4	5	6	7	8	9	10	
1	PDR_ PCR	0.091	0.096	0.099	0.109	0.099	0.098	0.106	0.098	0.106	0.098	1.000
2	WHT_GRO	0.086	0.087	0.078	0.089	0.097	0.094	0.100	0.110	0.118	0.141	1.000
3	V_F	0.071	0.073	0.063	0.076	0.073	0.093	0.109	0.119	0.138	0.185	1.000
4	OSD_VOL	0.085	0.064	0.062	0.116	0.075	0.085	0.098	0.103	0.131	0.183	1.000
5	PFB_OCR	0.079	0.084	0.073	0.091	0.077	0.101	0.112	0.105	0.134	0.145	1.000
6	C_B_SGR	0.107	0.097	0.086	0.101	0.111	0.095	0.111	0.094	0.097	0.101	1.000
7	RMK_MIL	0.062	0.060	0.046	0.081	0.077	0.092	0.111	0.127	0.148	0.195	1.000
8	FSH	0.087	0.072	0.081	0.085	0.092	0.084	0.103	0.115	0.122	0.158	1.000
9	CMT_OAP	0.043	0.055	0.048	0.041	0.066	0.070	0.203	0.110	0.147	0.217	1.000
10	OFD	0.098	0.090	0.075	0.086	0.092	0.094	0.075	0.109	0.123	0.159	1.000
11	B_T	0.068	0.085	0.070	0.085	0.108	0.093	0.120	0.097	0.103	0.171	1.000
12	TEX	0.041	0.018	0.068	0.027	0.044	0.068	0.098	0.127	0.183	0.325	1.000
13	WAP	0.037	0.034	0.043	0.053	0.050	0.084	0.125	0.122	0.142	0.311	1.000
14	LEA_LUM	0.069	0.024	0.022	0.050	0.036	0.063	0.128	0.070	0.190	0.348	1.000
15	PPP	0.027	0.033	0.038	0.022	0.022	0.049	0.055	0.115	0.187	0.451	1.000
16	CRP	0.072	0.054	0.058	0.067	0.072	0.072	0.081	0.094	0.126	0.305	1.000
17	I_S_NFM_FMP	0.000	0.013	0.005	0.003	0.010	0.083	0.070	0.031	0.242	0.543	1.000
18	ELE	0.060	0.110	0.010	0.009	0.061	0.126	0.064	0.001	0.047	0.510	1.000
19	OME	0.058	0.115	0.019	0.019	0.019	0.135	0.038	0.019	0.038	0.538	1.000
20	OMF	0.064	0.092	0.035	0.094	0.081	0.087	0.102	0.101	0.129	0.214	1.000
21	MVH_OTP	0.109	0.074	0.051	0.023	0.021	0.129	0.042	0.074	0.152	0.325	1.000
22	P_C_COA	0.030	0.004	0.007	0.019	0.050	0.031	0.034	0.050	0.150	0.626	1.000
23	GAS_GDT	0.003	0.013	0.003	0.040	0.062	0.110	0.113	0.113	0.214	0.330	1.000
24	CMN_ROS	0.045	0.021	0.013	0.045	0.024	0.050	0.070	0.097	0.169	0.465	1.000
25	OSG_DWE	0.038	0.030	0.034	0.064	0.052	0.065	0.085	0.113	0.145	0.374	1.000
26	WOL_NMM	0.106	0.061	0.045	0.030	0.091	0.061	0.045	0.045	0.167	0.348	1.000
27	TRD_CNS	0.036	0.014	0.007	0.007	0.036	0.107	0.043	0.164	0.121	0.464	1.000
28	ELY_WTR	0.039	0.042	0.070	0.052	0.068	0.075	0.047	0.104	0.165	0.338	1.000
29	OIL	0.130	0.120	0.023	0.102	0.107	0.090	0.281	0.084	0.041	0.020	1.000
30	FRS	0.154	0.161	0.103	0.111	0.093	0.086	0.103	0.103	0.050	0.035	1.000

Source: Author’s calculations from Consumer Finances and Socio Economic Survey conducted by the Central Bank of Sri Lanka in 2003/2004

No:	GTAP Industry Classification	Estate Sector										Total
		Income Decile										
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
1	PDR_ PCR	0.089	0.092	0.089	0.098	0.102	0.100	0.099	0.088	0.118	0.125	1.000
2	WHT_GRO	0.088	0.083	0.101	0.110	0.107	0.097	0.101	0.119	0.107	0.088	1.000
3	V_F	0.076	0.074	0.078	0.087	0.095	0.103	0.099	0.099	0.146	0.144	1.000
4	OSD_VOL	0.093	0.087	0.093	0.098	0.093	0.096	0.093	0.107	0.124	0.118	1.000
5	PFB_OCR	0.040	0.104	0.093	0.107	0.104	0.110	0.115	0.102	0.094	0.130	1.000
6	C_B_SGR	0.084	0.098	0.091	0.098	0.093	0.096	0.112	0.110	0.100	0.117	1.000
7	RMK_MIL	0.045	0.053	0.081	0.077	0.111	0.102	0.108	0.081	0.228	0.115	1.000
8	FSH	0.049	0.067	0.063	0.087	0.091	0.091	0.117	0.116	0.117	0.203	1.000
9	CMT_OAP	0.041	0.050	0.069	0.079	0.078	0.107	0.105	0.226	0.174	0.071	1.000
10	OFD	0.084	0.087	0.089	0.093	0.093	0.104	0.103	0.103	0.124	0.120	1.000
11	B_T	0.075	0.100	0.077	0.094	0.094	0.129	0.096	0.096	0.129	0.111	1.000
12	TEX	0.074	0.072	0.088	0.097	0.119	0.107	0.103	0.132	0.056	0.152	1.000
13	WAP	0.038	0.032	0.053	0.063	0.086	0.087	0.113	0.136	0.072	0.320	1.000
14	LEA_LUM	0.021	0.037	0.032	0.057	0.053	0.067	0.099	0.153	0.343	0.138	1.000
15	PPP	0.026	0.038	0.051	0.077	0.064	0.077	0.115	0.103	0.179	0.269	1.000
16	CRP	0.057	0.082	0.064	0.074	0.092	0.096	0.110	0.117	0.138	0.170	1.000
17	I_S_NFM_FMP	0.000	0.048	0.029	0.134	0.106	0.198	0.040	0.046	0.007	0.392	1.000
18	ELE	0.002	0.005	0.000	0.001	0.003	0.000	0.005	0.116	0.147	0.719	1.000
19	OME	0.018	0.009	0.018	0.000	0.018	0.000	0.696	0.125	0.000	0.116	1.000
20	OMF	0.056	0.069	0.069	0.080	0.096	0.104	0.098	0.089	0.186	0.154	1.000
21	MVH_OTP	0.046	0.050	0.055	0.069	0.071	0.089	0.143	0.099	0.133	0.244	1.000
22	P_C_COA	0.004	0.004	0.031	0.031	0.009	0.009	0.063	0.138	0.156	0.554	1.000
23	GAS_GDT	0.010	0.000	0.010	0.010	0.020	0.010	0.120	0.170	0.320	0.330	1.000
24	CMN_ROS	0.025	0.039	0.039	0.093	0.059	0.117	0.126	0.073	0.223	0.205	1.000
25	OSG_DWE	0.043	0.046	0.057	0.062	0.069	0.097	0.118	0.100	0.133	0.275	1.000
26	WOL_NMM	0.055	0.044	0.033	0.077	0.033	0.022	0.066	0.121	0.165	0.385	1.000
27	TRD_CNS	0.076	0.000	0.050	0.000	0.000	0.143	0.050	0.160	0.521	0.000	1.000
28	ELY_WTR	0.068	0.068	0.062	0.087	0.082	0.089	0.080	0.073	0.158	0.233	1.000
29	OIL	0.119	0.112	0.102	0.095	0.132	0.115	0.108	0.149	0.024	0.044	1.000
30	FRS	0.115	0.107	0.115	0.104	0.101	0.107	0.101	0.089	0.077	0.086	1.000

Source: Author’s calculations from Consumer Finances and Socio Economic Survey conducted by the Central Bank of Sri Lanka in 2003/2004

Consumption Shares from Household Survey Data: India

No:	GTAP Industry Classification	Rural												Total
		Monthly Per Capita Consumer Expenditure (MPCE) Class in Indian Rs.												
		0-225	225-255	255-300	300-340	340-380	380-420	420-470	470-525	525-615	615-775	775-950	950-above	
		1	2	3	4	5	6	7	8	9	10	11	12	
1	PDR_ PCR	0.055	0.064	0.073	0.076	0.080	0.081	0.085	0.090	0.090	0.094	0.100	0.112	1.000
2	WHT_GRO	0.026	0.014	0.028	0.030	0.054	0.051	0.051	0.072	0.093	0.130	0.156	0.295	1.000
3	V_F	0.035	0.041	0.051	0.057	0.063	0.072	0.078	0.082	0.094	0.110	0.131	0.186	1.000
4	OSD_VOL	0.031	0.045	0.055	0.062	0.071	0.075	0.079	0.089	0.098	0.109	0.124	0.162	1.000
5	PFB_OCR	0.033	0.051	0.054	0.065	0.071	0.075	0.081	0.091	0.099	0.110	0.122	0.148	1.000
6	C_B_SGR	0.028	0.038	0.044	0.051	0.058	0.073	0.077	0.088	0.097	0.115	0.140	0.191	1.000
7	RMK_MIL	0.009	0.012	0.020	0.029	0.040	0.053	0.061	0.082	0.104	0.133	0.173	0.284	1.000
8	FSH	0.014	0.036	0.034	0.040	0.049	0.059	0.074	0.078	0.096	0.119	0.147	0.254	1.000
9	CMT_OAP	0.014	0.036	0.034	0.040	0.049	0.058	0.074	0.079	0.095	0.120	0.147	0.254	1.000
10	OFD	0.039	0.048	0.057	0.064	0.070	0.073	0.081	0.086	0.096	0.107	0.124	0.155	1.000
11	B_T	0.025	0.041	0.044	0.051	0.058	0.064	0.076	0.082	0.095	0.114	0.137	0.213	1.000
12	TEX	0.036	0.045	0.050	0.058	0.064	0.073	0.077	0.084	0.093	0.111	0.127	0.182	1.000
13	WAP	0.036	0.045	0.050	0.058	0.065	0.073	0.077	0.084	0.093	0.112	0.124	0.183	1.000
14	LEA_LUM	0.031	0.031	0.036	0.046	0.053	0.065	0.068	0.085	0.097	0.122	0.145	0.221	1.000
15	PPP	0.038	0.040	0.051	0.050	0.065	0.067	0.083	0.052	0.096	0.098	0.127	0.233	1.000
16	CRP	0.038	0.039	0.051	0.050	0.065	0.067	0.085	0.052	0.096	0.097	0.128	0.232	1.000
17	I_S_NFM_FMP	0.032	0.037	0.042	0.050	0.055	0.064	0.071	0.079	0.093	0.117	0.140	0.220	1.000
18	ELE	0.013	0.018	0.021	0.026	0.030	0.029	0.041	0.047	0.058	0.088	0.117	0.512	1.000
19	OME	0.032	0.037	0.043	0.050	0.055	0.064	0.071	0.079	0.093	0.116	0.140	0.220	1.000
20	OMF	0.032	0.037	0.043	0.050	0.055	0.064	0.071	0.079	0.093	0.116	0.140	0.220	1.000
21	MVH_OTP	0.013	0.018	0.020	0.025	0.030	0.029	0.041	0.048	0.059	0.088	0.117	0.512	1.000
22	P_C_COA	0.013	0.018	0.020	0.025	0.031	0.029	0.041	0.048	0.059	0.087	0.117	0.512	1.000
23	GAS_GDT	0.013	0.018	0.020	0.025	0.031	0.029	0.041	0.048	0.059	0.087	0.117	0.512	1.000
24	CMN_ROS	0.016	0.020	0.022	0.032	0.039	0.043	0.048	0.060	0.078	0.112	0.155	0.375	1.000
25	OSG_DWE	0.012	0.013	0.017	0.022	0.028	0.035	0.050	0.062	0.074	0.111	0.188	0.388	1.000
26	WOL_NMM	0.038	0.040	0.051	0.050	0.065	0.067	0.083	0.052	0.096	0.098	0.127	0.232	1.000
27	TRD_CNS	0.008	0.037	0.021	0.031	0.037	0.054	0.048	0.070	0.082	0.110	0.152	0.350	1.000
28	ELY_WTR	0.040	0.050	0.050	0.060	0.060	0.070	0.080	0.090	0.090	0.110	0.120	0.180	1.000
29	OIL	0.010	0.020	0.020	0.020	0.030	0.030	0.040	0.050	0.060	0.090	0.120	0.510	1.000
30	FRS	0.010	0.020	0.020	0.020	0.030	0.030	0.040	0.050	0.060	0.090	0.120	0.510	1.000

Source: Author's calculations from the Household Expenditure Survey conducted by National Sample Survey Organisation (NSSO) of India in 2004

No:	GTAP Industry Classification	Urban Monthly Per Capita Consumer Expenditure (MPCE) Class in Indian Rs. 0-225 1	225-255 2	255-300 3	300-340 4	340-380 5	380-420 6	420-470 7	470-525 8	525-615 9	615-775 10	775-950 11	950-above 12	Total
1	PDR_ PCR	0.050	0.063	0.074	0.072	0.078	0.085	0.084	0.087	0.094	0.096	0.102	0.116	1.000
2	WHT_GRO	0.025	0.022	0.030	0.034	0.051	0.070	0.076	0.081	0.125	0.128	0.154	0.203	1.000
3	V_F	0.027	0.035	0.042	0.048	0.054	0.064	0.074	0.084	0.097	0.117	0.148	0.209	1.000
4	OSD_VOL	0.034	0.042	0.052	0.062	0.066	0.074	0.081	0.092	0.104	0.112	0.124	0.157	1.000
5	PFB_OCR	0.042	0.046	0.056	0.062	0.069	0.074	0.082	0.088	0.103	0.110	0.125	0.144	1.000
6	C_B_SGR	0.042	0.048	0.054	0.067	0.075	0.078	0.088	0.090	0.100	0.106	0.118	0.134	1.000
7	RMK_MIL	0.013	0.024	0.023	0.040	0.048	0.060	0.079	0.088	0.113	0.135	0.162	0.216	1.000
8	FSH	0.019	0.033	0.043	0.046	0.059	0.072	0.082	0.099	0.095	0.106	0.147	0.198	1.000
9	CMT_OAP	0.019	0.033	0.043	0.046	0.059	0.072	0.082	0.099	0.095	0.106	0.147	0.198	1.000
10	OFD	0.044	0.048	0.058	0.061	0.067	0.079	0.085	0.088	0.102	0.108	0.116	0.144	1.000
11	B_T	0.013	0.028	0.030	0.042	0.043	0.052	0.062	0.075	0.083	0.117	0.171	0.284	1.000
12	TEX	0.013	0.028	0.030	0.042	0.043	0.052	0.062	0.075	0.083	0.117	0.171	0.284	1.000
13	WAP	0.027	0.034	0.043	0.049	0.054	0.064	0.072	0.083	0.091	0.115	0.144	0.225	1.000
14	LEA_LUM	0.021	0.026	0.033	0.044	0.049	0.058	0.067	0.082	0.096	0.123	0.153	0.247	1.000
15	PPP	0.021	0.026	0.033	0.044	0.049	0.058	0.067	0.082	0.096	0.123	0.153	0.247	1.000
16	CRP	0.010	0.110	0.059	0.083	0.092	0.063	0.037	0.115	0.083	0.115	0.077	0.155	1.000
17	I_S_NFM_FMP	0.027	0.034	0.043	0.049	0.054	0.064	0.072	0.083	0.091	0.115	0.144	0.225	1.000
18	ELE	0.009	0.009	0.012	0.013	0.022	0.030	0.037	0.049	0.060	0.098	0.198	0.462	1.000
19	OME	0.010	0.110	0.059	0.083	0.092	0.063	0.037	0.115	0.083	0.115	0.077	0.155	1.000
20	OMF	0.021	0.028	0.032	0.042	0.049	0.055	0.070	0.081	0.097	0.127	0.160	0.240	1.000
21	MVH_OTP	0.009	0.009	0.012	0.013	0.022	0.030	0.037	0.049	0.060	0.098	0.198	0.462	1.000
22	P_C_COA	0.009	0.009	0.012	0.013	0.022	0.030	0.037	0.049	0.060	0.098	0.198	0.462	1.000
23	GAS_GDT	0.009	0.009	0.012	0.013	0.022	0.030	0.037	0.049	0.060	0.098	0.198	0.462	1.000
24	CMN_ROS	0.007	0.009	0.014	0.016	0.021	0.029	0.039	0.051	0.075	0.120	0.190	0.428	1.000
25	OSG_DWE	0.011	0.011	0.015	0.024	0.030	0.036	0.047	0.060	0.086	0.123	0.173	0.384	1.000
26	WOL_NMM	0.021	0.026	0.033	0.044	0.049	0.058	0.067	0.082	0.096	0.123	0.153	0.247	1.000
27	TRD_CNS	0.007	0.013	0.034	0.023	0.041	0.038	0.040	0.075	0.117	0.115	0.178	0.318	1.000
28	ELY_WTR	0.029	0.041	0.046	0.052	0.063	0.067	0.074	0.087	0.100	0.113	0.135	0.193	1.000
29	OIL	0.009	0.009	0.012	0.013	0.022	0.030	0.037	0.049	0.060	0.098	0.198	0.462	1.000
30	FRS	0.009	0.009	0.012	0.013	0.022	0.030	0.037	0.049	0.060	0.098	0.198	0.462	1.000

Source: Author’s calculations from the Household Expenditure Survey conducted by National Sample Survey Organisation (NSSO) of India in 2004

Consumption Shares from Household Survey Data: Pakistan

No:	GTAP Industry Classification	Rural Quintiles 1	2	3	4	5	Total
1	PDR_ PCR	0.119	0.154	0.206	0.224	0.297	1.000
2	WHT_GRO	0.152	0.180	0.194	0.216	0.258	1.000
3	V_F	0.102	0.143	0.179	0.228	0.349	1.000
4	OSD_VOL	0.120	0.152	0.177	0.222	0.328	1.000
5	PFB_OCR	0.131	0.161	0.182	0.219	0.307	1.000
6	C_B_SGR	0.115	0.155	0.189	0.214	0.327	1.000
7	RMK_MIL	0.079	0.127	0.167	0.236	0.391	1.000
8	FSH	0.102	0.152	0.224	0.234	0.288	1.000
9	CMT_OAP	0.067	0.117	0.170	0.242	0.405	1.000
10	OFD	0.095	0.140	0.191	0.219	0.355	1.000
11	B_T	0.101	0.143	0.178	0.229	0.350	1.000
12	TEX	0.114	0.151	0.176	0.225	0.334	1.000
13	WAP	0.088	0.139	0.174	0.229	0.370	1.000
14	LEA_LUM	0.104	0.148	0.174	0.220	0.355	1.000
15	PPP	0.026	0.058	0.130	0.125	0.662	1.000
16	CRP	0.116	0.152	0.188	0.232	0.312	1.000
17	I_S_NFM_FMP	0.101	0.128	0.158	0.223	0.390	1.000
18	ELE	0.061	0.101	0.135	0.208	0.495	1.000
19	OME	0.065	0.109	0.148	0.218	0.460	1.000
20	OMF	0.065	0.109	0.148	0.218	0.460	1.000
21	MVH_OTP	0.060	0.095	0.132	0.200	0.513	1.000
22	P_C_COA	0.097	0.136	0.168	0.222	0.377	1.000
23	GAS_GDT	0.097	0.136	0.168	0.222	0.377	1.000
24	CMN_ROS	0.078	0.116	0.149	0.214	0.444	1.000
25	OSG_DWE	0.078	0.116	0.149	0.214	0.444	1.000
26	WOL_NMM	0.109	0.153	0.178	0.217	0.342	1.000
27	TRD_CNS	0.078	0.116	0.149	0.214	0.444	1.000
28	ELY_WTR	0.061	0.101	0.135	0.208	0.495	1.000
29	OIL	0.097	0.136	0.168	0.222	0.377	1.000
30	FRS	0.112	0.155	0.195	0.214	0.325	1.000

No:	GTAP Industry Classification	Urban Quintiles 1	2	3	4	5	Total
1	PDR_ PCR	0.113	0.160	0.193	0.217	0.316	1.000
2	WHT_GRO	0.174	0.199	0.206	0.210	0.211	1.000
3	V_F	0.104	0.142	0.173	0.217	0.364	1.000
4	OSD_VOL	0.124	0.163	0.191	0.222	0.300	1.000
5	PFB_OCR	0.127	0.170	0.197	0.228	0.278	1.000
6	C_B_SGR	0.128	0.171	0.182	0.220	0.299	1.000
7	RMK_MIL	0.091	0.134	0.166	0.227	0.382	1.000
8	FSH	0.034	0.112	0.142	0.180	0.532	1.000
9	CMT_OAP	0.061	0.103	0.140	0.217	0.478	1.000
10	OFD	0.076	0.107	0.135	0.201	0.481	1.000
11	B_T	0.090	0.142	0.167	0.222	0.380	1.000
12	TEX	0.108	0.151	0.179	0.212	0.349	1.000
13	WAP	0.068	0.103	0.138	0.199	0.493	1.000
14	LEA_LUM	0.094	0.136	0.176	0.210	0.383	1.000
15	PPP	0.006	0.049	0.078	0.154	0.713	1.000
16	CRP	0.114	0.154	0.175	0.223	0.335	1.000
17	I_S_NFM_FMP	0.073	0.108	0.147	0.197	0.475	1.000
18	ELE	0.058	0.088	0.139	0.198	0.516	1.000
19	OME	0.061	0.086	0.113	0.173	0.567	1.000
20	OMF	0.061	0.086	0.113	0.173	0.567	1.000
21	MVH_OTP	0.043	0.071	0.096	0.171	0.619	1.000
22	P_C_COA	0.089	0.122	0.156	0.212	0.421	1.000
23	GAS_GDT	0.089	0.122	0.156	0.212	0.421	1.000
24	CMN_ROS	0.061	0.096	0.134	0.187	0.522	1.000
25	OSG_DWE	0.061	0.096	0.134	0.187	0.522	1.000
26	WOL_NMM	0.099	0.141	0.178	0.212	0.370	1.000
27	TRD_CNS	0.061	0.096	0.134	0.187	0.522	1.000
28	ELY_WTR	0.058	0.088	0.139	0.198	0.516	1.000
29	OIL	0.089	0.122	0.156	0.212	0.421	1.000
30	FRS	0.215	0.262	0.238	0.193	0.091	1.000

Source: Author's calculations from the Household Expenditure Survey conducted by Federal Bureau of Statistics of Pakistan in 2004

Consumption Shares from Household Survey Data: Bangladesh

		Monthly Household Income Groups in Taka : Rural																			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**Total**
No:	**GTAP Industry Classification**	**<750**	**750-999**	**1000-1249**	**1250-1499**	**1500-1999**	**2000-2499**	**2500-2999**	**3000-3999**	**4000-4999**	**5000-5999**	**6000-6999**	**7000-7999**	**8000-8999**	**9000-9999**	**10000-12499**	**12500-14999**	**15000-174999**	**17500-19999**	**20000+**	
1	PDR_ PCR	0.02	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.08	0.08	1.00
2	WHT_GRO	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.05	0.50	0.03	0.05	0.07	1.00
3	V_F	0.02	0.02	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.06	0.06	0.06	0.07	0.07	0.09	0.09	0.10	1.00
4	OSD_VOL	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.08	0.10	1.00
5	PFB_OCR	0.02	0.03	0.02	0.02	0.03	0.03	0.03	0.04	0.05	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.09	0.11	1.00
6	C_B_SGR	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.04	0.04	0.05	0.06	0.06	0.06	0.07	0.07	0.08	0.09	0.09	0.10	1.00
7	RMK_MIL	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.05	0.05	0.06	0.07	0.06	0.09	0.10	0.11	0.12	0.15	1.00
8	FSH	0.01	0.01	0.01	0.01	0.02	0.19	0.19	0.02	0.03	0.03	0.04	0.04	0.04	0.04	0.05	0.05	0.06	0.06	0.08	1.00
9	CMT_OMT_CTL_OAP	0.01	0.02	0.01	0.02	0.02	0.02	0.02	0.03	0.04	0.04	0.05	0.06	0.07	0.07	0.09	0.10	0.09	0.10	0.14	1.00
10	OFD	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.04	0.04	0.05	0.06	0.06	0.06	0.07	0.07	0.08	0.09	0.09	0.10	1.00
11	B_T	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.05	0.06	0.06	0.07	0.07	0.07	0.06	0.08	0.10	0.11	1.00
12	TEX	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.03	0.05	0.06	0.06	0.08	0.11	0.10	0.10	0.11	0.17	1.00
13	WAP	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.03	0.05	0.06	0.06	0.08	0.11	0.10	0.10	0.11	0.17	1.00
14	LEA_LUM	0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.03	0.04	0.05	0.05	0.07	0.07	0.06	0.10	0.09	0.11	0.11	0.12	1.00
15	PPP	0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.03	0.04	0.05	0.05	0.07	0.07	0.06	0.10	0.09	0.11	0.11	0.12	1.00
16	CRP	0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.03	0.04	0.05	0.05	0.07	0.07	0.06	0.10	0.09	0.11	0.11	0.12	1.00
17	I_S_NFM_FMP	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.03	0.05	0.06	0.07	0.11	0.10	0.06	0.11	0.27	1.00
18	ELE	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.03	0.08	0.12	0.07	0.09	0.06	0.13	0.27	1.00
19	OME	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.03	0.05	0.06	0.07	0.11	0.10	0.06	0.11	0.27	1.00
20	OMF	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.03	0.05	0.06	0.07	0.11	0.10	0.06	0.11	0.27	1.00
21	MVH_OTN_OPT	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.06	0.09	0.09	0.09	0.16	0.16	1.00
22	P_C_COA	0.00	0.09	0.00	0.00	0.02	0.19	0.00	0.02	0.22	0.06	0.01	0.05	0.01	0.02	0.03	0.02	0.26	0.00	0.00	1.00
23	GAS_GDT	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.04	0.00	0.04	0.04	0.06	0.04	0.18	1.00
24	CMN_OFI_ISR_OBS_ROS	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.04	0.07	0.05	0.07	0.08	0.17	0.09	0.24	1.00
25	OSG_DWE	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.04	0.04	0.05	0.06	0.06	0.08	0.09	0.12	0.11	0.19	1.00
26	WOL_OMN_NMM	0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.03	0.04	0.05	0.05	0.07	0.07	0.06	0.10	0.09	0.11	0.11	0.12	1.00
27	TRD_CNS	0.01	0.01	0.02	0.01	0.02	0.02	0.02	0.02	0.03	0.04	0.04	0.05	0.06	0.05	0.08	0.09	0.09	0.11	0.24	1.00
28	ELY_WTR_WTP_ATP	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.06	0.09	0.09	0.09	0.16	0.16	1.00
29	OIL	0.01	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.06	0.07	0.07	1.00
30	FRS	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.05	0.05	0.06	0.06	0.06	0.06	0.07	0.08	0.08	0.07	0.08	1.00

Source: Author’s calculations from the Household Expenditure Survey conducted by Bangladesh Bureau of Statistics in 2004/2005

No:	GTAP Industry Classification	**Monthly Household Income Groups in Taka : Urban**																			Total
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	
		<750	**750-999**	**1000-1249**	**1250-1499**	**1500-1999**	**2000-2499**	**2500-2999**	**3000-3999**	**4000-4999**	**5000-5999**	**6000-6999**	**7000-7999**	**8000-8999**	**9000-9999**	**10000-12499**	**12500-14999**	**15000-174999**	**17500-19999**	**20000+**	
1	PDR_ PCR	0.04	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.06	0.06	0.05	0.06	0.06	0.07	0.07	0.07	0.07	1.00
2	WHT_GRO	0.02	0.03	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.07	0.07	0.06	0.08	0.08	0.08	0.11	0.14	1.00
3	V_F	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.06	0.06	0.06	0.08	0.09	0.10	0.12	1.00
4	OSD_VOL	0.04	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.08	0.10	1.00
5	PFB_OCR	0.04	0.02	0.04	0.03	0.02	0.03	0.03	0.04	0.05	0.05	0.05	0.06	0.06	0.06	0.07	0.08	0.09	0.09	0.10	1.00
6	C_B_SGR	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.06	0.06	0.07	0.08	0.09	0.08	0.10	1.00
7	RMK_MIL	0.01	0.03	0.01	0.02	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.05	0.05	0.07	0.08	0.09	0.10	0.12	0.17	1.00
8	FSH	0.03	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.06	0.06	0.07	0.07	0.08	0.08	0.10	0.13	1.00
9	CMT_OMT_CTL_OAP	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.03	0.04	0.04	0.04	0.05	0.06	0.06	0.08	0.09	0.11	0.11	0.16	1.00
10	OFD	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.06	0.06	0.07	0.08	0.09	0.08	0.10	1.00
11	B_T	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.05	0.06	0.06	0.04	0.06	0.07	0.08	0.08	0.09	0.11	1.00
12	TEX	0.01	0.01	0.02	0.03	0.01	0.03	0.01	0.02	0.03	0.02	0.04	0.05	0.04	0.05	0.06	0.08	0.14	0.16	0.15	1.00
13	WAP	0.01	0.01	0.02	0.03	0.01	0.03	0.01	0.02	0.03	0.02	0.04	0.05	0.04	0.05	0.06	0.08	0.14	0.16	0.15	1.00
14	LEA_LUM	0.04	0.01	0.00	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.05	0.08	0.04	0.05	0.07	0.12	0.11	0.11	0.13	1.00
15	PPP	0.04	0.01	0.00	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.05	0.08	0.04	0.05	0.07	0.12	0.11	0.11	0.13	1.00
16	CRP	0.04	0.01	0.00	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.05	0.08	0.04	0.05	0.07	0.12	0.11	0.11	0.13	1.00
17	I_S_NFM_FMP	0.00	0.00	0.01	0.02	0.00	0.01	0.02	0.02	0.05	0.06	0.03	0.05	0.05	0.10	0.07	0.08	0.18	0.09	0.15	1.00
18	ELE	0.01	0.01	0.00	0.01	0.02	0.04	0.01	0.02	0.05	0.04	0.04	0.08	0.02	0.07	0.07	0.07	0.10	0.16	0.19	1.00
19	OME	0.00	0.00	0.01	0.02	0.00	0.01	0.02	0.02	0.05	0.06	0.03	0.05	0.05	0.10	0.07	0.08	0.18	0.09	0.15	1.00
20	OMF	0.00	0.00	0.01	0.02	0.00	0.01	0.02	0.02	0.05	0.06	0.03	0.05	0.05	0.10	0.07	0.08	0.18	0.09	0.15	1.00
21	MVH_OTN_OPT	0.03	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.04	0.03	0.04	0.05	0.06	0.07	0.07	0.10	0.10	0.11	0.17	1.00
22	P_C_COA	0.00	0.00	0.05	0.00	0.00	0.15	0.00	0.00	0.02	0.39	0.00	0.04	0.06	0.00	0.00	0.01	0.02	0.16	0.11	1.00
23	GAS_GDT	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.02	0.03	0.02	0.04	0.05	0.05	0.06	0.09	0.13	0.15	0.13	0.17	1.00
24	CMN_OFI_ISR_OBS_ROS	0.02	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.04	0.04	0.06	0.12	0.12	0.16	0.27	1.00
25	OSG_DWE	0.02	0.01	0.01	0.01	0.05	0.02	0.02	0.02	0.02	0.03	0.04	0.05	0.05	0.05	0.06	0.11	0.12	0.15	0.18	1.00
26	WOL_OMN_NMM	0.04	0.01	0.00	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.05	0.08	0.04	0.05	0.07	0.12	0.11	0.11	0.13	1.00
27	TRD_CNS	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.05	0.08	0.10	0.11	0.14	0.20	1.00
28	ELY_WTR_WTP_ATP	0.03	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.04	0.03	0.04	0.05	0.06	0.07	0.07	0.10	0.10	0.11	0.17	1.00
29	OIL	0.04	0.06	0.06	0.05	0.05	0.06	0.06	0.06	0.06	0.05	0.06	0.07	0.04	0.05	0.04	0.05	0.05	0.04	0.04	1.00
30	FRS	0.04	0.04	0.03	0.04	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.05	0.04	0.06	0.05	0.05	0.04	0.07	0.12	1.00

Source: Author’s calculations from the Household Expenditure Survey conducted by Bangladesh Bureau of Statistics in 2004/2005

Table C 2 Shares Based on Sources of Income from Household Survey Data: Sri Lanka

GTAP Factors	Rural Sector Income Deciles									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Unskilled	0.6864	0.7557	0.7408	0.7739	0.7881	0.7579	0.7650	0.7703	0.7495	0.7983
Skilled	0.0065	0.0160	0.0335	0.0202	0.0118	0.0264	0.0244	0.0209	0.0381	0.0105
Capital	0.3071	0.2283	0.2257	0.2060	0.2001	0.2156	0.2105	0.2089	0.2124	0.1912
Total	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

GTAP Factors	Urban Sector Income Deciles									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Unskilled	0.3568	0.3759	0.4596	0.4260	0.4251	0.4153	0.2940	0.3131	0.2056	0.0692
Skilled	0.3464	0.3658	0.3403	0.3475	0.3838	0.3784	0.4594	0.4551	0.5167	0.6708
Capital	0.2969	0.2583	0.2002	0.2266	0.1911	0.2063	0.2465	0.2318	0.2777	0.2600
Total	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

GTAP Factors	Estate Sector Income Deciles									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Unskilled	0.850	0.870	0.817	0.827	0.790	0.532	0.497	0.446	0.240	0.379
Skilled	0.051	0.052	0.118	0.114	0.154	0.418	0.448	0.494	0.642	0.163
Capital	0.099	0.078	0.065	0.059	0.055	0.050	0.055	0.060	0.117	0.458
Total	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Source: Author’s calculations from Consumer Finances and Socio Economic Survey conducted by the Central Bank of Sri Lanka in 2003/2004

Shares based on Sources of Income from Household Survey Data: India

GTAP Factors	Rural											
	Monthly Per Capita Consumer Expenditure (MPCE) Class in Indian Rs.											
	0-225	225-255	255-300	300-340	340-380	380-420	420-470	470-525	525-615	615-775	775-950	950-above
	1	2	3	4	5	6	7	8	9	10	11	12
Unskilled	0.646	0.689	0.681	0.661	0.664	0.634	0.624	0.595	0.580	0.514	0.464	0.394
Skilled	0.236	0.213	0.222	0.232	0.212	0.230	0.210	0.206	0.191	0.161	0.143	0.122
Capital	0.118	0.098	0.097	0.106	0.124	0.136	0.166	0.198	0.230	0.324	0.393	0.484
Total	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

GTAP Factors	Urban											
	Monthly Per Capita Consumer Expenditure (MPCE) Class in Indian Rs.											
	0-225	225-255	255-300	300-340	340-380	380-420	420-470	470-525	525-615	615-775	775-950	950-above
	1	2	3	4	5	6	7	8	9	10	11	12
Unskilled	0.544	0.553	0.497	0.430	0.353	0.305	0.199	0.138	0.125	0.065	0.035	0.012
Skilled	0.255	0.321	0.394	0.449	0.491	0.514	0.561	0.592	0.614	0.593	0.558	0.438
Capital	0.201	0.126	0.109	0.122	0.156	0.181	0.239	0.270	0.262	0.342	0.407	0.549
Total	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Source: Author's calculations from the Household Expenditure Survey conducted by National Sample Survey Organisation (NSSO) of India in 2004

Shares based on Sources of Income from Household Survey Data: Pakistan

GTAP Factors	Rural Quintiles				
	1	**2**	**3**	**4**	**5**
Unskilled	0.4475	0.4485	0.4879	0.5322	0.5338
Skilled	0.3744	0.3436	0.2920	0.2295	0.1771
Capital	0.1781	0.2079	0.2201	0.2383	0.2891
Total	1.0000	1.0000	1.0000	1.0000	1.0000

GTAP Factors	Urban Quintiles				
	1	**2**	**3**	**4**	**5**
Unskilled	0.2835	0.3555	0.2900	0.2971	0.2738
Skilled	0.5377	0.4847	0.5120	0.4863	0.3982
Capital	0.1788	0.1598	0.1980	0.2166	0.3280
Total	1.0000	1.0000	1.0000	1.0000	1.0000

Source: Author's calculations from the Household Expenditure Survey conducted by Federal Bureau of Statistics of Pakistan in 2004

Shares based on Sources of Income from Household Survey Data: Bangladesh

GTAP Factors	Monthly Household Income Groups (in Taka) Rural Sector																		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
	<750	**750-999**	**1000-1249**	**1250-1499**	**1500-1999**	**2000-2499**	**2500-2999**	**3000-3999**	**4000-4999**	**5000-5999**	**6000-6999**	**7000-7999**	**8000-8999**	**9000-9999**	**10000-12499**	**12500-14999**	**15000-17499**	**17500-19999**	**20000+**
Unskilled	0.606	0.571	0.561	0.553	0.528	0.515	0.494	0.471	0.435	0.411	0.395	0.361	0.334	0.331	0.280	0.269	0.251	0.236	0.155
Skilled	0.092	0.136	0.154	0.175	0.195	0.221	0.248	0.274	0.305	0.329	0.348	0.378	0.390	0.414	0.438	0.468	0.487	0.519	0.617
Capital	0.302	0.292	0.285	0.272	0.277	0.264	0.258	0.255	0.260	0.260	0.257	0.261	0.276	0.255	0.282	0.263	0.262	0.245	0.228
Total	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

GTAP Factors	Monthly Household Income Groups (in Taka) Urban Sector																		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
	<750	**750-999**	**1000-1249**	**1250-1499**	**1500-1999**	**2000-2499**	**2500-2999**	**3000-3999**	**4000-4999**	**5000-5999**	**6000-6999**	**7000-7999**	**8000-8999**	**9000-9999**	**10000-12499**	**12500-14999**	**15000-17499**	**17500-19999**	**20000+**
Unskilled	0.372	0.444	0.264	0.225	0.316	0.257	0.239	0.234	0.226	0.228	0.221	0.197	0.187	0.194	0.216	0.210	0.154	0.228	0.161
Skilled	0.364	0.333	0.576	0.654	0.544	0.617	0.639	0.588	0.558	0.529	0.488	0.535	0.529	0.542	0.471	0.463	0.489	0.381	0.383
Capital	0.264	0.223	0.160	0.122	0.141	0.126	0.122	0.177	0.216	0.244	0.291	0.268	0.284	0.264	0.313	0.328	0.357	0.391	0.456
Total	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Source: Author’s calculations from the Household Expenditure Survey conducted by Bangladesh Bureau of Statistics in 2004/2005

Table C 3 Expenditure Elasticities for Selected Commodity Groups in Sri Lanka

Commodity	Sector of Residence		
	Urban	**Rural**	**Estate**
Food and Drink	0.8022	0.8137	0.8083
Liquor and Tobacco	1.1866	1.1702	1.1630
Housing	1.5676	1.6330	1.5643
Fuel and Electricity	0.6228	0.6235	0.6119
Clothing	1.3541	1.3678	1.2648
Nondurables	0.7364	0.7494	0.7345
Personal care and Health	1.3559	1.6122	1.4152
Transport and Communication	2.1522	2.3738	2.9189
Miscellaneous	1.0153	2.7291	1.5897

Source: Rajapakse, S. (2011), Estimation of a complete system of nonlinear Engel curves: further evidence from Box–Cox Engel curves for Sri Lanka, Applied Economics

43, 371–385.

Expenditure Elasticities for commodities across Household Groups in Bangladesh

Commodity	Household Groups					
	RLY	RMY	RHY	ULY	UMY	UHY
Rice	0.9396	1.1331	0.5541	0.8296	0.8589	0.3206
Cereals and root crops	1.1406	1.2727	0.6199	0.9017	0.8519	0.3181
Sweets	1.2699	1.3036	0.6521	0.9464	0.8546	0.3237
Dry Beans	1.1153	1.2497	0.6098	0.8671	0.8605	0.3198
Nuts and Vegetables	1.4367	1.3864	0.6263	0.9362	0.8479	0.3182
Fruits	1.4953	1.2548	0.7321	0.9123	0.8512	0.3118
Animal Products	1.1403	1.2986	0.8074	0.9562	0.8435	0.3205
Fats and Oil	1.2921	1.1769	0.6675	0.9383	0.8469	0.3072
Misc. Food	1.3986	1.5160	0.6861	0.9114	0.8439	0.2970
Beverages and Tobacco	1.6499	1.3002	0.6568	0.8979	0.8549	0.3162
Housing	0.6586	0.6318	0.8551	1.0427	1.2788	0.2618
Clothing & other non food	0.0060	0.0057	1.5259	1.3685	1.0739	2.2066

Source: Yen,T. and Roe, T.L. (1986), Determinants of Rural and Urban Household Demand: An Analysis of Dominican Household Consumption, Economic Development Centre, Department of Economics, Minneapolis, Bulletin Number 86-3.

Labels in the columns can be defined as:

RLY - Rural low income household group
RMY - Rural medium income household group
RHY - Rural high income household group
ULY - Urban low income household group
UMY - Urban medium income household group
UHY - Urban high income household group

Expenditure Elasticities for commodities across Household Groups in India

Commodity	Rural Household Groups			Urban Household Groups		
	Poorest 30%	**Middle 40%**	**Richest 30%**	**Poorest 30%**	**Middle 40%**	**Richest 30%**
Cereals and cereal substitutes	0.457	0.569	0.729	0.214	0.315	0.487
Milk and milk products	4.618	1.995	1.326	2.520	1.557	1.210
Edible oils	0.860	0.906	0.951	0.693	0.792	0.887
Meat, fish, egg	1.066	1.041	1.020	1.205	1.112	1.051
Sugar	2.077	1.493	1.194	0.947	0.968	0.984
Other food	0.927	0.952	0.976	1.142	1.079	1.037
Clothing	4.650	1.999	1.326	3.849	1.782	1.270
Fuel and light	0.531	0.640	0.783	0.592	0.710	0.834
Other non food	3.628	1.856	1.294	2.702	1.596	1.221

Source: Majumder, A.(1986), Consumer Expenditure Pattern in India: A Comparison of the almost Ideal Demand System and the Linear Expenditure System, The Indian Journal of Statistics,Vol.48(1), pp. 115-143.

Expenditure Elasticities for commodities across Household Groups in Pakistan

Commodity	Rural: Household Groups (Rupees per month)						Urban: Household Groups (Rupees per month)					
	I ≤1000	II 1001-1500	III 1501-2000	IV 2001-3000	V 3001-5000	VI 5001-15000	I ≤1000	II 1001-1500	III 1501-2000	IV 2001-3000	V 3001-5000	VI 5001-15000
Food and Drinks	0.848	0.756	0.700	0.735	0.585	0.461	0.809	0.781	0.635	0.666	0.619	0.573
Clothing and Footwear	0.753	0.696	0.618	0.700	0.681	0.497	0.764	0.660	0.708	0.568	0.537	0.743
Fuel and Lighting	0.572	0.600	0.610	0.433	0.471	0.305	0.616	0.570	0.565	0.361	0.406	0.610
Housing	0.879	0.823	0.883	0.801	0.812	0.802	0.997	0.954	1.215	1.060	1.309	1.124
Transport and Communication	0.795	0.888	0.917	0.863	1.047	1.190	1.008	1.184	1.191	1.291	1.362	1.683
Household Effects	0.799	0.867	0.832	0.896	0.641	0.628	0.733	0.749	0.631	0.570	0.638	0.793
Personal Effects	0.908	0.847	0.901	0.918	0.636	0.581	1.051	0.977	0.766	1.016	0.880	0.834
Health Care	0.978	1.129	0.762	0.916	0.853	0.739	0.825	0.892	0.910	0.830	0.930	0.882
Education	0.469	0.772	0.851	0.689	0.776	0.569	1.127	1.315	1.377	1.203	1.365	1.105
Entertainment	1.064	1.023	1.844	0.836	0.728	1.069	1.349	1.187	1.245	1.059	1.044	1.273
Durables	0.905	0.178	-0.024	0.750	0.656	1.180	0.028	-0.500	1.440	0.790	1.006	1.627
Miscellaneous	1.727	1.808	1.935	1.815	1.674	1.643	1.660	1.988	1.595	1.754	1.500	1.486

Source: Burney, N.A. and Khan, A.H. (1991), Household Consumption Pattern in Pakistan: An Urban Rural Comparison using Micro Data, The Pakistan Development Review, Vol.30 (2), pp.145-171

Table C 4 Marginal Budget Shares in Regions Other than South Asia in Good *i* for Region *r*

$MBS\_RW_{ir}^{w}$	5 XSA	6 USA	7 CAN	8 EU	9 ASE	10 HIA	11 JPN	12 CHN	13 XME	14 AUS_NZL	15 RUS_XSU	16 ROW
1 pdr_pcr	0.094	0.000	0.000	0.000	0.018	0.001	0.000	0.021	0.003	0.000	0.000	0.003
2 wht_gro	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.006	0.000	0.002	0.006
3 v_f	0.027	0.000	0.000	0.001	0.014	0.002	0.000	0.052	0.013	0.000	0.013	0.013
4 osd_vol	0.012	0.000	0.001	0.004	0.010	0.002	0.001	0.002	0.009	0.003	0.004	0.006
5 pfb_ocr	0.013	0.001	0.002	0.001	0.003	0.001	0.001	0.000	0.003	0.001	0.003	0.006
6 c_b_sgr	0.015	0.001	0.001	0.002	0.005	0.000	0.001	0.000	0.003	0.002	0.006	0.005
7 rmk_mil	0.017	0.005	0.011	0.017	0.008	0.006	0.005	0.001	0.023	0.012	0.039	0.019
8 fsh	0.051	0.000	0.001	0.002	0.017	0.005	0.001	0.023	0.004	0.003	0.000	0.004
9 cmt_oap	0.045	0.011	0.012	0.014	0.036	0.015	0.008	0.079	0.035	0.013	0.046	0.028
10 ofd	0.027	0.021	0.029	0.068	0.034	0.028	0.046	0.036	0.028	0.037	0.030	0.035
11 b_t	0.014	0.009	0.015	0.018	0.026	0.021	0.030	0.029	0.022	0.018	0.014	0.018
12 tex	0.068	0.005	0.006	0.015	0.017	0.012	0.001	0.015	0.018	0.007	0.008	0.012
13 wap	0.021	0.014	0.012	0.036	0.023	0.025	0.015	0.030	0.014	0.015	0.019	0.020
14 lea_lum	0.008	0.009	0.006	0.017	0.012	0.008	0.004	0.015	0.020	0.004	0.017	0.014
15 ppp	0.003	0.009	0.010	0.021	0.010	0.009	0.007	0.003	0.007	0.013	0.006	0.011
16 crp	0.021	0.022	0.020	0.039	0.040	0.022	0.015	0.030	0.035	0.016	0.026	0.043
17 i_s_nfm_fmp	0.000	0.002	0.002	0.005	0.003	0.004	0.002	0.008	0.006	0.005	0.005	0.012
18 ele	0.004	0.008	0.006	0.017	0.031	0.043	0.027	0.024	0.012	0.006	0.002	0.017
19 ome	0.002	0.014	0.015	0.019	0.017	0.021	0.006	0.021	0.018	0.011	0.023	0.021
20 omf	0.006	0.010	0.013	0.031	0.022	0.018	0.008	0.021	0.037	0.009	0.007	0.016
21 mvh_otn_otp	0.112	0.045	0.077	0.087	0.080	0.062	0.065	0.044	0.081	0.056	0.089	0.073
22 p_c_coa	0.020	0.011	0.013	0.009	0.040	0.015	0.006	0.026	0.039	0.010	0.028	0.019
23 gas_gdt	0.000	0.003	0.004	0.003	0.000	0.002	0.000	0.001	0.005	0.001	0.022	0.002
24 cmn_ros	0.146	0.237	0.224	0.312	0.136	0.180	0.172	0.125	0.174	0.155	0.134	0.174
25 osg_dwe	0.117	0.372	0.253	0.087	0.182	0.259	0.304	0.205	0.098	0.280	0.055	0.223
26 wol_omn_nmm	0.011	0.001	0.002	0.005	0.003	0.002	0.001	0.012	0.008	0.001	0.004	0.008
27 trd_cns	0.030	0.169	0.238	0.142	0.162	0.207	0.245	0.145	0.228	0.282	0.305	0.155
28 ely_wtr	0.087	0.019	0.027	0.030	0.047	0.027	0.027	0.032	0.050	0.040	0.094	0.035
29 oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30 frs	0.029	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.000	0.004
Total	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**

Source: Author's calculations from GTAP data

Sri Lanka

Table C 5 Marginal Budget Shares for South Asia in Good *i* for Region r

	MBS_SR$_{i,h,r}$	**Rural Sector**				**Income Deciles**					
No:	**GTAP Industry Classification**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	PDR_ PCR	0.057	0.053	0.065	0.060	0.054	0.039	0.037	0.028	0.022	0.011
2	WHT_GRO	0.001	0.001	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.000
3	V_F	0.074	0.068	0.075	0.086	0.082	0.064	0.066	0.058	0.048	0.030
4	OSD_VOL	0.015	0.013	0.016	0.015	0.014	0.010	0.010	0.009	0.007	0.005
5	PFB_OCR	0.028	0.026	0.027	0.031	0.028	0.021	0.021	0.017	0.014	0.008
6	C_B_SGR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	RMK_MIL	0.016	0.014	0.024	0.025	0.027	0.024	0.024	0.025	0.019	0.013
8	FSH	0.037	0.035	0.049	0.049	0.048	0.041	0.042	0.036	0.030	0.020
9	CMT_OAP	0.014	0.010	0.015	0.015	0.017	0.015	0.018	0.015	0.014	0.013
10	OFD	0.110	0.094	0.131	0.098	0.104	0.076	0.076	0.062	0.052	0.032
11	B_T	0.059	0.053	0.064	0.061	0.061	0.043	0.042	0.036	0.027	0.018
12	TEX	0.010	0.009	0.015	0.013	0.016	0.012	0.014	0.011	0.014	0.009
13	WAP	0.024	0.021	0.028	0.032	0.036	0.033	0.036	0.037	0.038	0.028
14	LEA_LUM	0.005	0.003	0.005	0.006	0.007	0.008	0.005	0.007	0.006	0.005
15	PPP	0.004	0.005	0.006	0.007	0.014	0.010	0.012	0.014	0.016	0.013
16	CRP	0.027	0.027	0.032	0.033	0.038	0.029	0.031	0.031	0.029	0.022
17	I_S_NFM_FMP	0.000	0.000	0.002	0.002	0.003	0.002	0.003	0.006	0.004	0.003
18	ELE	0.002	0.001	0.005	0.003	0.001	0.003	0.005	0.004	0.004	0.004
19	OME	0.002	0.003	0.015	0.017	0.007	0.006	0.006	0.005	0.006	0.007
20	OMF	0.013	0.010	0.014	0.014	0.013	0.011	0.011	0.010	0.010	0.009
21	MVH_OTP	0.058	0.050	0.060	0.087	0.065	0.101	0.093	0.088	0.087	0.119
22	P_C_COA	0.011	0.005	0.010	0.014	0.017	0.019	0.031	0.032	0.035	0.058
23	GAS_GDT	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24	CMN_ROS	0.154	0.048	0.074	0.075	0.090	0.121	0.116	0.142	0.161	0.228
25	OSG_DWE	0.050	0.037	0.055	0.056	0.065	0.062	0.056	0.062	0.063	0.053
26	WOL_NMM	0.006	0.005	0.008	0.007	0.010	0.007	0.007	0.007	0.006	0.005
27	TRD_CNS	0.160	0.351	0.126	0.115	0.104	0.170	0.161	0.182	0.224	0.234
28	ELY_WTR	0.048	0.042	0.061	0.061	0.065	0.063	0.068	0.065	0.059	0.051
29	OIL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	FRS	0.016	0.013	0.017	0.015	0.013	0.010	0.009	0.007	0.005	0.002
	Total	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**

Source: Author's calculations based on elasticity values from existing literature and household survey data from Consumer Finances and Socio Economic Survey conducted by the Central Bank of Sri Lanka in 2003/2004.

No:	MBS_SU$_{i,h,r}$ GTAP Industry Classification	Urban Sector 1	2	3	4	Income Deciles 5	6	7	8	9	10
1	PDR_ PCR	0.031	0.042	0.049	0.046	0.037	0.022	0.029	0.016	0.015	0.005
2	WHT_GRO	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.000
3	V_F	0.053	0.072	0.069	0.071	0.061	0.047	0.065	0.045	0.042	0.022
4	OSD_VOL	0.013	0.013	0.014	0.022	0.013	0.009	0.012	0.008	0.008	0.005
5	PFB_OCR	0.017	0.024	0.023	0.025	0.019	0.015	0.019	0.011	0.012	0.005
6	C_B_SGR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	RMK_MIL	0.021	0.026	0.023	0.033	0.029	0.020	0.029	0.021	0.020	0.010
8	FSH	0.049	0.053	0.067	0.059	0.058	0.032	0.046	0.032	0.028	0.014
9	CMT_OAP	0.015	0.024	0.024	0.017	0.025	0.016	0.055	0.019	0.020	0.012
10	OFD	0.105	0.126	0.118	0.114	0.110	0.067	0.064	0.058	0.053	0.027
11	B_T	0.036	0.059	0.055	0.057	0.065	0.033	0.051	0.026	0.022	0.015
12	TEX	0.005	0.003	0.012	0.004	0.006	0.006	0.010	0.008	0.009	0.006
13	WAP	0.021	0.026	0.037	0.038	0.032	0.032	0.058	0.035	0.033	0.029
14	LEA_LUM	0.004	0.002	0.002	0.004	0.002	0.002	0.006	0.002	0.004	0.003
15	PPP	0.006	0.010	0.013	0.006	0.006	0.008	0.010	0.014	0.018	0.017
16	CRP	0.039	0.038	0.046	0.045	0.043	0.026	0.035	0.025	0.027	0.027
17	I_S_NFM_FMP	0.000	0.001	0.000	0.000	0.000	0.002	0.002	0.000	0.003	0.003
18	ELE	0.003	0.007	0.001	0.001	0.003	0.004	0.002	0.000	0.001	0.004
19	OME	0.003	0.009	0.002	0.001	0.001	0.005	0.002	0.001	0.001	0.005
20	OMF	0.007	0.013	0.005	0.012	0.009	0.006	0.009	0.005	0.005	0.004
21	MVH_OTP	0.175	0.156	0.121	0.046	0.037	0.138	0.054	0.060	0.099	0.085
22	P_C_COA	0.014	0.002	0.005	0.011	0.026	0.010	0.013	0.012	0.028	0.047
23	GAS_GDT	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24	CMN_ROS	0.125	0.076	0.055	0.155	0.075	0.092	0.156	0.135	0.191	0.209
25	OSG_DWE	0.043	0.046	0.057	0.092	0.066	0.050	0.078	0.065	0.068	0.070
26	WOL_NMM	0.007	0.005	0.005	0.003	0.007	0.003	0.002	0.002	0.005	0.004
27	TRD_CNS	0.141	0.074	0.041	0.035	0.157	0.282	0.135	0.324	0.194	0.296
28	ELY_WTR	0.052	0.074	0.139	0.087	0.101	0.067	0.050	0.070	0.090	0.074
29	OIL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	FRS	0.014	0.019	0.014	0.012	0.009	0.005	0.007	0.005	0.002	0.001
	Total	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**

Source: Author's calculations based on elasticity values from existing literature and household survey data from Consumer Finances and Socio Economic Survey conducted by the Central Bank of Sri Lanka in 2003/2004

	MBS_SE$_{ihr}$	**Estate Sector**					**Income Deciles**				
	GTAP Industry Classification	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	PDR_ PCR	0.057	0.079	0.057	0.067	0.068	0.036	0.040	0.029	0.019	0.036
2	WHT_GRO	0.002	0.003	0.003	0.003	0.003	0.001	0.002	0.002	0.001	0.001
3	V_F	0.073	0.095	0.076	0.090	0.096	0.056	0.061	0.049	0.035	0.062
4	OSD_VOL	0.018	0.023	0.018	0.020	0.019	0.010	0.011	0.011	0.006	0.010
5	PFB_OCR	0.012	0.043	0.029	0.035	0.033	0.019	0.023	0.016	0.007	0.018
6	C_B_SGR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	RMK_MIL	0.016	0.025	0.028	0.028	0.040	0.020	0.024	0.014	0.019	0.018
8	FSH	0.016	0.030	0.022	0.031	0.032	0.017	0.025	0.020	0.010	0.031
9	CMT_OAP	0.012	0.019	0.019	0.024	0.023	0.017	0.019	0.032	0.012	0.009
10	OFD	0.091	0.125	0.096	0.107	0.104	0.062	0.071	0.057	0.033	0.058
11	B_T	0.073	0.129	0.075	0.097	0.095	0.070	0.059	0.047	0.031	0.048
12	TEX	0.019	0.025	0.023	0.027	0.032	0.015	0.017	0.018	0.004	0.018
13	WAP	0.033	0.037	0.046	0.058	0.078	0.042	0.063	0.061	0.015	0.124
14	LEA_LUM	0.002	0.006	0.004	0.007	0.006	0.004	0.007	0.009	0.010	0.007
15	PPP	0.004	0.007	0.007	0.012	0.009	0.006	0.010	0.007	0.006	0.017
16	CRP	0.054	0.103	0.061	0.075	0.091	0.050	0.066	0.057	0.032	0.072
17	I_S_NFM_FMP	0.000	0.003	0.002	0.007	0.006	0.006	0.001	0.001	0.000	0.009
18	ELE	0.000	0.001	0.000	0.000	0.001	0.000	0.001	0.010	0.006	0.052
19	OME	0.003	0.002	0.003	0.000	0.003	0.000	0.078	0.011	0.000	0.009
20	OMF	0.006	0.010	0.008	0.009	0.011	0.006	0.007	0.005	0.005	0.007
21	MVH_OTP	0.038	0.054	0.045	0.059	0.061	0.040	0.074	0.041	0.027	0.088
22	P_C_COA	0.001	0.001	0.004	0.004	0.001	0.001	0.005	0.009	0.005	0.032
23	GAS_GDT	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24	CMN_ROS	0.031	0.065	0.049	0.122	0.076	0.080	0.099	0.046	0.068	0.112
25	OSG_DWE	0.026	0.037	0.034	0.040	0.043	0.032	0.045	0.031	0.020	0.073
26	WOL_NMM	0.007	0.008	0.004	0.011	0.005	0.002	0.005	0.008	0.005	0.022
27	TRD_CNS	0.352	0.000	0.237	0.000	0.000	0.371	0.150	0.381	0.599	0.000
28	ELY_WTR	0.042	0.056	0.038	0.056	0.052	0.030	0.031	0.023	0.024	0.063
29	OIL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	FRS	0.012	0.015	0.012	0.012	0.011	0.006	0.007	0.005	0.002	0.004
	Total	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**

Source: Author’s calculations based on elasticity values from existing literature and household survey data from Consumer Finances and Socio Economic Survey conducted by the Central Bank of Sri Lanka in 2003/2004

India

No:	MBS_IR$_{ihr}$ GTAP Industry Classification	Rural					Monthly Per Capita Consumer Expenditure (MPCE) Class in Indian Rs.						
		0-225	**225-255**	**255-300**	**300-340**	**340-380**	**380-420**	**420-470**	**470-525**	**525-615**	**615-775**	**775-950**	**950-above**
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	PDR_ PCR	0.139	0.123	0.125	0.111	0.100	0.091	0.084	0.079	0.067	0.055	0.046	0.025
2	WHT_GRO	0.038	0.016	0.028	0.026	0.039	0.034	0.029	0.037	0.040	0.045	0.042	0.038
3	V_F	0.056	0.050	0.055	0.053	0.050	0.051	0.048	0.045	0.044	0.041	0.038	0.026
4	OSD_VOL	0.056	0.062	0.067	0.065	0.063	0.060	0.055	0.056	0.052	0.046	0.041	0.026
5	PFB_OCR	0.037	0.044	0.041	0.042	0.040	0.038	0.035	0.036	0.033	0.029	0.025	0.015
6	C_B_SGR	0.032	0.033	0.034	0.034	0.033	0.037	0.034	0.035	0.032	0.030	0.029	0.019
7	RMK_MIL	0.017	0.017	0.026	0.032	0.038	0.045	0.045	0.054	0.058	0.059	0.060	0.047
8	FSH	0.010	0.019	0.016	0.016	0.017	0.018	0.020	0.019	0.019	0.019	0.018	0.015
9	CMT_OAP	0.018	0.035	0.029	0.029	0.031	0.033	0.036	0.035	0.035	0.035	0.034	0.028
10	OFD	0.089	0.084	0.088	0.085	0.079	0.074	0.072	0.068	0.065	0.057	0.052	0.031
11	B_T	0.013	0.016	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.014	0.013	0.010
12	TEX	0.106	0.101	0.100	0.099	0.094	0.096	0.088	0.086	0.081	0.076	0.068	0.047
13	WAP	0.007	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.005	0.005	0.004	0.003
14	LEA_LUM	0.007	0.005	0.005	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.004
15	PPP	0.021	0.017	0.019	0.016	0.018	0.016	0.018	0.010	0.015	0.012	0.013	0.011
16	CRP	0.045	0.035	0.041	0.034	0.038	0.035	0.039	0.021	0.033	0.027	0.027	0.024
17	I_S_NFM_FMP	0.012	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.009	0.007
18	ELE	0.003	0.003	0.003	0.004	0.004	0.003	0.004	0.004	0.004	0.005	0.005	0.011
19	OME	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.003	0.003
20	OMF	0.006	0.005	0.006	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.004
21	MVH_OTP	0.042	0.045	0.044	0.047	0.048	0.042	0.052	0.054	0.057	0.067	0.069	0.147
22	P_C_COA	0.022	0.024	0.023	0.025	0.026	0.022	0.027	0.029	0.030	0.035	0.036	0.077
23	GAS_GDT	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
24	CMN_ROS	0.042	0.040	0.039	0.049	0.051	0.050	0.049	0.055	0.060	0.069	0.074	0.087
25	OSG_DWE	0.056	0.046	0.053	0.059	0.064	0.072	0.090	0.100	0.101	0.120	0.159	0.159
26	WOL_NMM	0.019	0.015	0.018	0.015	0.017	0.015	0.016	0.009	0.014	0.012	0.012	0.010
27	TRD_CNS	0.016	0.056	0.028	0.035	0.037	0.048	0.037	0.049	0.048	0.051	0.055	0.062
28	ELY_WTR	0.081	0.077	0.068	0.070	0.060	0.063	0.063	0.063	0.053	0.052	0.044	0.032
29	OIL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	FRS	0.007	0.010	0.009	0.008	0.010	0.009	0.010	0.011	0.012	0.014	0.014	0.030
	Total	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**

Source: Author's calculations based on elasticity values from existing literature and Household Expenditure Survey data conducted by National Sample Survey Organisation (NSSO) of India in 2004

No:	MBS_IU$_{ihr}$ GTAP Industry Classification	Urban					Monthly Per Capita Consumer Expenditure (MPCE) Class in Indian Rs.						
		0-225	225-255	255-300	300-340	340-380	380-420	420-470	470-525	525-615	615-775	775-950	950-above
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	PDR_ PCR	0.095	0.083	0.075	0.066	0.056	0.054	0.047	0.037	0.031	0.025	0.019	0.012
2	WHT_GRO	0.039	0.025	0.026	0.026	0.031	0.037	0.035	0.029	0.034	0.029	0.024	0.017
3	V_F	0.049	0.045	0.040	0.041	0.037	0.039	0.039	0.034	0.030	0.029	0.026	0.019
4	OSD_VOL	0.064	0.056	0.052	0.056	0.047	0.047	0.044	0.038	0.034	0.029	0.023	0.015
5	PFB_OCR	0.045	0.035	0.032	0.032	0.028	0.027	0.026	0.021	0.019	0.017	0.013	0.008
6	C_B_SGR	0.041	0.033	0.028	0.031	0.028	0.026	0.025	0.020	0.017	0.015	0.011	0.007
7	RMK_MIL	0.030	0.040	0.029	0.045	0.042	0.048	0.054	0.046	0.046	0.044	0.037	0.026
8	FSH	0.014	0.017	0.017	0.016	0.016	0.018	0.018	0.016	0.012	0.011	0.011	0.008
9	CMT_OAP	0.026	0.031	0.031	0.030	0.030	0.033	0.033	0.030	0.022	0.020	0.019	0.014
10	OFD	0.094	0.072	0.065	0.063	0.054	0.057	0.053	0.042	0.037	0.032	0.024	0.016
11	B_T	0.011	0.016	0.013	0.017	0.014	0.015	0.015	0.014	0.012	0.014	0.014	0.013
12	TEX	0.044	0.064	0.053	0.067	0.054	0.058	0.059	0.055	0.047	0.054	0.055	0.049
13	WAP	0.006	0.005	0.005	0.005	0.004	0.005	0.004	0.004	0.003	0.003	0.003	0.002
14	LEA_LUM	0.006	0.006	0.005	0.007	0.006	0.006	0.006	0.006	0.005	0.005	0.005	0.004
15	PPP	0.009	0.008	0.008	0.009	0.008	0.009	0.009	0.008	0.007	0.008	0.007	0.006
16	CRP	0.009	0.073	0.029	0.038	0.033	0.020	0.010	0.024	0.014	0.015	0.007	0.008
17	I_S_NFM_FMP	0.015	0.013	0.012	0.013	0.011	0.012	0.011	0.010	0.008	0.009	0.008	0.006
18	ELE	0.003	0.002	0.002	0.002	0.003	0.003	0.003	0.004	0.003	0.004	0.006	0.008
19	OME	0.002	0.015	0.006	0.008	0.007	0.004	0.002	0.005	0.003	0.003	0.001	0.002
20	OMF	0.006	0.006	0.005	0.006	0.005	0.005	0.006	0.005	0.005	0.005	0.005	0.004
21	MVH_OTP	0.038	0.026	0.028	0.028	0.037	0.044	0.047	0.048	0.045	0.060	0.084	0.105
22	P_C_COA	0.020	0.014	0.015	0.015	0.019	0.023	0.025	0.025	0.024	0.031	0.044	0.055
23	GAS_GDT	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24	CMN_ROS	0.042	0.038	0.042	0.044	0.047	0.056	0.067	0.067	0.076	0.098	0.108	0.130
25	OSG_DWE	0.114	0.080	0.087	0.124	0.120	0.128	0.147	0.142	0.159	0.184	0.180	0.214
26	WOL_NMM	0.008	0.008	0.007	0.009	0.008	0.008	0.008	0.008	0.007	0.007	0.006	0.005
27	TRD_CNS	0.090	0.111	0.222	0.137	0.187	0.154	0.142	0.205	0.247	0.196	0.212	0.202
28	ELY_WTR	0.072	0.073	0.062	0.063	0.060	0.057	0.054	0.049	0.043	0.040	0.033	0.025
29	OIL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	FRS	0.008	0.005	0.006	0.006	0.007	0.009	0.009	0.010	0.009	0.012	0.017	0.021
	Total	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**

Source: Author’s calculations based on elasticity values from existing literature and Household Expenditure Survey data conducted by National Sample Survey Organisation (NSSO) of India in 2004

Pakistan

No:	$MBS\_PR_{i,h,r}$ GTAP Industry Classification	**Rural** 1	2	**Quintiles** 3	4	5
1	PDR_ PCR	0.013	0.011	0.011	0.009	0.006
2	WHT_GRO	0.000	0.000	0.000	0.000	0.000
3	V_F	0.049	0.046	0.045	0.042	0.034
4	OSD_VOL	0.044	0.038	0.034	0.031	0.025
5	PFB_OCR	0.001	0.001	0.001	0.001	0.001
6	C_B_SGR	0.055	0.050	0.047	0.039	0.032
7	RMK_MIL	0.184	0.198	0.201	0.206	0.183
8	FSH	0.008	0.008	0.009	0.007	0.005
9	CMT_OAP	0.050	0.059	0.066	0.068	0.061
10	OFD	0.003	0.003	0.003	0.002	0.002
11	B_T	0.031	0.030	0.029	0.027	0.022
12	TEX	0.074	0.065	0.059	0.055	0.044
13	WAP	0.008	0.009	0.008	0.008	0.007
14	LEA_LUM	0.005	0.005	0.005	0.004	0.004
15	PPP	0.000	0.000	0.000	0.000	0.000
16	CRP	0.062	0.054	0.052	0.047	0.034
17	I_S_NFM_FMP	0.001	0.001	0.001	0.001	0.001
18	ELE	0.009	0.010	0.010	0.011	0.014
19	OME	0.001	0.001	0.001	0.001	0.001
20	OMF	0.004	0.005	0.005	0.006	0.006
21	MVH_OTP	0.069	0.074	0.079	0.087	0.120
22	P_C_COA	0.014	0.013	0.012	0.012	0.011
23	GAS_GDT	0.008	0.008	0.008	0.007	0.007
24	CMN_ROS	0.099	0.099	0.098	0.102	0.114
25	OSG_DWE	0.081	0.081	0.080	0.084	0.093
26	WOL_NMM	0.018	0.017	0.015	0.014	0.012
27	TRD_CNS	0.028	0.028	0.028	0.029	0.032
28	ELY_WTR	0.078	0.087	0.090	0.100	0.128
29	OIL	0.000	0.000	0.000	0.000	0.000
30	FRS	0.001	0.001	0.001	0.001	0.001
	Total	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**

No:	$MBS\_PU_{i,h,r}$ GTAP Industry Classification	**Urban** 1	2	3	**Quintiles** 4	5
1	PDR_ PCR	0.010	0.009	0.008	0.007	0.004
2	WHT_GRO	0.000	0.000	0.000	0.000	0.000
3	V_F	0.047	0.042	0.039	0.036	0.025
4	OSD_VOL	0.037	0.033	0.029	0.025	0.014
5	PFB_OCR	0.001	0.001	0.001	0.001	0.000
6	C_B_SGR	0.043	0.039	0.031	0.028	0.016
7	RMK_MIL	0.158	0.156	0.147	0.145	0.103
8	FSH	0.003	0.006	0.005	0.005	0.006
9	CMT_OAP	0.051	0.058	0.060	0.067	0.062
10	OFD	0.003	0.002	0.002	0.002	0.003
11	B_T	0.025	0.026	0.024	0.023	0.017
12	TEX	0.062	0.057	0.052	0.044	0.031
13	WAP	0.008	0.008	0.008	0.008	0.009
14	LEA_LUM	0.004	0.004	0.004	0.004	0.003
15	PPP	0.000	0.000	0.000	0.000	0.000
16	CRP	0.058	0.052	0.045	0.041	0.026
17	I_S_NFM_FMP	0.001	0.001	0.001	0.001	0.001
18	ELE	0.006	0.006	0.007	0.008	0.008
19	OME	0.001	0.001	0.001	0.001	0.001
20	OMF	0.005	0.005	0.005	0.005	0.007
21	MVH_OTP	0.061	0.068	0.069	0.089	0.137
22	P_C_COA	0.018	0.016	0.016	0.015	0.013
23	GAS_GDT	0.011	0.010	0.010	0.009	0.008
24	CMN_ROS	0.151	0.157	0.168	0.169	0.200
25	OSG_DWE	0.123	0.128	0.138	0.138	0.164
26	WOL_NMM	0.015	0.014	0.014	0.012	0.009
27	TRD_CNS	0.043	0.044	0.048	0.048	0.056
28	ELY_WTR	0.054	0.055	0.066	0.068	0.075
29	OIL	0.000	0.000	0.000	0.000	0.000
30	FRS	0.001	0.001	0.000	0.000	0.000
	Total	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**

Source: Author's calculations from the Household Expenditure Survey conducted by Federal Bureau of Statistics of Pakistan in 2004

Bangladesh

	MBS_BR$_{i,h,r}$	Monthly Household Income Groups in Taka- Rural																		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
No:	**GTAP Industry Classification**	**<750**	**750-999**	**1000-1249**	**1250-1499**	**1500-1999**	**2000-2499**	**2500-2999**	**3000-3999**	**4000-4999**	**5000-5999**	**6000-6999**	**7000-7999**	**8000-8999**	**9000-9999**	**10000-12499**	**12500-14999**	**15000-17499**	**17500-19999**	**20000+**
1	PDR_ PCR	0.273	0.231	0.324	0.305	0.303	0.266	0.284	0.267	0.224	0.209	0.185	0.176	0.144	0.160	0.130	0.132	0.113	0.127	0.092
2	WHT_GRO	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000
3	V_F	0.048	0.050	0.052	0.053	0.051	0.045	0.048	0.047	0.040	0.040	0.036	0.035	0.032	0.033	0.027	0.030	0.027	0.028	0.023
4	OSD_VOL	0.031	0.030	0.033	0.030	0.028	0.024	0.026	0.025	0.022	0.021	0.019	0.019	0.017	0.019	0.015	0.016	0.013	0.014	0.012
5	PFB_OCR	0.019	0.021	0.019	0.017	0.016	0.016	0.018	0.019	0.017	0.018	0.015	0.016	0.014	0.015	0.012	0.014	0.011	0.012	0.010
6	C_B_SGR	0.029	0.030	0.030	0.030	0.029	0.025	0.027	0.027	0.024	0.024	0.023	0.022	0.019	0.022	0.019	0.019	0.017	0.019	0.014
7	RMK_MIL	0.003	0.004	0.005	0.004	0.004	0.004	0.005	0.005	0.006	0.007	0.006	0.007	0.007	0.006	0.008	0.008	0.007	0.008	0.007
8	FSH	0.063	0.069	0.063	0.062	0.065	0.079	0.093	0.063	0.060	0.058	0.056	0.055	0.049	0.051	0.045	0.048	0.041	0.045	0.041
9	CMT_OMT_CTL_OAP	0.029	0.041	0.037	0.046	0.045	0.038	0.040	0.041	0.041	0.044	0.046	0.045	0.044	0.048	0.051	0.051	0.038	0.043	0.040
10	OFD	0.027	0.028	0.029	0.029	0.027	0.024	0.025	0.025	0.023	0.022	0.022	0.020	0.018	0.020	0.018	0.018	0.016	0.018	0.013
11	B_T	0.015	0.014	0.014	0.013	0.014	0.011	0.011	0.011	0.011	0.010	0.010	0.010	0.009	0.009	0.007	0.007	0.007	0.009	0.007
12	TEX	0.026	0.039	0.026	0.041	0.048	0.039	0.045	0.047	0.070	0.067	0.087	0.093	0.079	0.111	0.117	0.098	0.078	0.090	0.096
13	WAP	0.005	0.007	0.005	0.007	0.008	0.007	0.008	0.008	0.012	0.012	0.015	0.016	0.014	0.019	0.020	0.017	0.014	0.016	0.017
14	LEA_LUM	0.003	0.003	0.004	0.005	0.003	0.004	0.005	0.006	0.005	0.006	0.005	0.007	0.006	0.005	0.007	0.006	0.005	0.006	0.004
15	PPP	0.002	0.002	0.003	0.003	0.002	0.003	0.003	0.004	0.004	0.004	0.004	0.005	0.004	0.004	0.005	0.004	0.004	0.004	0.003
16	CRP	0.011	0.009	0.015	0.017	0.012	0.014	0.017	0.020	0.018	0.021	0.018	0.025	0.021	0.019	0.024	0.020	0.019	0.021	0.015
17	I_S_NFM_FMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
18	ELE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
19	OME	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.002
20	OMF	0.001	0.001	0.002	0.002	0.003	0.001	0.003	0.003	0.004	0.005	0.004	0.006	0.005	0.007	0.008	0.007	0.003	0.006	0.010
21	MVH_OTN_OPT	0.026	0.053	0.032	0.021	0.028	0.028	0.039	0.043	0.054	0.058	0.073	0.067	0.084	0.069	0.077	0.071	0.060	0.104	0.070
22	P_C_COA	0.000	0.086	0.000	0.000	0.016	0.121	0.000	0.010	0.037	0.024	0.002	0.015	0.002	0.006	0.007	0.004	0.040	0.000	0.000
23	GAS_GDT	0.069	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.002
24	CMN_OFI_ISR_OBS_ROS	0.101	0.080	0.071	0.087	0.078	0.062	0.078	0.092	0.089	0.099	0.113	0.110	0.154	0.108	0.132	0.143	0.231	0.126	0.227
25	OSG_DWE	0.082	0.070	0.095	0.097	0.094	0.077	0.094	0.103	0.103	0.109	0.112	0.106	0.122	0.129	0.125	0.138	0.138	0.136	0.161
26	WOL_OMN_NMM	0.005	0.004	0.007	0.007	0.005	0.006	0.007	0.009	0.008	0.009	0.008	0.010	0.009	0.008	0.010	0.009	0.008	0.009	0.006
27	TRD_CNS	0.016	0.014	0.019	0.014	0.016	0.014	0.016	0.017	0.016	0.018	0.017	0.017	0.019	0.017	0.019	0.022	0.017	0.022	0.033
28	ELY_WTR_WTP_ATP	0.026	0.026	0.031	0.020	0.027	0.027	0.038	0.042	0.053	0.056	0.071	0.065	0.082	0.067	0.075	0.069	0.058	0.101	0.068
29	OIL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	FRS	0.089	0.088	0.085	0.087	0.077	0.065	0.071	0.066	0.058	0.057	0.054	0.052	0.043	0.045	0.038	0.043	0.033	0.032	0.024
	Total	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**

Source: Author's calculations based on elasticity values from existing literature and Household Expenditure Survey data conducted by Bangladesh Bureau of Statistics in 2004/2005

No:	$MBS\_BU_{i,h,r}$ GTAP Industry Classification	Monthly Household Income Groups in Taka-Urban																		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
		<750	**750-999**	**1000-1249**	**1250-1499**	**1500-1999**	**2000-2499**	**2500-2999**	**3000-3999**	**4000-4999**	**5000-5999**	**6000-6999**	**7000-7999**	**8000-8999**	**9000-9999**	**10000-12499**	**12500-14999**	**15000-17499**	**17500-19999**	**20000+**
1	PDR_ PCR	0.161	0.164	0.185	0.179	0.178	0.173	0.186	0.168	0.132	0.117	0.120	0.103	0.093	0.088	0.075	0.064	0.059	0.047	0.039
2	WHT_GRO	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	V_F	0.039	0.044	0.041	0.036	0.035	0.034	0.038	0.038	0.033	0.029	0.033	0.027	0.029	0.027	0.026	0.022	0.023	0.022	0.018
4	OSD_VOL	0.025	0.028	0.032	0.024	0.023	0.023	0.024	0.023	0.020	0.019	0.019	0.016	0.017	0.017	0.015	0.011	0.011	0.010	0.009
5	PFB_OCR	0.022	0.017	0.032	0.018	0.016	0.018	0.019	0.021	0.019	0.017	0.017	0.015	0.016	0.015	0.014	0.012	0.012	0.010	0.008
6	C_B_SGR	0.028	0.033	0.028	0.025	0.021	0.024	0.026	0.025	0.023	0.020	0.021	0.019	0.020	0.019	0.017	0.013	0.014	0.012	0.010
7	RMK_MIL	0.003	0.008	0.002	0.004	0.003	0.004	0.004	0.006	0.004	0.005	0.006	0.005	0.004	0.007	0.006	0.005	0.005	0.005	0.005
8	FSH	0.056	0.050	0.051	0.040	0.041	0.045	0.055	0.056	0.050	0.048	0.053	0.049	0.045	0.048	0.046	0.035	0.033	0.034	0.033
9	CMT_OMT_CTL_OAP	0.039	0.047	0.044	0.036	0.027	0.034	0.038	0.040	0.041	0.037	0.038	0.041	0.047	0.038	0.044	0.035	0.040	0.035	0.037
10	OFD	0.026	0.031	0.027	0.023	0.020	0.023	0.024	0.024	0.021	0.019	0.020	0.018	0.019	0.018	0.016	0.012	0.013	0.011	0.010
11	B_T	0.007	0.011	0.014	0.010	0.009	0.012	0.010	0.009	0.008	0.008	0.008	0.007	0.005	0.006	0.006	0.005	0.005	0.005	0.004
12	TEX	0.032	0.043	0.093	0.107	0.039	0.084	0.041	0.058	0.053	0.040	0.066	0.062	0.054	0.056	0.057	0.052	0.086	0.083	0.057
13	WAP	0.006	0.007	0.016	0.019	0.007	0.015	0.007	0.010	0.009	0.007	0.012	0.011	0.009	0.010	0.010	0.009	0.015	0.014	0.010
14	LEA_LUM	0.006	0.003	0.001	0.004	0.004	0.004	0.004	0.005	0.004	0.003	0.005	0.006	0.003	0.004	0.005	0.005	0.004	0.004	0.003
15	PPP	0.004	0.002	0.000	0.003	0.003	0.003	0.003	0.003	0.003	0.002	0.004	0.004	0.002	0.003	0.003	0.004	0.003	0.003	0.002
16	CRP	0.023	0.012	0.002	0.015	0.013	0.014	0.015	0.017	0.014	0.012	0.018	0.022	0.012	0.013	0.016	0.019	0.015	0.013	0.011
17	I_S_NFM_FMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
18	ELE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
19	OME	0.000	0.000	0.001	0.001	0.000	0.000	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.002	0.001	0.001	0.002	0.001	0.001
20	OMF	0.000	0.000	0.003	0.006	0.001	0.002	0.004	0.005	0.007	0.008	0.004	0.005	0.005	0.009	0.005	0.004	0.009	0.004	0.005
21	MVH_OTN_OPT	0.154	0.155	0.101	0.113	0.129	0.103	0.115	0.105	0.145	0.115	0.118	0.124	0.142	0.160	0.144	0.138	0.129	0.117	0.129
22	P_C_COA	0.000	0.000	0.035	0.000	0.000	0.012	0.000	0.000	0.005	0.118	0.000	0.009	0.013	0.000	0.000	0.001	0.002	0.016	0.008
23	GAS_GDT	0.004	0.002	0.006	0.001	0.005	0.002	0.003	0.007	0.008	0.005	0.008	0.010	0.010	0.011	0.013	0.013	0.014	0.010	0.010
24	CMN_OFI_ISR_OBS_ROS	0.030	0.039	0.052	0.062	0.067	0.073	0.084	0.091	0.090	0.086	0.129	0.139	0.139	0.122	0.159	0.214	0.189	0.226	0.272
25	OSG_DWE	0.110	0.066	0.059	0.072	0.144	0.107	0.098	0.102	0.095	0.096	0.115	0.126	0.116	0.113	0.118	0.140	0.146	0.155	0.137
26	WOL_OMN_NMM	0.009	0.005	0.001	0.007	0.006	0.006	0.006	0.007	0.006	0.005	0.007	0.009	0.005	0.006	0.007	0.008	0.006	0.006	0.005
27	TRD_CNS	0.010	0.012	0.023	0.009	0.015	0.015	0.021	0.020	0.021	0.022	0.023	0.026	0.031	0.022	0.032	0.027	0.028	0.029	0.030
28	ELY_WTR_WTP_ATP	0.149	0.150	0.098	0.124	0.126	0.100	0.112	0.102	0.141	0.111	0.115	0.121	0.138	0.155	0.140	0.134	0.125	0.113	0.125
29	OIL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	FRS	0.055	0.069	0.053	0.063	0.067	0.067	0.061	0.057	0.044	0.048	0.039	0.025	0.021	0.030	0.020	0.015	0.012	0.016	0.021
	Total	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**

Source: Author's calculations based on elasticity values from existing literature and Household Expenditure Survey data conducted by Bangladesh Bureau of Statistics in 2004/2005

Table C 6 Armington CES Elasticities between Domestic and Imports

ESUBD (σ)	**ESUBD**
1 pdr_pcr	3.61
2 wht_gro	2.7
3 v_f	1.85
4 osd_vol	2.96
5 pfb_ocr	3.09
6 c_b_sgr	2.7
7 rmk_mil	3.65
8 fsh	1.25
9 cmt_oap	2.9
10 ofd	2
11 b_t	1.15
12 tex	3.75
13 wap	3.7
14 lea_lum	3.58
15 ppp	2.95
16 crp	3.3
17 i_s_nfm_fmp	3.55
18 ele	4.4
19 ome	4.05
20 omf	3.75
21 mvh_otn_otp	2.57
22 p_c_coa	2.17
23 gas_gdt	10.77
24 cmn_ros	1.9
25 osg_dwe	1.9
26 wol_omn_nmm	2.37
27 trd_cns	1.9
28 ely_wtr	2.51
29 oil	5.2
30 frs	2.5
Total	94.68

Source: GTAP Version 7 database (2004)

Table C 7 CES between Primary Factors

ESBV(α)	**ESUBVA**
1 pdr_pcr	0.49
2 wht_gro	0.23
3 v_f	0.23
4 osd_vol	0.5
5 pfb_ocr	0.23
6 c_b_sgr	0.68
7 rmk_mil	0.78
8 fsh	0.2
9 cmt_oap	0.56
10 ofd	1.12
11 b_t	1.12
12 tex	1.26
13 wap	1.26
14 lea_lum	1.26
15 ppp	1.26
16 crp	1.26
17 i_s_nfm_fmp	1.26
18 ele	1.26
19 ome	1.26
20 omf	1.26
21 mvh_otn_otp	1.53
22 p_c_coa	0.64
23 gas_gdt	0.65
24 cmn_ros	1.26
25 osg_dwe	1.26
26 wol_omn_nmm	0.89
27 trd_cns	1.59
28 ely_wtr	1.4
29 oil	0.2
30 frs	0.2
31 CGDS	1
Total	28.1

Source: GTAP Version 7 database (2004)

Table C 8 Income Elasticity of Demand in Good *i* for Region *r* ($\varepsilon_{i,r}$)

EY $(\varepsilon_{i,r})$	5 XSA	6 USA	7 CAN	8 EU	9 ASE	10 HIA	11 JPN	12 CHN	13 XME	14 AUS_NZL	15 RUS_XSU	16 ROW	Total
1 pdr_pcr	0.59	0.01	0.03	0.04	0.55	0.09	0.02	0.63	0.43	0.03	0.43	0.54	5.88
2 wht_gro	0.59	0.01	0.03	0.06	0.53	0.09	0.02	0.63	0.4	0.03	0.42	0.5	5.8
3 v_f	0.59	0.01	0.03	0.04	0.54	0.09	0.02	0.63	0.36	0.03	0.42	0.45	5.69
4 osd_vol	0.71	0.85	0.89	0.84	0.69	0.58	0.9	0.76	0.74	0.9	0.76	0.75	12.36
5 pfb_ocr	0.6	0.41	0.72	0.18	0.54	0.25	0.31	0.88	0.72	0.47	0.56	0.59	8.75
6 c_b_sgr	0.7	0.93	0.87	0.92	0.71	0.83	0.93	0.64	0.77	0.9	0.78	0.75	12.69
7 rmk_mil	1.17	0.89	0.85	0.86	0.9	0.75	0.88	0.91	0.72	0.86	0.74	0.77	14.27
8 fsh	1.17	0.89	0.85	0.86	0.92	0.75	0.88	0.91	0.72	0.86	0.74	0.89	14.41
9 cmt_oap	1.17	0.89	0.85	0.86	0.92	0.75	0.88	0.91	0.71	0.85	0.74	0.79	14.3
10 ofd	0.71	0.94	0.91	0.93	0.74	0.84	0.93	0.77	0.77	0.92	0.77	0.78	13.05
11 b_t	0.71	0.94	0.91	0.93	0.73	0.83	0.93	0.77	0.77	0.92	0.77	0.79	13.03
12 tex	1.18	0.94	0.91	0.94	0.99	0.9	0.94	0.94	0.82	0.92	0.84	0.86	15.3
13 wap	1.18	0.94	0.91	0.94	0.92	0.87	0.94	0.94	0.81	0.92	0.83	0.85	15.16
14 lea_lum	1.15	0.98	0.94	0.97	0.92	0.9	0.94	0.95	1	0.94	0.98	0.96	15.79
15 ppp	1.05	1	1.01	1.03	1.02	1.04	1.02	1.03	1.07	1.01	1.09	1.05	16.8
16 crp	1.05	1	1.01	1.03	1.02	1.04	1.02	1.03	1.07	1.01	1.09	1.06	16.8
17 i_s_nfm_fmp	1.05	1	1.01	1.03	1.02	1.04	1.02	1.03	1.07	1.01	1.08	1.04	16.79
18 ele	1.05	1	1.01	1.03	1.02	1.04	1.02	1.03	1.07	1.01	1.09	1.04	16.79
19 ome	1.05	1	1.01	1.03	1.02	1.04	1.02	1.03	1.07	1.01	1.09	1.04	16.79
20 omf	1.05	1	1.01	1.03	1.02	1.04	1.02	1.03	1.07	1.01	1.09	1.06	16.82
21 mvh_otn_otp	1.19	0.99	1	1.02	0.99	0.99	0.99	1	1	1	0.99	0.98	16.45
22 p_c_coa	1.21	0.97	0.96	0.99	1.06	0.94	0.98	0.99	0.93	0.97	0.94	0.94	16.21
23 gas_gdt	1.2	0.97	0.95	0.97	1.08	0.92	0.97	0.98	0.92	0.96	0.97	0.94	16.09
24 cmn_ros	1.21	1.01	1.03	1.06	1.18	1.07	1.03	1.21	1.26	1.03	1.29	1.15	18.69
25 osg_dwe	1.17	1.02	1.04	1.06	1.16	1.11	1.05	1.19	1.23	1.04	1.25	1.14	18.52
26 wol_omn_nmm	1.05	1	1.01	1.03	1.01	1.04	1.02	1.03	1.06	1.01	1.06	1.04	16.7
27 trd_cns	1.23	1.02	1.03	1.05	1.13	1.09	1.04	1.17	1.19	1.04	1.21	1.14	18.3
28 ely_wtr	1.21	0.97	0.96	0.98	0.99	0.94	0.97	0.98	0.9	0.96	0.92	0.94	16
29 oil	1.21	0.97	0.96	0.99	1.28	0.98	0.98	0.99	0.93	0.97	1.08	0.95	16.61
30 frs	1.05	1	1.01	1.04	1.02	1.04	1.02	1.03	1.07	1.01	1.09	1.1	16.86
Total	30.21	25.58	25.69	25.75	27.62	24.87	25.72	27.98	26.66	25.64	27.12	26.86	437.69

Source: GTAP Version 7 database (2004)

Table C 9 Armington CES for Regional Allocation of Imports

ESBM (θ)	**ESUBM**
1 pdr_pcr	5.91
2 wht_gro	5.91
3 v_f	3.7
4 osd_vol	5.99
5 pfb_ocr	6.18
6 c_b_sgr	5.4
7 rmk_mil	7.3
8 fsh	2.5
9 cmt_oap	7.06
10 ofd	4
11 b_t	2.3
12 tex	7.5
13 wap	7.4
14 lea_lum	7.3
15 ppp	5.9
16 crp	6.6
17 i_s_nfm_fmp	7.23
18 ele	8.8
19 ome	8.1
20 omf	7.5
21 mvh_otn_otp	5.94
22 p_c_coa	4.4
23 gas_gdt	32.49
24 cmn_ros	3.8
25 osg_dwe	3.8
26 wol_omn_nmm	3.99
27 trd_cns	3.8
28 ely_wtr	4.02
29 oil	10.4
30 frs	5
Total	200.21

Source: GTAP Version 7 database (2004)

APPENDIX D

Table D 1 Bilateral Tariff Rates in India

Industry	IND	PAK	LKA	BGD	XSA	USA	CAN	EU	ASE	HIA	JPN	CHN	XME	AUS_NZL	RUS_XSU	ROW
1 pdr_pcr	0.00	70.00	0.00	0.00	0.00	54.91	69.98	55.59	54.04	0.00	0.00	0.00	67.73	14.37	0.00	32.55
2 wht_gro	0.00	0.00	0.00	0.00	0.00	49.75	0.00	2.88	4.79	0.00	0.00	0.00	0.00	8.49	0.00	17.96
3 v_f	0.00	31.91	54.98	99.61	37.67	36.31	45.26	43.82	34.04	39.70	31.18	48.08	33.98	40.84	35.87	31.58
4 osd_vol	0.00	30.00	39.07	53.37	35.15	48.58	31.44	71.45	98.36	32.08	74.66	60.86	48.94	30.12	29.57	48.72
5 pfb_ocr	0.00	32.13	39.90	16.88	3.12	12.56	10.09	22.07	61.93	16.00	11.52	33.02	32.68	16.82	10.00	19.06
6 c_b_sgr	0.00	15.00	15.00	15.00	29.36	98.76	92.75	50.33	28.71	0.00	0.00	0.00	82.94	99.26	0.00	98.74
7 rmk_mil	0.00	16.33	30.51	28.02	0.00	38.17	34.54	35.72	39.90	21.50	32.83	24.28	36.01	39.86	0.00	17.19
8 fsh	0.00	30.00	29.62	0.33	14.46	29.00	30.00	26.18	28.13	23.75	15.43	13.95	21.41	30.00	0.00	17.31
9 cmt_oap	0.00	0.00	51.04	12.37	4.17	24.82	16.68	7.29	13.53	15.26	22.75	28.84	3.27	9.57	2.91	3.33
10 ofd	0.00	33.95	42.81	25.09	27.08	43.95	33.80	38.67	40.15	31.64	45.41	34.94	35.52	37.49	16.52	32.83
11 b_t	0.00	60.69	123.29	30.00	37.45	116.84	84.42	137.18	78.01	65.97	52.77	83.71	99.25	79.93	164.97	162.11
12 tex	0.00	15.77	15.00	14.49	1.08	15.16	15.04	15.69	15.10	15.10	15.84	18.44	15.50	24.39	17.61	17.12
13 wap	0.00	15.00	15.00	15.00	0.00	15.00	14.98	14.72	14.98	14.89	15.00	14.04	15.00	14.27	13.95	13.09
14 lea_lum	0.00	12.76	14.75	12.08	5.38	14.30	14.92	14.27	13.93	13.88	14.63	14.55	10.19	10.63	13.47	9.92
15 ppp	0.00	14.83	14.96	15.00	0.76	12.79	11.45	14.42	12.27	13.93	14.92	14.17	14.83	14.07	14.76	9.15
16 crp	0.00	15.06	15.06	9.44	3.96	14.52	14.27	15.16	15.52	14.16	14.58	14.83	13.72	14.79	13.52	12.66
17 i_s_nfm_fmp	0.00	17.81	15.48	16.38	5.29	17.26	16.99	16.94	16.52	16.34	17.82	15.70	15.48	15.08	17.39	15.49
18 ele	0.00	0.79	3.55	13.45	0.00	2.15	1.88	4.37	2.03	1.89	3.99	2.74	4.30	1.59	9.70	5.32
19 ome	0.00	14.56	14.86	14.55	0.07	13.09	13.91	14.20	13.49	14.41	14.53	14.34	13.97	14.19	14.53	14.58
20 omf	0.00	15.00	14.77	15.00	7.26	15.00	15.00	15.00	14.85	14.99	15.00	13.46	15.00	15.17	14.98	14.32
21 mvh_otn_otp	0.00	1.80	5.19	18.32	0.00	8.63	7.13	11.60	11.60	13.34	20.54	10.79	10.43	9.46	6.78	9.66
22 p_c_coa	0.00	15.00	15.00	15.00	0.00	21.53	25.31	14.56	25.70	15.00	15.00	24.44	10.78	34.77	18.95	18.47
23 gas_gdt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.00	0.00	0.00	9.97	0.00	0.00	2.33
24 cmn_ros	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25 osg_dwe	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26 wol_omn_nmm	0.00	14.36	13.38	11.37	2.35	14.67	10.54	14.98	8.09	12.86	14.04	10.83	13.37	8.20	10.96	7.24
27 trd_cns	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28 ely_wtr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29 oil	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.96	0.00	0.00	0.00	10.00	0.00	9.62	9.83
30 frs	0.00	5.17	5.24	27.51	26.07	11.07	5.47	10.76	5.46	13.08	14.51	25.09	8.35	5.03	26.56	5.45

Source: The GTAP Version 7 Database (Purdue University: Centre for Global Trading Analysis, 2008)

Table D 2 Bilateral Tariff Rates in Pakistan

Industry	IND	PAK	LKA	BGD	XSA	USA	CAN	EU	ASE	HIA	JPN	CHN	XME	AUS_NZL	RUS_XSU	ROW
1 pdr_pcr	8.95	0.00	0.00	0.00	0.00	10.00	10.00	0.00	2.46	0.00	0.00	1.42	9.84	0.00	0.00	0.48
2 wht_gro	9.40	0.00	0.00	25.00	7.81	22.28	0.00	0.52	5.04	0.00	0.00	5.01	24.58	24.88	25.00	1.05
3 v_f	9.10	0.00	14.21	15.61	18.58	7.79	5.18	7.27	15.10	19.14	7.26	8.81	17.07	5.06	6.48	5.97
4 osd_vol	10.07	0.00	9.97	9.83	10.04	21.87	14.35	11.06	38.57	14.73	27.46	16.64	14.56	10.48	0.00	21.30
5 pfb_ocr	8.07	0.00	19.23	8.10	9.01	5.14	5.79	6.69	16.79	11.71	8.59	19.32	6.25	5.16	5.00	11.80
6 c_b_sgr	24.37	0.00	0.00	0.00	0.00	24.99	0.00	23.05	6.85	0.00	0.00	0.00	25.00	1.31	0.00	23.47
7 rmk_mil	20.92	0.00	0.00	24.95	22.27	24.62	23.87	23.83	24.64	15.92	18.50	23.88	24.17	24.11	0.00	20.40
8 fsh	10.00	0.00	10.00	0.00	0.00	0.00	0.00	1.40	9.12	0.00	10.00	10.00	10.00	0.00	0.00	2.42
9 cmt_oap	13.81	0.00	0.00	18.23	7.12	13.46	10.57	8.13	10.25	7.12	16.48	18.42	9.57	10.32	1.43	7.86
10 ofd	19.47	0.00	19.16	18.99	20.83	19.81	21.82	23.25	22.30	24.86	20.72	24.39	24.29	21.19	0.00	21.78
11 b_t	50.19	0.00	0.00	0.00	0.00	83.67	92.13	61.67	53.41	50.46	100.00	53.08	81.80	80.06	0.00	24.48
12 tex	11.77	0.00	13.51	18.56	19.92	16.86	14.19	16.80	18.94	16.69	14.05	20.66	20.69	14.03	12.85	16.34
13 wap	25.00	0.00	24.79	24.42	25.00	24.97	25.00	23.49	24.73	24.64	24.12	24.87	24.91	21.78	24.45	16.88
14 lea_lum	14.97	0.00	24.92	7.41	22.72	19.90	14.94	14.39	21.89	17.85	24.53	22.75	13.46	21.13	7.48	8.39
15 ppp	11.63	0.00	20.91	18.19	18.09	11.06	9.61	17.59	21.22	23.83	21.57	19.39	18.13	13.54	10.06	15.71
16 crp	11.40	0.00	8.32	16.56	15.21	9.99	11.94	14.26	15.61	14.53	12.93	14.43	13.12	9.99	6.23	11.60
17 i_s_nfm_fmp	11.62	0.00	13.05	19.17	9.14	18.39	18.30	16.21	16.33	16.90	18.47	18.30	8.09	11.62	16.90	16.43
18 ele	19.88	0.00	19.23	18.62	13.79	16.00	13.93	16.56	9.52	13.87	18.03	17.45	17.14	17.14	8.94	14.96
19 ome	12.00	0.00	9.74	18.01	14.99	13.48	13.17	12.35	16.19	12.87	12.52	14.55	14.95	15.02	13.55	12.03
20 omf	17.58	0.00	21.90	21.48	22.49	11.37	8.16	11.59	19.07	14.75	16.49	22.91	21.78	15.23	4.97	12.20
21 mvh_otn_otp	2.20	0.00	20.40	19.66	0.04	5.77	5.21	21.35	42.18	43.31	58.83	23.95	15.65	7.08	4.93	6.96
22 p_c_coa	22.29	0.00	0.00	20.95	10.00	11.32	11.26	16.31	11.96	22.46	22.26	10.43	20.64	10.00	0.00	14.74
23 gas_gdt	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24 cmn_ros	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25 osg_dwe	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26 wol_omn_nmm	5.36	0.00	6.37	21.96	15.57	16.97	11.45	19.16	23.04	20.77	20.73	22.97	14.95	5.85	6.09	10.39
27 trd_cns	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28 ely_wtr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29 oil	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00	2.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00
30 frs	94.56	0.00	124.81	49.14	10.04	17.47	10.00	16.54	18.06	11.26	9.23	20.14	21.89	0.00	9.97	13.33

Source: The GTAP Version 7 Database (Purdue University: Centre for Global Trading Analysis, 2008)

Table D 3 Bilateral Tariff Rates in Sri Lanka

Industry	IND	PAK	LKA	BGD	XSA	USA	CAN	EU	ASE	HIA	JPN	CHN	XME	AUS_NZL	RUS_XSU	ROW
1 pdr_pcr	35.00	35.00	0.00	35.00	0.00	35.00	0.00	34.73	32.69	0.00	35.00	33.23	34.26	34.96	0.00	0.00
2 wht_gro	1.61	14.08	0.00	0.00	0.00	24.82	0.00	2.67	5.11	0.00	0.00	0.16	14.33	0.01	0.00	0.01
3 v_f	29.56	27.94	0.00	35.00	9.90	19.58	13.11	13.82	23.00	6.64	23.52	18.49	12.08	17.93	0.00	12.68
4 osd_vol	13.27	23.34	0.00	0.00	20.15	21.46	24.97	16.68	21.71	10.43	11.50	9.85	17.26	23.18	0.00	22.68
5 pfb_ocr	24.46	15.21	0.00	2.70	24.14	57.88	5.26	66.68	66.00	17.02	1.91	25.55	17.32	11.98	5.62	21.90
6 c_b_sgr	24.84	25.00	0.00	0.00	24.97	10.00	24.99	24.73	22.38	0.00	0.00	22.99	24.14	22.21	0.00	24.43
7 rmk_mil	14.15	0.00	0.00	0.00	9.97	19.85	10.33	13.32	10.34	2.89	21.36	4.87	22.13	10.42	0.00	13.65
8 fsh	8.09	9.00	0.00	0.00	7.82	7.76	10.00	5.80	8.15	8.62	0.63	0.00	6.61	8.28	0.00	4.87
9 cmt_oap	21.16	7.51	0.00	0.00	8.92	16.05	8.58	13.07	20.88	12.92	6.09	12.82	13.66	18.68	0.00	20.12
10 ofd	13.11	8.10	0.00	14.69	6.37	19.65	10.30	12.94	11.23	3.99	7.00	10.94	13.14	14.71	0.00	6.57
11 b_t	97.66	46.75	0.00	0.00	128.22	64.19	0.00	31.55	80.46	31.46	96.11	98.91	38.60	76.73	0.00	114.16
12 tex	0.88	0.29	0.00	1.35	7.70	1.14	1.13	0.67	0.86	1.50	0.81	0.71	4.55	0.94	0.00	0.51
13 wap	8.13	9.58	0.00	8.50	9.98	12.90	11.42	8.29	9.43	4.74	8.87	9.27	5.90	21.75	0.00	9.01
14 lea_lum	13.32	13.24	0.00	8.93	18.32	18.36	14.28	14.03	9.54	18.96	14.85	17.25	21.78	10.73	9.40	8.99
15 ppp	7.70	9.93	0.00	7.83	10.69	7.84	9.47	8.00	9.80	10.42	8.30	10.16	10.78	7.91	7.38	7.75
16 crp	4.82	5.03	0.00	3.81	8.61	4.47	6.43	6.30	7.44	8.92	8.23	7.10	4.58	8.79	3.66	4.36
17 i_s_nfm_fmp	3.53	9.34	0.00	12.92	18.06	7.43	5.88	8.63	6.87	8.24	10.67	8.68	7.43	4.71	5.49	4.36
18 ele	1.83	1.81	0.00	0.61	3.91	1.43	3.42	2.47	2.67	3.75	4.11	5.18	5.34	1.61	0.05	3.09
19 ome	3.80	6.23	0.00	8.27	5.11	5.90	4.86	5.54	7.76	7.34	4.75	7.90	5.34	5.05	6.22	5.40
20 omf	8.10	11.41	0.00	13.10	12.06	4.80	8.82	2.69	8.66	10.00	7.74	11.89	2.76	6.49	0.00	3.76
21 mvh_otn_otp	9.63	9.85	0.00	0.00	4.59	4.14	2.66	5.43	10.84	7.73	10.46	8.64	4.77	6.51	1.48	1.37
22 p_c_coa	6.31	0.00	0.00	15.77	0.00	10.48	15.72	7.72	7.42	10.94	10.39	7.28	13.08	6.82	0.00	11.09
23 gas_gdt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24 cmn_ros	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25 osg_dwe	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26 wol_omn_nmm	8.61	17.84	0.00	25.00	6.93	7.15	7.58	1.83	11.54	10.99	10.37	17.69	2.80	6.60	7.33	7.29
27 trd_cns	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28 ely_wtr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29 oil	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30 frs	14.35	5.35	0.00	0.00	0.00	16.37	0.00	4.75	7.18	7.57	13.89	7.70	5.33	0.00	0.00	1.39

Source: The GTAP Version 7 Database (Purdue University: Centre for Global Trading Analysis, 2008)

Table D 4 Bilateral Tariff Rates in Bangladesh

Industry	IND	PAK	LKA	BGD	XSA	USA	CAN	EU	ASE	HIA	JPN	CHN	XME	AUS_NZL	RUS_XSU	ROW
1 pdr_pcr	22.50	22.05	0.00	0.00	0.00	14.60	0.00	0.00	18.51	22.49	0.00	0.04	22.49	22.46	0.00	0.40
2 wht_gro	5.12	7.40	0.00	0.00	0.00	7.49	7.50	0.00	0.00	0.00	0.00	0.00	0.00	7.50	0.00	7.44
3 v_f	19.35	10.70	13.70	0.00	9.30	25.82	7.60	6.53	22.54	22.18	0.00	25.15	22.51	9.18	5.92	13.72
4 osd_vol	6.52	15.99	23.95	0.00	0.02	22.72	7.50	25.71	23.57	18.58	23.05	13.76	6.81	7.57	7.92	19.37
5 pfb_ocr	8.75	0.70	5.36	0.00	32.28	0.33	14.00	1.55	25.79	3.64	1.47	25.79	1.25	0.47	0.00	0.61
6 c_b_sgr	29.45	27.46	0.00	0.00	0.00	22.52	0.00	22.82	30.24	0.00	0.00	0.00	30.49	21.45	0.00	27.39
7 rmk_mil	32.38	0.00	0.00	0.00	0.00	31.82	0.00	32.07	31.62	32.20	0.00	27.28	31.76	32.30	24.99	31.99
8 fsh	32.38	0.00	22.50	0.00	0.00	22.11	0.00	0.00	21.34	16.61	32.49	15.00	0.00	32.36	0.00	14.92
9 cmt_oap	3.76	19.60	20.75	0.00	0.00	18.90	0.61	13.19	16.77	20.03	16.03	11.89	21.42	18.33	0.00	1.58
10 ofd	19.75	25.35	13.53	0.00	22.49	8.20	5.81	18.62	16.66	21.25	22.81	15.04	25.04	5.47	30.43	20.15
11 b_t	32.30	0.00	0.00	0.00	0.00	32.29	0.00	32.03	32.45	19.77	31.72	32.49	32.50	32.16	30.24	24.87
12 tex	21.10	25.98	27.09	0.00	15.25	21.44	19.98	23.18	24.02	28.07	26.71	28.82	29.27	22.48	15.70	23.23
13 wap	32.18	32.24	32.45	0.00	30.14	31.88	32.49	30.60	32.34	32.38	32.37	32.31	32.47	26.10	0.00	28.64
14 lea_lum	19.45	3.95	29.79	0.00	26.28	20.13	32.29	11.24	26.35	12.57	12.27	23.69	21.76	19.70	3.05	3.33
15 ppp	22.02	18.42	27.76	0.00	32.46	3.38	4.97	19.29	18.99	25.70	22.58	24.55	5.05	20.94	23.11	19.65
16 crp	14.22	12.50	16.96	0.00	28.13	10.06	6.23	10.01	16.71	13.27	16.17	9.86	13.44	4.51	1.56	7.35
17 i_s_nfm_fmp	16.28	24.20	19.75	0.00	0.00	18.43	17.22	14.59	15.70	14.95	14.04	20.23	18.18	14.36	13.37	11.02
18 ele	16.15	12.00	14.22	0.00	10.17	12.38	11.86	13.74	10.00	12.02	13.25	15.52	13.60	14.76	10.39	12.62
19 ome	10.02	17.57	8.70	0.00	8.50	8.86	8.62	8.67	13.41	6.56	6.96	9.92	6.27	14.36	11.25	7.20
20 omf	27.92	22.45	31.96	0.00	0.00	24.23	21.12	29.14	30.99	30.68	30.18	27.88	29.83	19.59	0.00	23.51
21 mvh_otn_otp	22.75	21.86	5.79	0.00	3.62	9.81	14.78	12.86	13.60	15.45	18.63	17.57	4.64	13.88	8.33	9.61
22 p_c_coa	23.90	20.00	0.00	0.00	0.00	30.35	29.66	29.44	29.16	27.38	29.90	22.72	29.96	15.53	26.71	23.07
23 gas_gdt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24 cmn_ros	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25 osg_dwe	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26 wol_omn_nmm	18.99	23.20	24.68	0.00	0.00	21.46	17.28	19.92	26.44	24.62	18.70	26.52	7.91	1.65	15.47	12.47
27 trd_cns	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28 ely_wtr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29 oil	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.04	0.00	0.00	0.00	32.48	0.00	0.00	31.81
30 frs	13.80	7.81	0.00	0.00	0.00	0.78	0.00	6.26	0.17	8.90	0.00	8.61	7.53	0.10	0.00	0.31

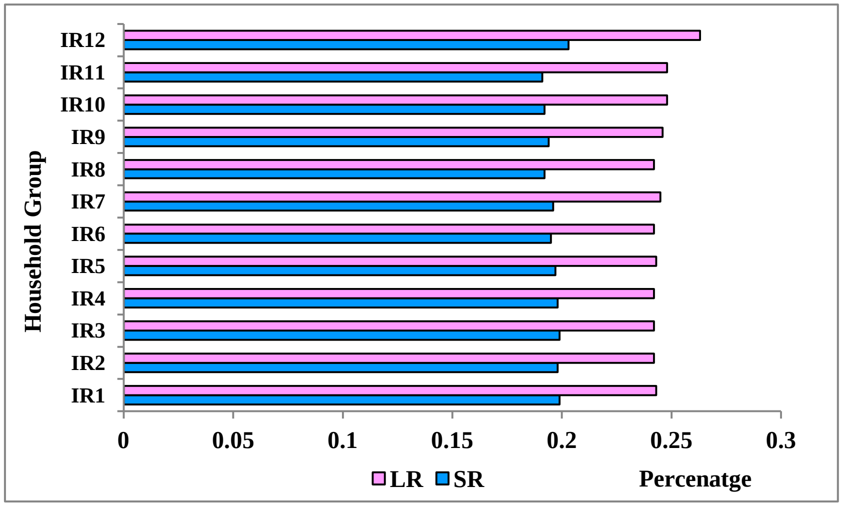
Source: The GTAP Version 7 Database (Purdue University: Centre for Global Trading Analysis, 2008)

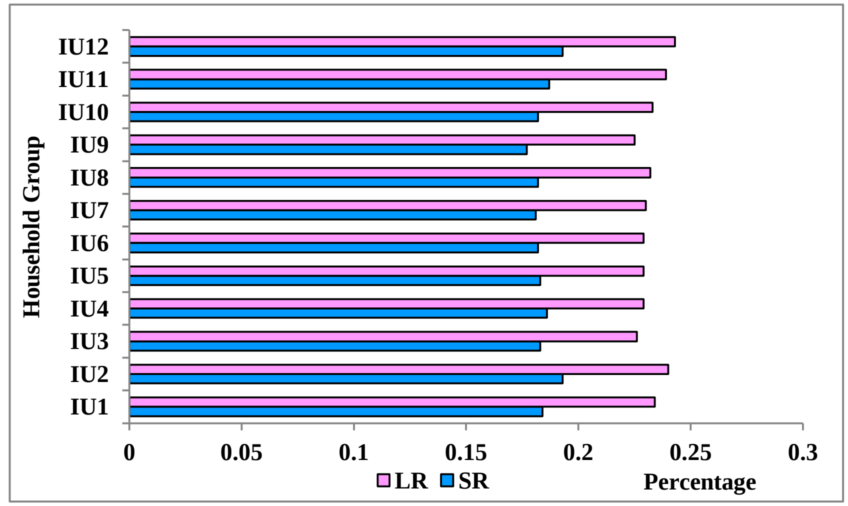
Table D 5 Bilateral Tariff Rates in Rest of South Asia

Industry	IND	PAK	LKA	BGD	XSA	USA	CAN	EU	ASE	HIA	JPN	CHN	XME	AUS_NZL	RUS_XSU	ROW
1 pdr_pcr	3.90	0.13	2.22	0.00	0.00	11.50	0.00	0.05	0.00	0.00	0.00	0.00	0.13	0.11	0.00	0.00
2 wht_gro	5.20	0.00	15.00	0.00	0.00	0.28	9.99	0.00	12.24	0.00	0.00	0.00	14.25	14.54	0.00	0.00
3 v_f	10.29	11.21	15.00	10.00	0.00	11.04	5.77	14.24	10.75	5.04	0.00	10.09	15.02	12.58	0.00	5.45
4 osd_vol	11.38	0.00	9.72	30.00	0.00	16.25	9.99	17.12	9.33	0.00	0.00	10.00	6.61	10.00	0.00	9.39
5 pfb_ocr	14.08	10.59	17.19	10.00	0.00	13.94	0.00	10.06	11.24	10.47	9.82	12.37	12.60	13.88	0.00	9.99
6 c_b_sgr	11.69	0.00	0.89	0.00	0.00	0.00	0.00	1.46	4.26	0.00	0.00	0.00	4.21	5.98	0.00	1.58
7 rmk_mil	18.35	14.99	10.51	14.53	0.00	9.95	14.50	9.55	10.48	0.00	0.00	10.75	8.94	10.48	0.00	10.44
8 fsh	15.24	0.00	20.37	0.00	0.00	0.00	0.00	7.72	12.82	15.12	0.00	0.00	18.39	19.08	0.00	0.16
9 cmt_oap	11.09	14.49	15.91	0.00	0.00	18.20	0.00	16.28	15.40	0.00	0.00	12.34	17.97	9.46	0.00	12.02
10 ofd	17.88	16.42	15.34	30.00	29.99	16.92	12.62	20.41	16.82	25.08	10.02	17.63	16.08	17.99	0.00	8.87
11 b_t	67.97	0.00	23.84	50.00	49.99	51.65	40.00	34.89	38.77	33.96	41.56	49.75	18.21	30.64	34.47	12.04
12 tex	9.90	9.85	20.02	5.91	29.44	13.03	25.09	18.90	11.09	14.04	14.67	11.40	6.41	2.10	15.40	7.80
13 wap	19.09	24.08	24.94	28.32	29.98	24.37	24.67	20.85	23.60	20.04	21.13	24.45	1.20	24.52	0.00	4.40
14 lea_lum	18.71	5.39	17.22	34.31	0.00	26.27	0.89	21.11	17.04	18.51	21.46	26.65	14.31	16.08	23.45	11.06
15 ppp	14.76	12.05	19.69	10.18	9.99	12.23	8.33	14.02	14.24	18.27	14.63	20.19	14.08	14.71	11.05	14.28
16 crp	14.47	6.94	20.87	20.45	28.47	16.03	9.90	17.26	18.88	13.25	12.97	19.23	17.10	23.12	12.37	17.83
17 i_s_nfm_fmp	12.76	0.00	21.16	0.00	0.00	21.97	15.49	17.78	20.24	9.06	13.82	15.80	9.68	22.76	0.93	15.27
18 ele	12.29	15.14	15.89	0.00	0.00	12.05	7.43	11.85	7.15	12.74	8.81	13.42	15.41	17.31	14.87	2.06
19 ome	14.60	8.64	23.34	16.16	0.00	26.75	19.03	16.56	20.71	12.24	15.29	12.94	14.51	21.08	10.79	12.63
20 omf	20.87	23.22	24.65	24.91	30.00	21.90	24.01	18.25	21.92	19.59	16.26	15.31	18.95	23.92	14.90	11.15
21 mvh_otn_otp	35.91	0.00	42.99	0.00	0.00	25.57	37.62	21.19	36.31	60.01	58.16	22.28	31.77	13.03	1.48	5.20
22 p_c_coa	15.73	0.00	24.32	10.00	0.00	22.51	24.46	18.83	23.14	13.92	24.39	13.91	18.01	20.47	0.00	0.04
23 gas_gdt	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24 cmn_ros	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25 osg_dwe	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26 wol_omn_nmm	33.81	20.21	19.41	27.00	0.00	27.48	20.57	19.85	19.23	17.31	18.54	12.90	6.17	22.88	1.99	18.38
27 trd_cns	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28 ely_wtr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29 oil	10.21	0.00	25.00	0.00	0.00	0.00	0.00	0.00	12.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30 frs	8.07	0.00	18.49	0.00	0.00	0.00	0.00	4.42	12.95	0.00	15.00	25.00	3.48	15.04	0.00	6.20

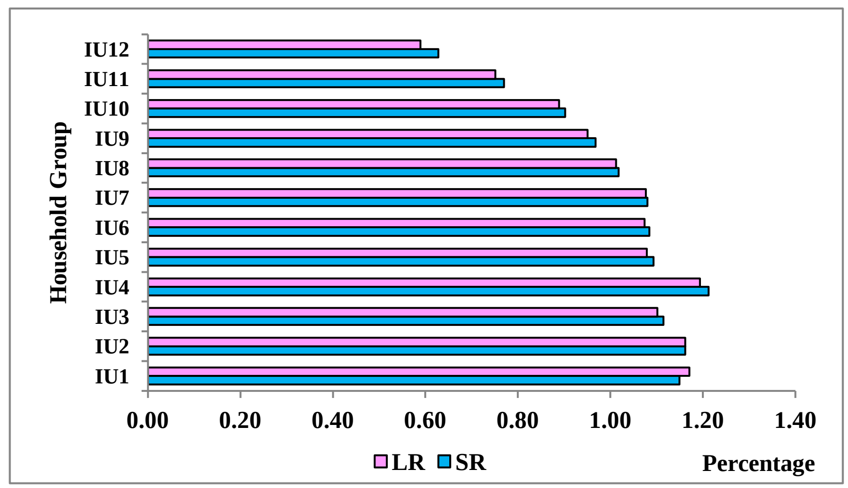
Source: The GTAP Version 7 Database (Purdue University: Centre for Global Trading Analysis, 2008)

Figure D 1 Projections on Change in Real Household Consumption in India: SAFTA

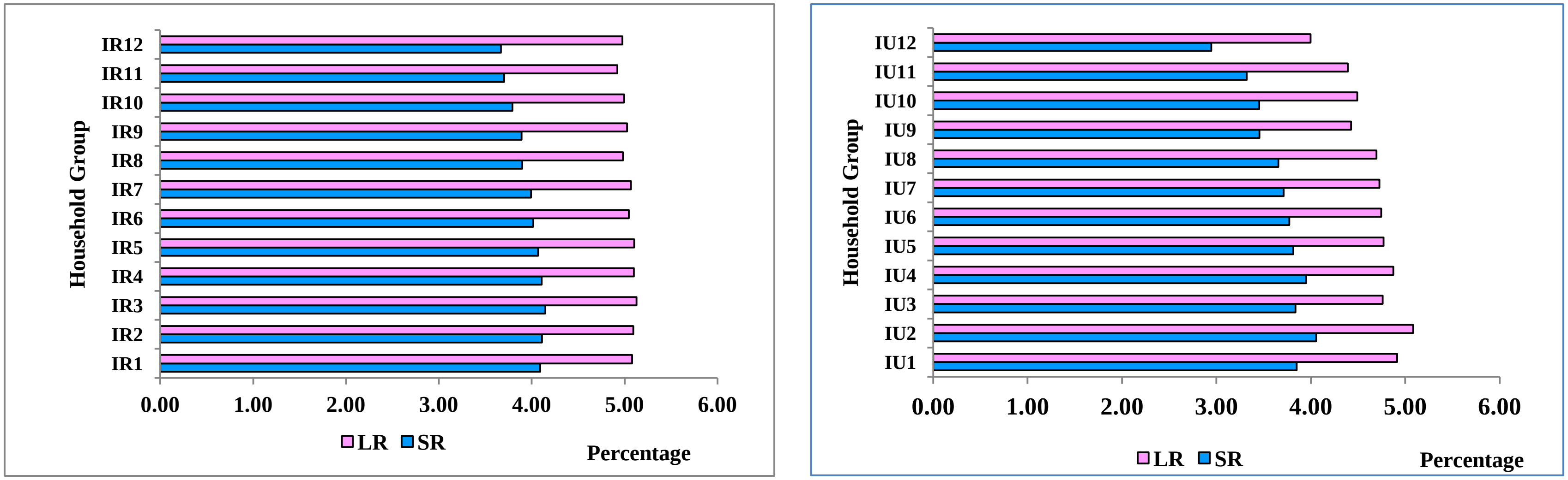




Projections on Change in Real Household Consumption in India: Customs Union



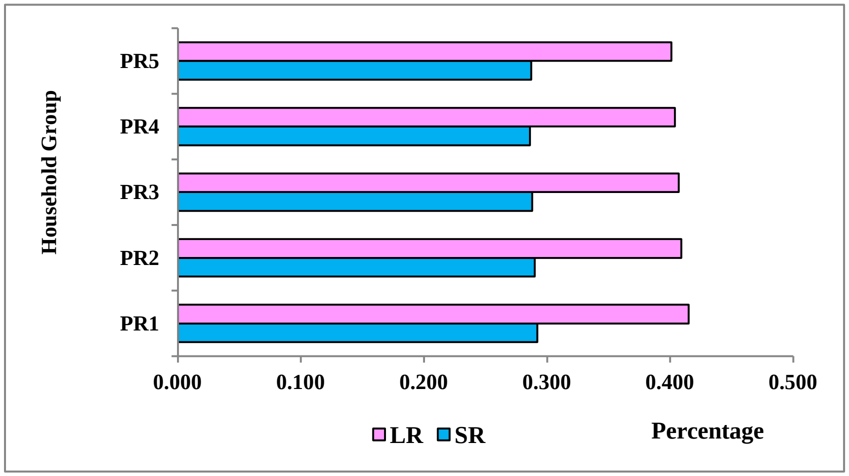
Projections on Change in Real Household Consumption in India: Unilateral Trade Liberalisation

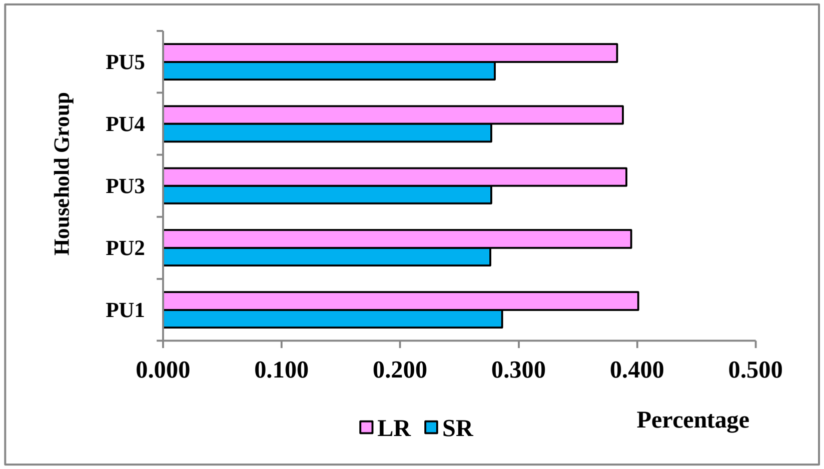


Source: Simulation results derived from SAMGEM

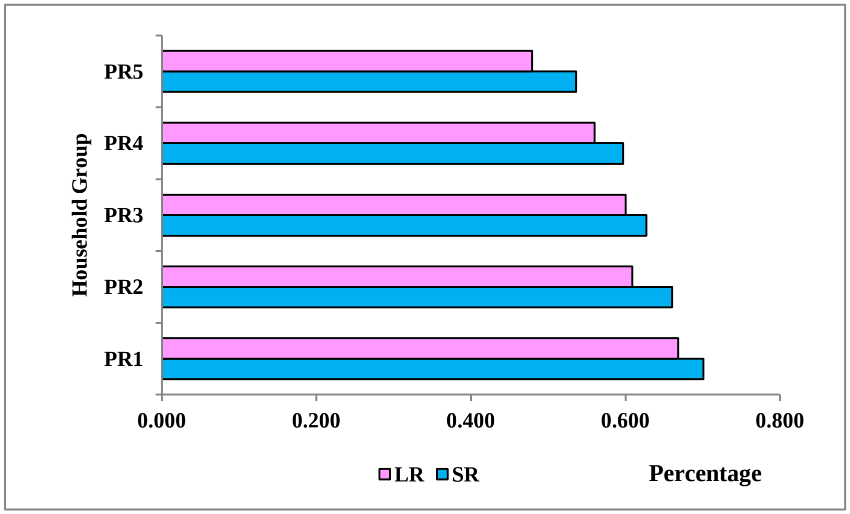
Note: SR-Short-Run LR-Long-Run IR1- IR12-Rural Household Groups IU1-IU12-Urban Household Groups

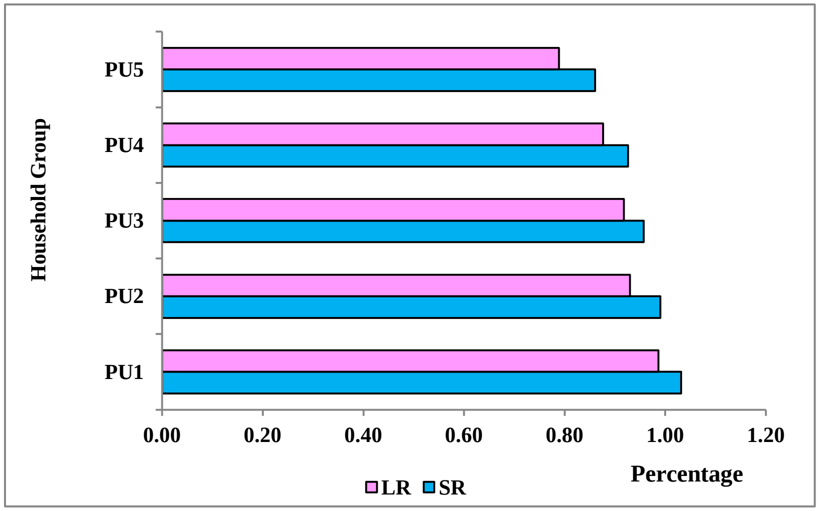
Figure D 2 Projections of Change in Real Household Consumption in Pakistan: SAFTA



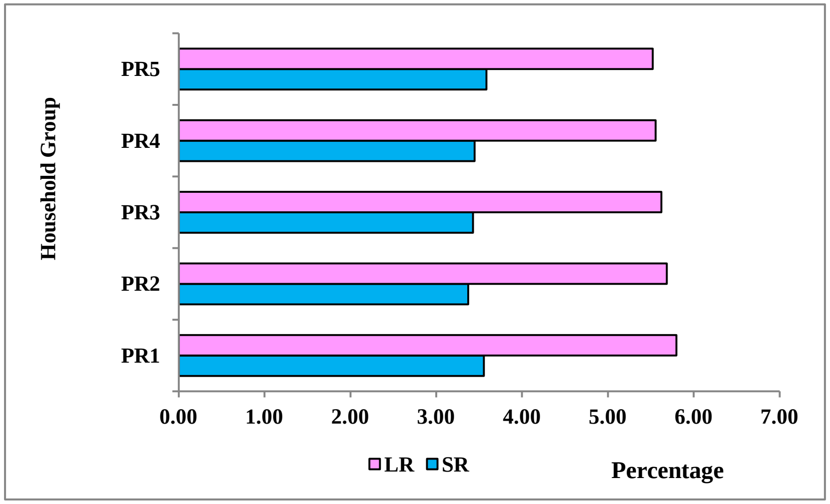


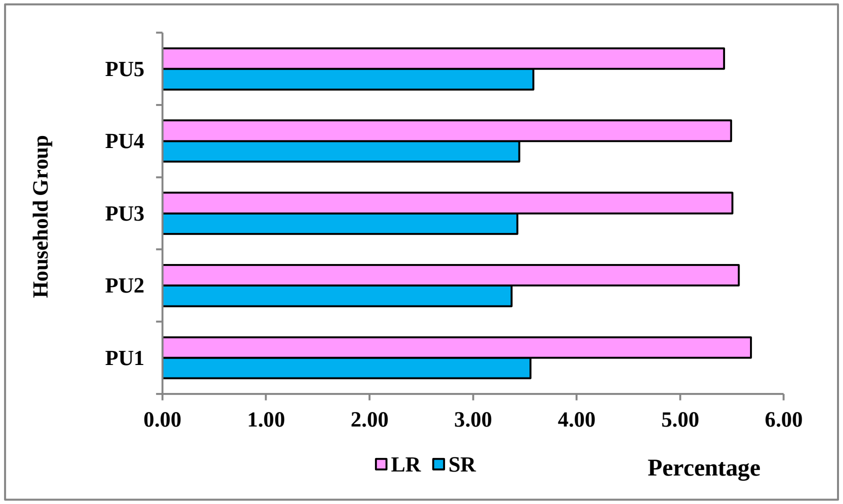
Projections on Change in Real Household Consumption in Pakistan: Customs Union





Projections on Change in Real Household Consumption in Pakistan: Unilateral Trade Liberalisation

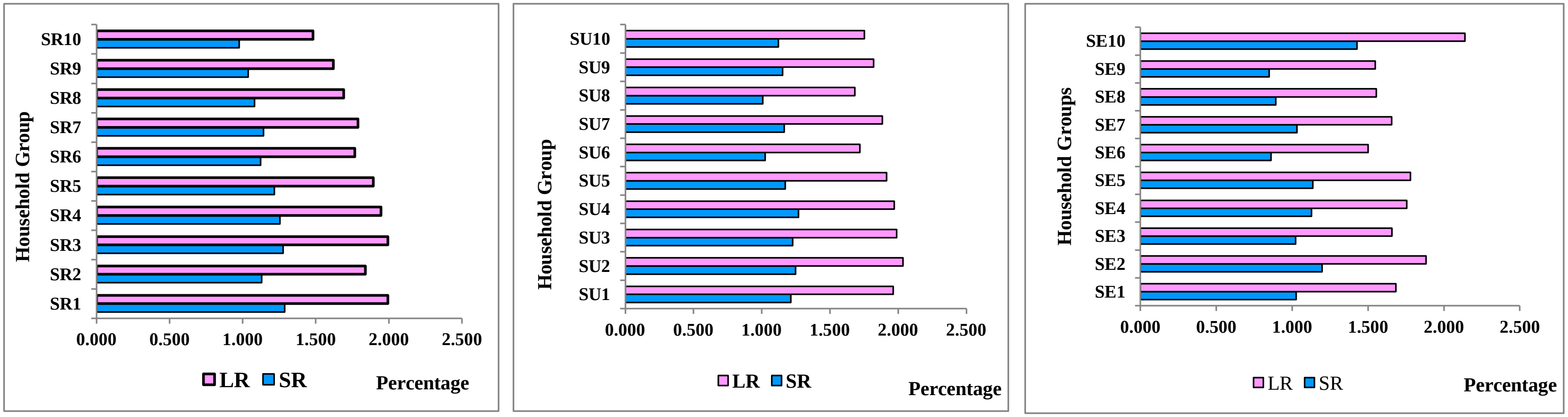




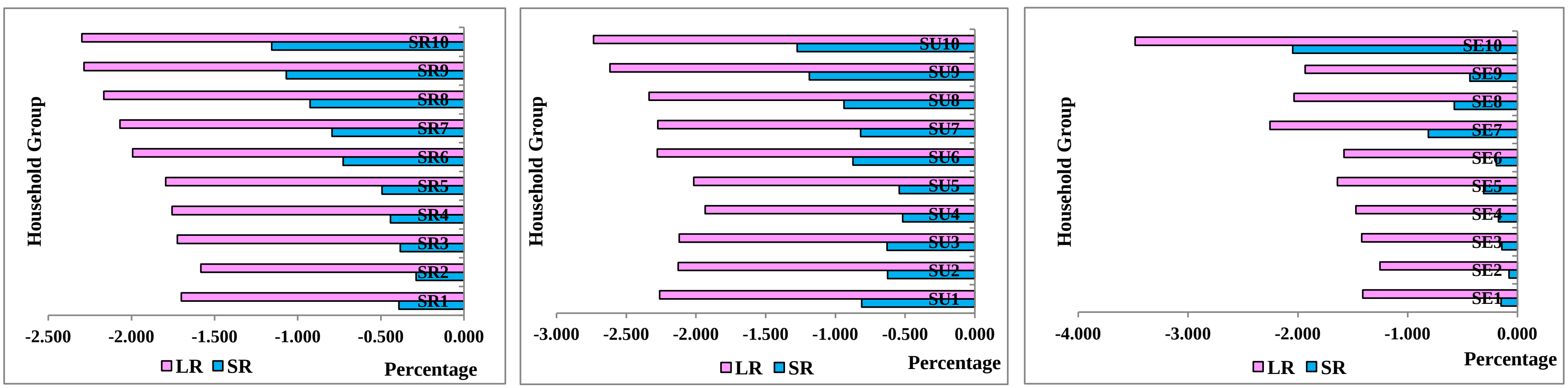
Source: Simulation results derived from SAMGEM

Note: SR-Short-Run LR-Long-Run PR1- PR5-Rural Household Groups PU1-PU5-Urban Household Groups

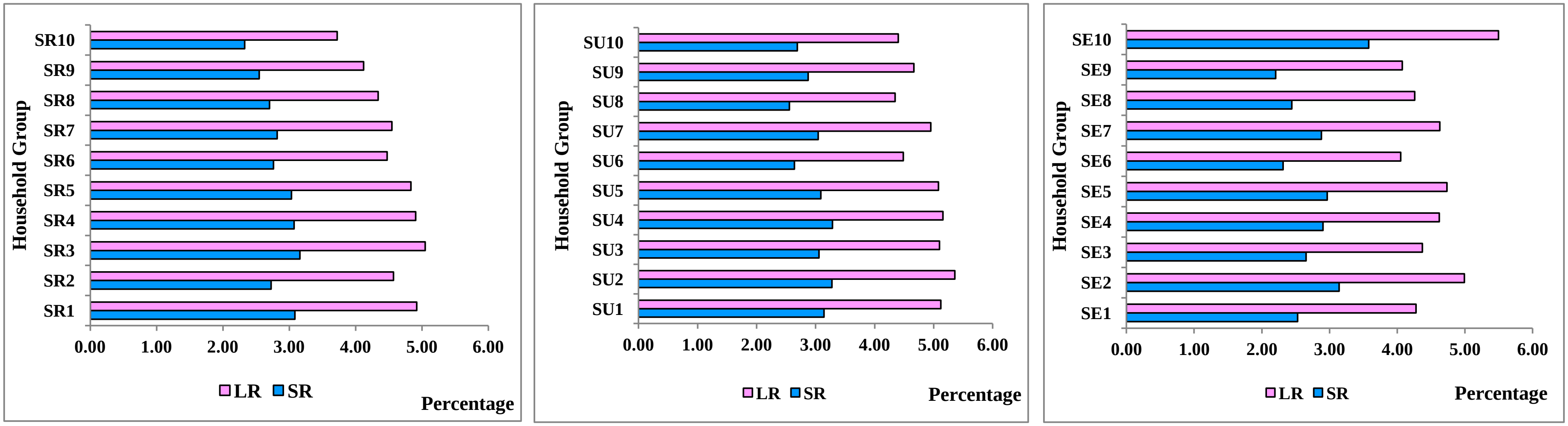
Figure D 3 Projections on Change in Real Household Consumption in Sri Lanka: SAFTA



Projections on Change in Real Household Consumption in Sri Lanka: Customs Union



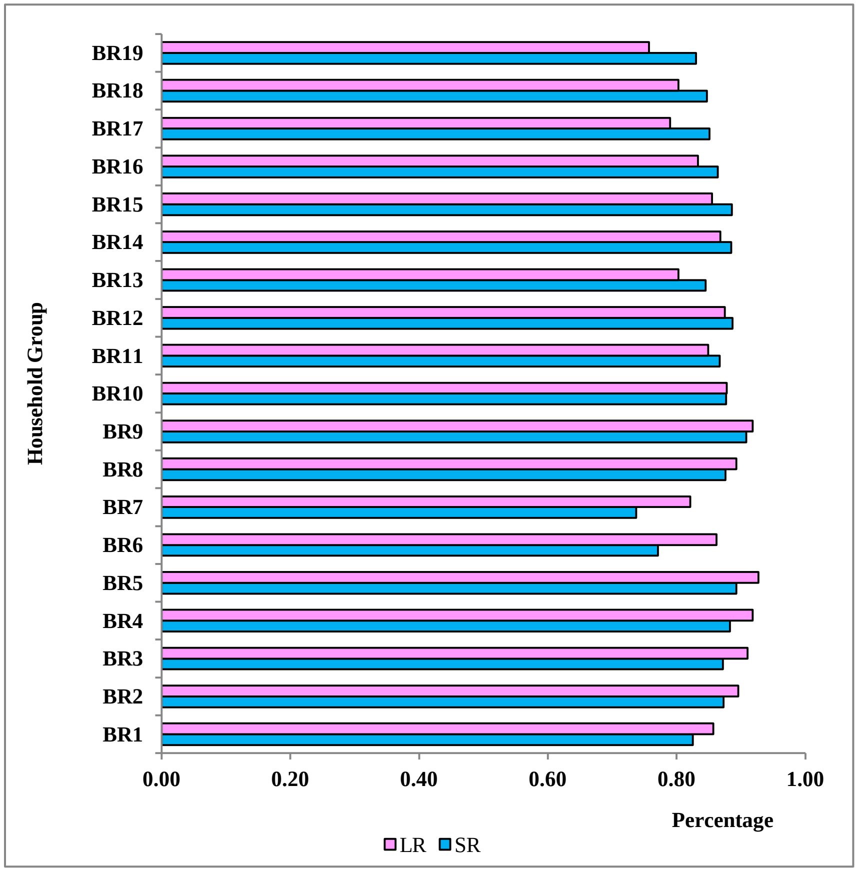
Projections on Change in Real Household Consumption in Sri Lanka: Unilateral Trade Liberalisation

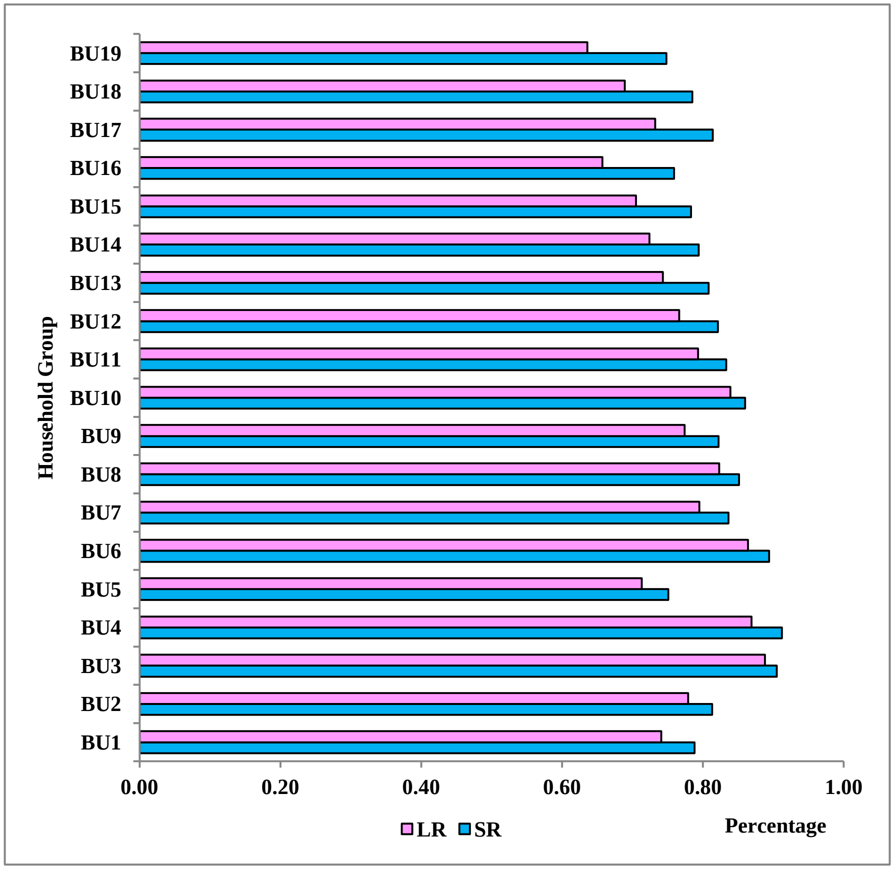


Source: Simulation results derived from SAMGEM Note: SR-Short-Run LR-Long-Run

SR1- SR10-Rural Household Groups SU1-SU10-Urban Household Groups SE1-SE10-Estate Sector Household Groups

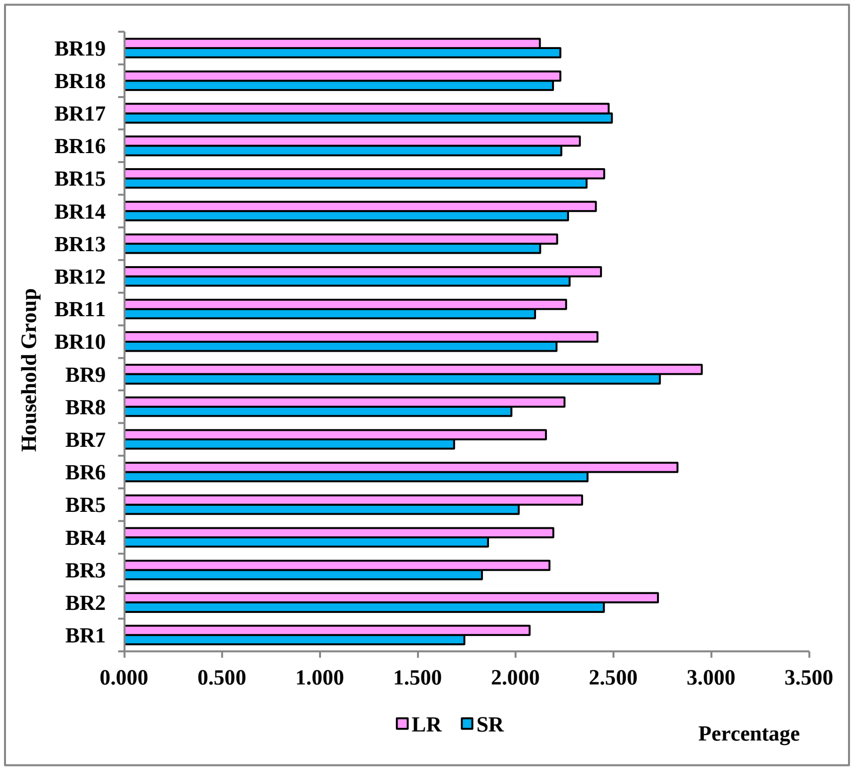
Figure D 4 Projections on Change in Real Household Consumption in Bangladesh: SAFTA

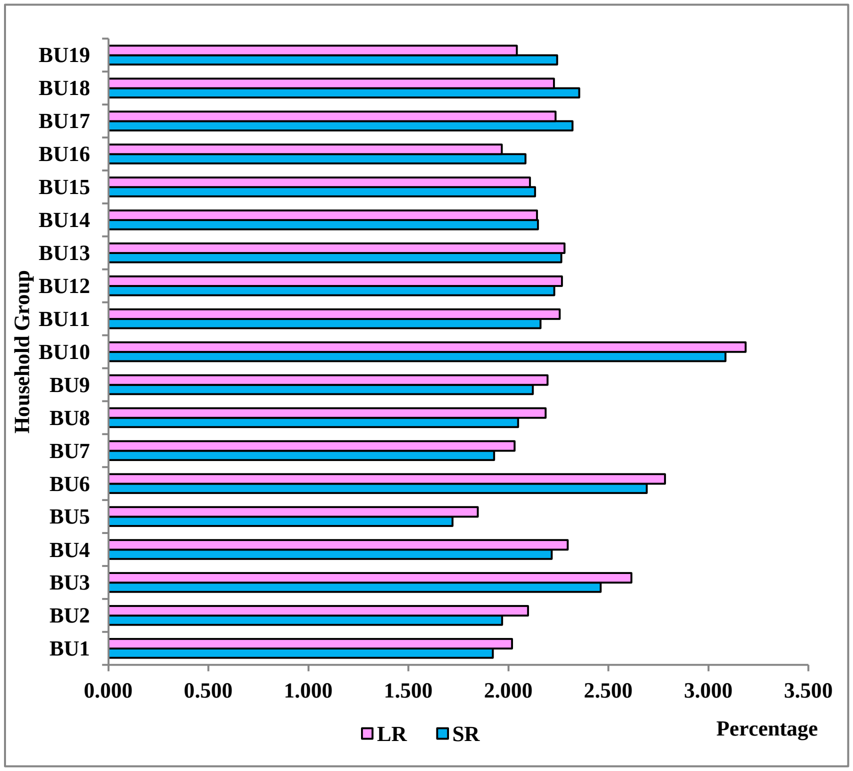




Source: Simulation results derived from SAMGEM
Note: SR-Short-Run LR-Long-Run BR1- BR19-Rural Household Groups BU1-BU19-Urban Household Groups

Projections on Change in Real Household Consumption in Sri Lanka: Customs Union

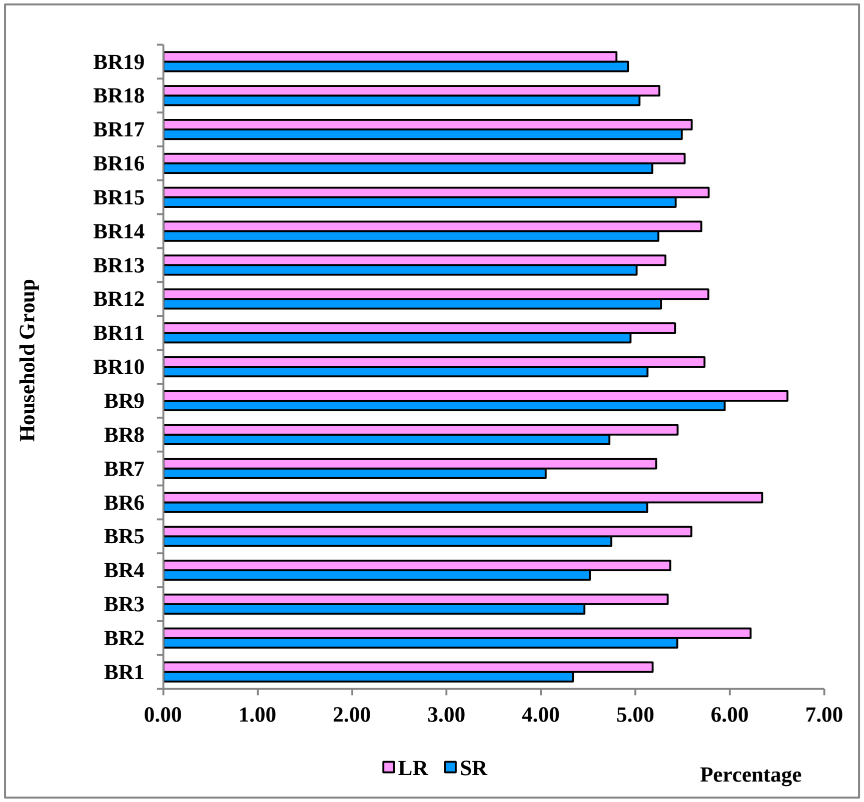


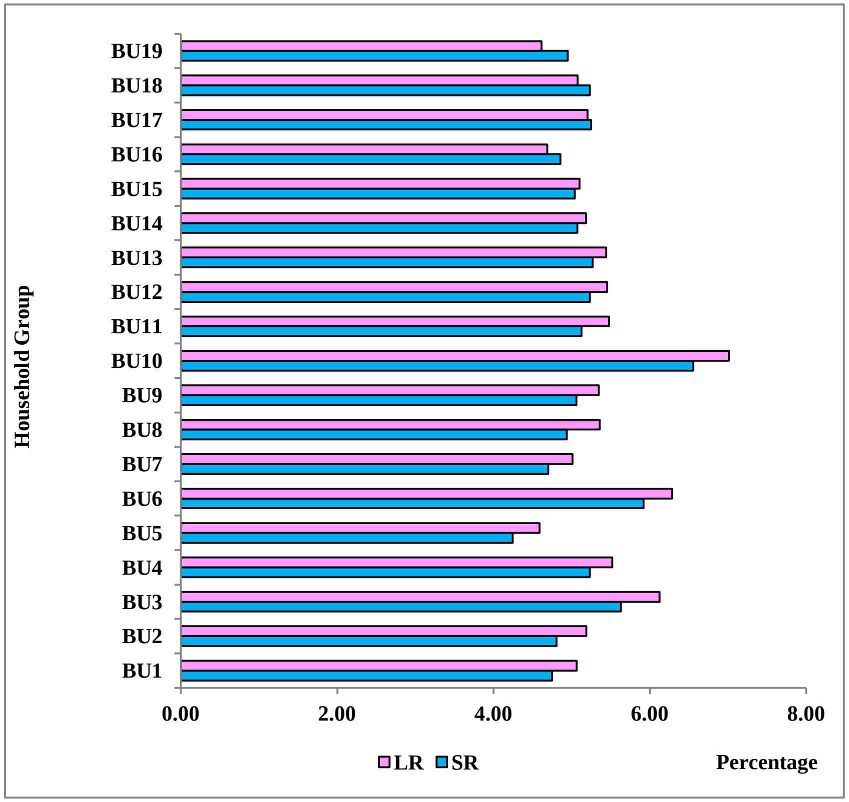


Source: Simulation results derived from SAMGEM

Note: SR-Short-Run LR-Long-Run BR1- BR19-Rural Household Groups BU1-BU19-Urban Household Groups

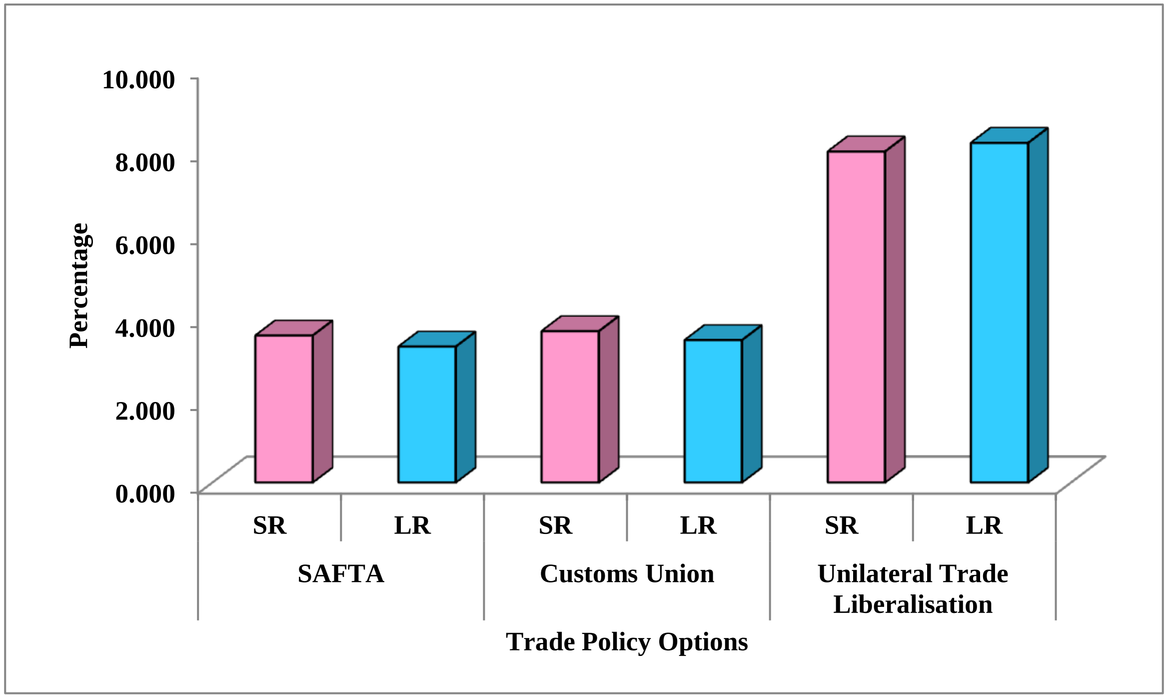
Projections on Change in Real Household Consumption in Bangladesh: Unilateral Trade Liberalisation





Source: Simulation results derived from SAMGEM
Note: SR-Short-Run LR-Long-Run BR1- BR19-Rural Household Groups BU1-BU19-Urban Household Groups

Figure D 5 Projections on Change in Real Household Consumption under Different Trade Policy Options: Rest of South Asia



Source: Simulation results derived from SAMGEM
Note: SR-Short-Run LR-Long-Run

Table D 6 Change in Tax Revenue from Different Sources

SAFTA										
	Short-Run (US $ Million)					**Long-Run (US$ Million)**				
	IND	**PAK**	**LKA**	**BGD**	**XSA**	**IND**	**PAK**	**LKA**	**BGD**	**XSA**
Consumer taxes	6871.45	1742.77	-0.01	1716.09	2012.81	8056.22	2420.57	12.74	1599.79	1896.28
Tax on public goods	0.00	0.02	-0.03	0.00	-4.49	0.00	0.02	-0.05	0.00	-4.37
Tax on intermediate goods	6524.41	64.80	-49.34	-107.51	695.58	7194.82	515.47	-38.00	23.38	-45.95
Factor tax	154.11	28.13	161.66	150.59	873.18	181.38	36.65	257.45	203.71	597.56
Output tax	4137.67	7.65	574.71	-1444.29	1623.14	5743.88	8.63	1708.37	-1149.83	1221.31
Export tax	-782.94	794.86	518.55	0.61	251.12	-1000.73	756.93	666.10	0.48	158.14
Import tax	161.41	-4120.06	-8451.04	-19139.24	-17680.26	1894.15	-2899.09	-7524.26	-19433.06	-19202.36
TOTAL INDIRECT TAXES	**17066.11**	**-1481.83**	**-7245.50**	**-18823.76**	**-12228.92**	**22069.72**	**839.19**	**-4917.66**	**-18755.53**	**-15379.38**
INCOME TAX	**8804.63**	**1675.37**	**435.48**	**1295.58**	**2919.89**	**10369.90**	**2072.71**	**693.25**	**1244.58**	**2050.23**
TOTAL	**25870.74**	**193.54**	**-6810.02**	**-17528.19**	**-9309.03**	**32439.62**	**2911.90**	**-4224.41**	**-17510.96**	**-13329.15**
Customs Union										
Consumer taxes	37588.21	882.69	-6.30	5435.08	2127.98	34145.67	2384.72	-22.72	5503.93	2028.26
Tax on public goods	0.00	0.02	0.38	0.00	-7.26	0.00	0.02	0.47	0.00	-7.61
Tax on intermediate goods	32843.58	908.58	-7.77	-732.65	801.60	33396.62	2109.79	-69.28	-550.82	33.31
Factor tax	43.43	9.04	-435.60	881.16	773.66	-43.33	22.74	-748.67	889.74	484.02
Output tax	38003.63	4.00	-551.69	4874.98	764.53	36122.59	8.67	-5734.10	4860.50	320.96
Export tax	1238.79	1159.99	-1678.14	0.99	224.82	1482.03	1266.49	-1658.57	0.85	0.85
Import tax	92386.57	-7233.08	36669.24	-33412.15	-18737.07	81134.95	-5023.36	33945.28	-33321.51	-20329.95
TOTAL INDIRECT TAXES	**202104.22**	**-4268.75**	**33990.13**	**-22952.60**	**-14051.73**	**186238.52**	**769.07**	**25712.39**	**-22617.32**	**-17345.10**
INCOME TAX	**2458.45**	**806.41**	**-1173.88**	**5102.30**	**2583.71**	**-2471.08**	**1518.17**	**-2014.30**	**4300.99**	**1669.40**
TOTAL	**204562.67**	**-3462.34**	**32816.24**	**-17850.30**	**-11468.03**	**183767.44**	**2287.24**	**23698.09**	**-18316.33**	**-15675.70**

Unilateral Trade Liberalisation										
Consumer taxes	-30725.0	4203.2	-17.8	11081.8	4311.6	-3083.7	17500.5	13.7	11875.9	4618.3
Tax on public goods	0.0	0.3	0.2	0.0	-28.8	0.0	0.4	0.1	0.0	-26.6
Tax on intermediate goods	-69132.9	-15853.4	-108.6	-1989.4	257.9	-58553.7	-7840.2	-57.0	-695.1	-679.0
Factor tax	-42.5	-26.6	-19.5	1697.3	955.2	754.5	156.1	321.4	3006.0	648.7
Output tax	20895.8	40.8	-2280.2	-4976.7	-923.7	61175.0	49.0	2493.0	-1789.8	-1565.0
Export tax	9566.7	4636.6	1224.2	3.3	94.4	3533.6	3838.7	1468.7	2.5	-108.8
Import tax	-1046003.1	-227823.4	-44884.0	-129866.8	-61923.9	-993265.9	-201008.4	-42015.9	-127932.2	-63634.8
TOTAL INDIRECT TAXES	**-1115441.0**	**-234822.5**	**-46085.7**	**-124050.6**	**-57257.4**	**-989440.3**	**-187304.0**	**-37775.9**	**-115532.8**	**-60747.1**
INCOME TAX	**-2573.6**	**-207.9**	**-50.9**	**10738.1**	**3175.1**	**43102.6**	**8309.9**	**865.5**	**15449.9**	**2283.4**
TOTAL	**-1118014.6**	**-235030.4**	**-46136.7**	**-113312.5**	**-54082.3**	**-946337.7**	**-178994.1**	**-36910.4**	**-100082.8**	**-58463.7**

Source: Simulation results derived from SAMGEM

Table D 7 SSA Projections of Percentage Changes in Selected Macroeconomic Variables Under SAFTA

Country/ Region	Variable	SAFTA							
		Short-run				Long-run			
		Mean	Standard Deviation	Confidence Limit		Mean	Standard Deviation	Confidence Limit	
				UL	LL			UL	LL
India	GDP	0.130	0.016	0.200	0.060	0.180	0.024	0.287	0.073
	Terms of Trade	0.260	0.029	0.389	0.131	0.280	0.031	0.416	0.144
	Per Capita Utility	0.200	0.021	0.294	0.106	0.230	0.026	0.347	0.113
	Total Exports	1.040	0.132	1.628	0.452	0.950	0.131	1.537	0.363
	Total Imports	1.070	0.115	1.585	0.555	1.180	0.130	1.760	0.600
	Consumer Price Index (CPI)	0.263	0.031	0.401	0.125	0.291	0.033	0.440	0.141
	Employment								
	Unskilled	0.220	0.031	0.360	0.080	0.000	0.000	0.000	0.000
	Skilled	0.168	0.032	0.310	0.026	0.000	0.000	0.000	0.000
	Capital	0.000	0.000	0.000	0.000	0.257	0.042	0.443	0.071
	Household Income	0.460	0.048	0.672	0.248	0.545	0.057	0.800	0.290
	Govt. revenue	0.303	0.064	0.587	0.019	0.380	0.067	0.679	0.081
	Regional Income	0.459	0.048	0.673	0.245	0.525	0.054	0.767	0.283
Pakistan	GDP	0.190	0.036	0.351	0.029	0.290	0.057	0.546	0.034
	Terms of Trade	0.180	0.098	0.616	-0.256	0.190	0.095	0.616	-0.236
	Per Capita Utility	0.260	0.061	0.534	-0.014	0.350	0.079	0.704	-0.004
	Total Exports	1.710	0.311	3.098	0.322	1.680	0.322	3.120	0.240
	Total Imports	1.160	0.241	2.238	0.082	1.450	0.291	2.752	0.148
	Consumer Price Index (CPI)	0.176	0.092	0.589	-0.237	0.200	0.093	0.616	-0.216
	Employment								
	Unskilled	0.297	0.066	0.594	0.000	0.000	0.000	0.000	0.000

	Skilled	0.203	0.052	0.434	-0.028	0.000	0.000	0.000	0.000
	Capital	0.000	0.000	0.000	0.000	0.407	0.092	0.818	-0.005
	Household Income	0.475	0.145	1.124	-0.174	0.620	0.170	1.379	-0.139
	Govt. revenue	0.016	0.159	0.727	-0.695	0.244	0.192	1.101	-0.613
	Regional Income	0.443	0.152	1.122	-0.236	0.567	0.172	1.337	-0.203
	GDP	0.760	0.121	1.301	0.219	1.580	0.284	2.848	0.312
Sri Lanka	Terms of Trade	0.060	0.221	1.047	-0.927	-0.210	0.230	0.818	-1.238
	Per Capita Utility	0.850	0.214	1.806	-0.106	1.390	0.357	2.985	-0.205
	Total Exports	6.420	1.238	11.956	0.884	8.010	1.407	14.299	1.721
	Total Imports	4.970	0.979	9.345	0.595	6.700	1.084	11.545	1.855
	Consumer Price Index (CPI)	-0.349	0.247	0.756	-1.454	-0.557	0.269	0.646	-1.761
	Employment								
	Unskilled	1.120	0.030	1.256	0.984	0.000	0.000	0.000	0.000
	Skilled	1.176	0.023	1.280	1.072	0.000	0.000	0.000	0.000
	Capital	0.000	0.000	0.000	0.000	2.152	0.486	4.323	-0.018
	Household Income	0.918	0.043	1.110	0.726	1.474	0.244	2.566	0.382
	Govt. revenue	-2.349	0.212	-1.403	-3.295	-1.457	0.345	0.086	-3.000
	Regional Income	0.523	0.236	1.577	-0.531	0.942	0.413	2.788	-0.904
	GDP	0.860	0.130	1.442	0.278	0.710	0.134	1.309	0.111
Bangladesh	Terms of Trade	-1.100	0.184	-0.278	-1.922	-0.910	0.165	-0.171	-1.649
	Per Capita Utility	0.680	0.174	1.458	-0.098	0.480	0.150	1.151	-0.191
	Total Exports	8.070	1.850	16.339	-0.199	6.850	1.459	13.369	0.331
	Total Imports	5.680	1.475	12.274	-0.914	5.560	1.341	11.553	-0.433
	Consumer Price Index (CPI)	-0.893	0.234	0.151	-1.938	-0.741	0.207	0.186	-1.667
	Employment								
	Unskilled	1.200	0.265	2.385	0.015	0.000	0.000	0.000	0.000
	Skilled	1.081	0.188	1.920	0.242	0.000	0.000	0.000	0.000

	Capital	0.000	0.000	0.000	0.000	0.870	0.252	1.998	-0.257
	Household Income	0.111	0.400	1.900	-1.678	0.201	0.446	2.193	-1.791
	Govt. revenue	-1.671	0.516	0.636	-3.978	-1.670	0.379	0.025	-3.365
	Regional Income	-0.173	0.387	1.558	-1.904	-0.186	0.333	1.301	-1.673
	GDP	2.930	0.277	4.169	1.691	2.460	0.250	3.578	1.342
Rest of South Asia	Terms of Trade	-0.700	0.231	0.334	-1.734	-0.940	0.206	-0.019	-1.861
	Per Capita Utility	3.030	0.369	4.678	1.382	2.050	0.265	3.232	0.868
	Total Exports	10.850	1.201	16.220	5.480	13.720	1.404	19.996	7.444
	Total Imports	5.180	0.630	7.996	2.364	3.740	0.568	6.279	1.201
	Consumer Price Index (CPI)	-1.224	0.205	-0.309	-2.139	-1.350	0.189	-0.506	-2.193
	Employment								
	Unskilled	5.027	0.588	7.656	2.398	0.000	0.000	0.000	0.000
	Skilled	3.884	0.472	5.992	1.776	0.000	0.000	0.000	0.000
	Capital	0.000	0.000	0.000	0.000	4.120	0.535	6.510	1.729
	Household Income	2.855	0.458	4.901	0.809	2.360	0.393	4.114	0.606
	Govt. revenue	-3.852	0.421	-1.970	-5.734	-5.516	0.372	-3.855	-7.177
	Regional Income	1.968	0.308	3.343	0.593	0.837	0.369	2.486	-0.812

Source: The results of the Systematic Sensitivity Analysis carried out with RunGEM Software

Note: UL- Upper Limit LL- Lower Limit

Table D 8 SSA Projections of Percentage Changes in Selected Macroeconomic Variables Under Unilateral Trade Liberalisation

Country/ Region	Variable	Unilateral Trade Liberalisation							
		Short-run				Long-run			
		Mean	Standard Deviation	Confidence Limit UL	Confidence Limit LL	Mean	Standard Deviation	Confidence Limit UL	Confidence Limit LL
India	GDP	3.110	0.164	3.845	2.375	3.990	0.276	5.225	2.755
	Terms of Trade	-4.280	0.271	-3.068	-5.492	-3.180	0.275	-1.950	-4.410
	Per Capita Utility	2.470	0.195	3.341	1.599	3.180	0.281	4.438	1.922
	Total Exports	24.760	1.071	29.546	19.974	19.110	1.293	24.889	13.331
	Total Imports	16.760	0.848	20.551	12.969	20.210	0.768	23.644	16.776
	Consumer Price Index (CPI)	-4.164	0.285	-2.890	-5.438	-2.939	0.295	-1.622	-4.257
	Employment								
	Unskilled	4.350	0.313	5.747	2.953	0.000	0.000	0.000	0.000
	Skilled	4.639	0.337	6.145	3.133	0.000	0.000	0.000	0.000
	Capital	0.000	0.000	0.000	0.000	5.145	0.489	7.330	2.960
	Household Income	-0.115	0.212	0.833	-1.063	2.648	0.541	5.067	0.229
	Govt. revenue	-13.103	0.341	-11.578	-14.628	-11.091	0.642	-8.223	-13.959
	Regional Income	-1.583	0.202	-0.679	-2.487	0.780	0.492	2.979	-1.419
Pakistan	GDP	2.770	0.206	3.689	1.851	4.590	0.266	5.781	3.399
	Terms of Trade	-3.840	0.318	-2.419	-5.261	-3.080	0.304	-1.720	-4.440
	Per Capita Utility	1.440	0.271	2.650	0.230	3.290	0.292	4.595	1.985
	Total Exports	22.240	1.084	27.087	17.393	18.880	1.241	24.426	13.334
	Total Imports	11.260	0.748	14.605	7.915	17.870	0.849	21.666	14.074
	Consumer Price Index (CPI)	-4.085	0.298	-2.752	-5.418	-3.196	0.295	-1.877	-4.515

	Employment								
	Unskilled	2.959	0.227	3.971	1.947	0.000	0.000	0.000	0.000
	Skilled	3.144	0.224	4.147	2.141	0.000	0.000	0.000	0.000
	Capital	0.000	0.000	0.000	0.000	5.561	0.333	7.051	4.071
	Household Income	-0.456	0.471	1.651	-2.563	2.639	0.312	4.035	1.243
	Govt. revenue	-19.666	0.929	-15.512	-23.820	-14.977	0.600	-12.297	-17.657
	Regional Income	-2.510	0.520	-0.185	-4.835	0.418	0.425	2.317	-1.481
Sri Lanka	GDP	1.990	0.124	2.544	1.436	4.070	0.251	5.192	2.948
	Terms of Trade	-1.750	0.130	-1.170	-2.330	-2.120	0.135	-1.516	-2.724
	Per Capita Utility	1.120	0.146	1.775	0.465	2.650	0.233	3.690	1.610
	Total Exports	15.170	0.610	17.895	12.445	17.430	0.850	21.232	13.628
	Total Imports	10.470	0.462	12.535	8.405	15.370	0.664	18.338	12.402
	Consumer Price Index (CPI)	-3.362	0.158	-2.656	-4.068	-3.440	0.167	-2.693	-4.187
	Employment								
	Unskilled	2.937	0.304	4.298	1.576	0.000	0.000	0.000	0.000
	Skilled	3.306	0.262	4.476	2.136	0.000	0.000	0.000	0.000
	Capital	0.000	0.000	0.000	0.000	5.425	0.416	7.283	3.567
	Household Income	-0.144	0.248	0.964	-1.252	1.854	0.333	3.341	0.367
	Govt. revenue	-15.913	0.372	-14.252	-17.574	-12.731	0.410	-10.898	-14.564
	Regional Income	-2.275	0.250	-1.158	-3.392	-0.539	0.317	0.878	-1.956
Bangladesh	GDP	5.170	0.444	7.153	3.187	5.230	0.431	7.157	3.303
	Terms of Trade	-6.040	0.624	-3.249	-8.831	-4.940	0.573	-2.377	-7.503
	Per Capita Utility	4.220	0.302	5.572	2.868	3.880	0.375	5.557	2.203
	Total Exports	41.760	2.530	53.068	30.452	34.480	2.758	46.808	22.152
	Total Imports	29.250	2.390	39.931	18.569	30.000	2.080	39.300	20.700
	Consumer Price Index (CPI)	-4.932	0.735	-1.648	-8.216	-4.020	0.446	-2.027	-6.013
	Employment								

	Unskilled	7.121	0.411	8.960	5.282	0.000	0.000	0.000	0.000
	Skilled	6.118	0.318	7.539	4.697	0.000	0.000	0.000	0.000
	Capital	0.000	0.000	0.000	0.000	6.845	0.547	9.290	4.400
	Household Income	1.388	0.507	3.653	-0.877	2.774	0.628	5.581	-0.033
	Govt. revenue	-10.804	0.399	-9.020	-12.588	-9.543	0.676	-6.521	-12.565
	Regional Income	-0.534	0.662	2.426	-3.494	0.233	0.781	3.726	-3.260
Rest of South Asia	GDP	6.180	0.425	8.080	4.280	6.120	0.419	7.993	4.247
	Terms of Trade	-3.780	0.203	-2.875	-4.685	-4.270	0.261	-3.105	-5.435
	Per Capita Utility	4.880	0.499	7.112	2.648	3.720	0.403	5.521	1.919
	Total Exports	21.830	1.009	26.342	17.318	27.990	1.646	35.346	20.634
	Total Imports	9.870	0.518	12.183	7.557	8.160	0.456	10.200	6.120
	Consumer Price Index (CPI)	-6.116	0.201	-5.216	-7.016	-6.185	0.251	-5.061	-7.309
	Employment								
	Unskilled	10.427	0.509	12.702	8.152	0.000	0.000	0.000	0.000
	Skilled	9.287	0.353	10.864	7.710	0.000	0.000	0.000	0.000
	Capital	0.000	0.000	0.000	0.000	10.558	0.670	13.553	7.563
	Household Income	2.989	0.482	5.143	0.835	3.035	0.527	5.390	0.680
	Govt. revenue	-22.381	0.454	-20.353	-24.409	-24.194	0.627	-21.390	-26.998
	Regional Income	-0.726	0.389	1.011	-2.463	-1.988	0.496	0.230	-4.206

Source: The results of the Systematic Sensitivity Analysis carried out with RunGEM Software

Note: UL- Upper Limit LL- Lower Limit

APPENDIX E

Table E 1 Percentage Change in CPI under SAFTA and Unilateral Trade Liberalisation

	SR1	SR2	SR3	SR4	SR5	SR6	SR7	SR8	SR9	SR10
SR	-0.513	-0.417	-0.561	-0.562	-0.533	-0.423	-0.449	-0.394	-0.345	-0.331
LR	-0.763	-0.703	-0.852	-0.839	-0.800	-0.649	-0.679	-0.590	-0.513	-0.443
	SU1	**SU2**	**SU3**	**SU4**	**SU5**	**SU6**	**SU7**	**SU8**	**SU9**	**SU10**
SR	-0.359	-0.415	-0.451	-0.468	-0.393	-0.239	-0.315	-0.277	-0.270	-0.222
LR	-0.610	-0.714	-0.753	-0.697	-0.673	-0.465	-0.535	-0.361	-0.418	-0.313
	SE1	**SE2**	**SE3**	**SE4**	**SE5**	**SE6**	**SE7**	**SE8**	**SE9**	**SE10**
SR	-0.457	-0.658	-0.492	-0.607	-0.613	-0.276	-0.424	-0.262	-0.258	-0.234
LR	-0.761	-1.005	-0.793	-0.906	-0.924	-0.545	-0.665	-0.529	-0.306	-0.298

Percentage change in CPI under the unilateral trade liberalisation

	SR1	SR2	SR3	SR4	SR5	SR6	SR7	SR8	SR9	SR10
SR	-3.640	-3.434	-3.855	-3.824	-3.809	-3.503	-3.577	-3.477	-3.320	-3.250
LR	-3.762	-3.631	-4.094	-4.030	-3.992	-3.581	-3.678	-3.495	-3.265	-3.068
	SU1	**SU2**	**SU3**	**SU4**	**SU5**	**SU6**	**SU7**	**SU8**	**SU9**	**SU10**
SR	-3.490	-3.663	-3.580	-3.748	-3.600	-3.148	-3.390	-2.961	-3.154	-2.991
LR	-3.633	-3.930	-3.866	-3.841	-3.828	-3.222	-3.451	-2.922	-3.056	-2.749
	SE1	**SE2**	**SE3**	**SE4**	**SE5**	**SE6**	**SE7**	**SE8**	**SE9**	**SE10**
SR	-3.572	-4.251	-3.779	-4.054	-4.106	-3.278	-3.781	-3.291	-3.143	-3.054
LR	-3.824	-4.640	-4.035	-4.328	-4.414	-3.441	-3.923	-3.462	-3.387	-3.217

Source: Simulation results derived from SAMGEM
Note: SR-Short-Run LR-Long-Run
SR1-SR10 – Rural Household Groups SU1-SU10 – Urban Household Groups
SE1-SE10 – Estate Sector Household Groups

Table E 2 Calculation of "t" Values to Determine Statistical Signifcance of S-Gini Co-efficient

Test of Significance: "t" values for Urban Sector

Household Group	Base Year			SAFTA						Unilateral Trade Liberalisation					
				Short-Run			Long-Run			Short-Run			Long-Run		
	μ	σ	t	μ	σ	t	μ	σ	t	μ	σ	t	μ	σ	t
Total	0.4658	0.0134	34.76	0.4655	0.0135	34.48	0.4651	0.0134	34.70	0.4646	0.0134	34.67	0.4637	0.0135	34.34
Between Groups	0.4525	0.0135	33.51	0.4522	0.0137	33.00	0.4518	0.0133	33.97	0.4513	0.0136	33.18	0.4504	0.0134	33.61
Within Groups	0.0133	0.0014	9.5	0.01333	0.00142	9.36	0.01332	0.00132	10.09	0.0133	0.0013	10.23	0.0133	0.0013	10.23
Gini by Households															
Decile 1	0.1226	0.0085	14.42	0.1226	0.0085	14.34	0.1226	0.0085	14.42	0.1226	0.0085	14.34	0.1226	0.0085	14.34
Decile 2	0.0435	0.0015	29.0	0.0435	0.0015	28.13	0.0435	0.0015	28.13	0.0435	0.0015	28.13	0.0435	0.0015	28.13
Decile 3	0.0321	0.0012	26.75	0.0321	0.0012	25.55	0.0321	0.0012	25.55	0.0321	0.0012	25.55	0.0321	0.0012	25.55
Decile 4	0.0339	0.0013	26.07	0.0339	0.0013	25.99	0.0339	0.0013	25.99	0.0339	0.0013	25.99	0.0339	0.0013	25.99
Decile 5	0.0321	0.0012	26.75	0.0321	0.0011	26.81	0.0321	0.0011	26.81	0.0321	0.0011	26.81	0.0321	0.0011	26.811
Decile 6	0.0332	0.0012	27.66	0.0332	0.0011	28.00	0.0332	0.0011	28.00	0.0332	0.0011	28.00	0.0332	0.0011	28.00
Decile 7	0.0383	0.0014	27.36	0.0382	0.0014	26.26	0.0382	0.0014	26.26	0.0382	0.0014	26.26	0.0382	0.0014	26.26
Decile 8	0.0490	0.0018	27.22	0.0490	0.0018	27.18	0.0490	0.0018	27.18	0.0490	0.0018	27.18	0.0490	0.0018	27.18
Decile 9	0.0678	0.0029	23.37	0.0678	0.0029	22.68	0.0678	0.0029	22.68	0.0678	0.0029	22.68	0.0678	0.0029	22.68
Decile 10	0.2737	0.0321	8.52	0.2737	0.0321	8.52	0.2737	0.0321	8.52	0.2737	0.0321	8.52	0.2737	0.0321	8.52

Source: Author's calculations from results estimated from DAD

Note: μ=Mean Value σ= Standard Deviation $t = \frac{\mu}{\sigma}$

The above figures have been round off in calculating the "t" values

Test of Significance: "t" values for Rural Sector

Household Group	Base Year			SAFTA						Unilateral Trade Liberalisation					
				Short-Run			Long-Run			Short-Run			Long-Run		
	μ	σ	t	μ	σ	t	μ	σ	t	μ	σ	t	μ	σ	t
Total	0.2990	0.0134	22.31	0.29866	0.0134	22.28	0.29860	0.0134	22.28	0.29801	0.0134	22.23	0.29787	0.0134	22.22
Between Groups	0.2915	0.0135	21.59	0.29119	0.0136	21.41	0.29111	0.0135	21.56	0.29053	0.0136	21.36	0.29040	0.0135	21.51
Within Groups	0.0074	0.0001	74.0	0.0074	0.00013	56.92	0.0074	0.00013	56.92	0.0074	0.0001	74.0	0.0074	0.0001	74.0
Gini by Households															
Decile 1	0.1053	0.02093	5.034	0.1053	0.02093	5.034	0.1053	0.02093	5.034	0.1053	0.02093	5.034	0.1053	0.02093	5.034
Decile 2	0.02791	0.0014	19.17	0.02791	0.0014	19.17	0.02791	0.0014	19.17	0.02791	0.0014	19.17	0.02791	0.0014	19.17
Decile 3	0.01882	0.0011	15.74	0.01882	0.0011	15.74	0.01882	0.0011	15.74	0.01882	0.0011	15.74	0.01882	0.0011	15.74
Decile 4	0.0166	0.0009	17.05	0.0166	0.0009	17.05	0.0166	0.0009	17.05	0.0166	0.0009	17.05	0.0166	0.0009	17.05
Decile 5	0.0220	0.0011	19.19	0.0220	0.0011	19.19	0.0220	0.0011	19.19	0.0220	0.0011	19.19	0.0220	0.0011	19.19
Decile 6	0.0188	0.0011	16.92	0.0188	0.0011	16.92	0.0188	0.0011	16.92	0.0188	0.0011	16.92	0.0188	0.0011	16.92
Decile 7	0.0272	0.0015	17.53	0.0272	0.0015	17.53	0.0272	0.0015	17.53	0.0272	0.0015	17.53	0.0272	0.0015	17.53
Decile 8	0.02631	0.0017	15.11	0.02631	0.0017	15.11	0.02631	0.0017	15.11	0.02631	0.0017	15.11	0.02631	0.0017	15.11
Decile 9	0.0399	0.0027	14.34	0.0399	0.0027	14.34	0.0399	0.0027	14.34	0.0399	0.0027	14.34	0.0399	0.0027	14.34
Decile 10	0.1923	0.0305	6.28	0.1923	0.0305	6.28	0.1923	0.0305	6.28	0.1923	0.0305	6.28	0.1923	0.0305	6.28

Source: Author's calculations from results estimated from DAD

Note: μ=Mean Value σ= Standard Deviation $t = \frac{\mu}{\sigma}$

The above figures have been round off in calculating the "t" values

Test of Significance: "t" values for Estate Sector

Household Group	Base Year			SAFTA						Unilateral Trade Liberalisation					
				Short-Run			Long-Run			Short-Run			Long-Run		
	μ	σ	t	μ	σ	t	μ	σ	t	μ	σ	t	μ	σ	t
Total	0.4040	0.007	57.17	0.4033	0.007	57.61	0.4032	0.007	57.6	0.4026	0.007	57.51	0.4025	0.007	57.5
Between Groups	0.3911	0.006	65.18	0.3904	0.006	65.06	0.3903	0.006	65.05	0.38977	0.006	64.96	0.38970	0.006	64.95
Within Groups	0.01289	0.0001	128.9	0.01288	0.0005	25.76	0.01287	0.0004	32.17	0.01286	0.0006	21.43	0.01286	0.0005	25.72
Gini by Households															
Decile 1	0.2584	0.0672	3.84	0.2584	0.0672	3.84	0.2584	0.0672	3.84	0.2584	0.0672	3.84	0.2584	0.0672	3.84
Decile 2	0.0363	0.0005	64.77	0.0363	0.0005	64.77	0.0363	0.0005	64.77	0.0363	0.0005	64.77	0.0363	0.0005	64.77
Decile 3	0.0275	0.0004	66.41	0.0275	0.0004	66.41	0.0275	0.0004	66.41	0.0275	0.0004	66.41	0.0275	0.0004	66.41
Decile 4	0.0246	0.0003	69.21	0.0246	0.0003	69.21	0.0246	0.0003	69.21	0.0246	0.0003	69.21	0.0246	0.0003	69.21
Decile 5	0.0244	0.0003	69.94	0.0244	0.0003	69.93	0.0244	0.0003	69.93	0.0244	0.0003	69.93	0.0244	0.0003	69.93
Decile 6	0.0263	0.0003	69.62	0.0263	0.0003	69.63	0.0263	0.0003	69.63	0.0263	0.0003	69.63	0.0263	0.0003	69.63
Decile 7	0.0283	0.0004	70.85	0.0283	0.0004	70.85	0.0283	0.0004	70.85	0.0283	0.0004	70.85	0.0283	0.0004	70.85
Decile 8	0.0365	0.0005	69.06	0.0365	0.0005	69.06	0.0365	0.0005	69.06	0.0365	0.0005	69.06	0.0365	0.0005	69.06
Decile 9	0.0559	0.0008	64.98	0.0559	0.0008	64.98	0.0559	0.0008	64.98	0.0559	0.0008	64.98	0.0559	0.0008	64.98
Decile 10	0.3025	0.0178	16.94	0.3025	0.0178	16.94	0.3025	0.0178	16.94	0.3025	0.0178	16.94	0.3025	0.0178	16.94

Source: Author's calculations from results estimated from DAD

Note: μ=Mean Value σ= Standard Deviation $t = \frac{\mu}{\sigma}$

The above figures have been round off in calculating the "t" values

Table E 3 Calculations of "t" Values to Determine Statistical Significance of FGT indices

Test of Significance: “t” values for Urban Sector

Household Group	Base Year			SAFTA						Unilateral Trade Liberalisation					
				Short-Run			Long-Run			Short-Run			Long-Run		
	μ	σ	t	μ	σ	t	μ	σ	t	μ	σ	t	μ	σ	t
Total **α =0**	7.32	0.006	1220	7.12	0.006	1186	6.9	0.006	1150	5.01	0.005	1002	4.87	0.005	974
α =1	1.5	0.001	1500	1.46	0.002	730	1.43	0.001	1430	1.16	0.001	1160	1.15	0.001	1150
α =2	0.53	0.000	infinity	0.51	0.000	infinity	0.5	0.000	infinity	0.41	0.000	infinity	0.4	0.000	infinity
Gini by Households															
Decile 1 **α =0**	72.92	0.036	2025	70.94	0.037	1917	69.59	0.038	1831	50	0.041	1219	48.64	0.041	1186
α =1	15.01	0.014	1072	14.62	0.014	1044	14.31	0.014	1022	11.6	0.013	892	11.49	0.013	883
α =2	5.3	0.007	752	5.16	0.007	737	5.08	0.007	725	4.1	0.006	683	4.06	0.006	676

Source: Author’s calculations from results estimated from DAD

Note: μ=Mean Value σ= Standard Deviation $t = \frac{\mu}{\sigma}$

The above figures have been round off in calculating the “t” values

Test of Significance: “t” values for Rural Sector

Household Group	Base Year			SAFTA						Unilateral Trade Liberalisation					
				Short-Run			Long-Run			Short-Run			Long-Run		
	μ	σ	t	μ	σ	t	μ	σ	t	μ	σ	t	μ	σ	t
Total **α =0**	16.02	0.003	5340	15.31	0.004	3827	14.95	0.003	4983	12.21	0.003	4070	11.08	0.003	3693
α =1	38.86	0.033	1177	4.10	0.003	1366	4.01	0.003	1336	3.41	0.003	1136	3.3	0.003	1100
α =2	1.07	0.004	267	1.01	0.001	1010	0.97	0.001	970	0.74	0.003	246	0.71	0.003	236
Gini by Households															
Decile 1 **α =0**	100	0.000	infinity	100	0.000	infinity	100	0.000	infinity	100	0.000	infinity	100	0.000	infinity
α =1	38.86	0.033	1177	37.96	0.033	1150	37.43	0.033	1134	33.48	0.036	930	32.65	0.036	906
α =2	10.55	0.003	3516	9.99	0.003	3330	9.67	0.003	3223	7.54	0.002	3770	7.51	0.002	3755
Decile 2 **α =0**	60.14	0.015	4009	53.11	0.016	3319	49.48	0.017	2910	22.15	0.013	1703	18.01	0.012	1500
α =1	3.88	0.001	3880	3.11	0.001	3110	2.68	0.001	2680	0.64	0.000	infinity	0.4	0.000	infinity
α =2	0.34	0.001	340	0.24	0.001	240	0.2	0.001	200	0.025	0.000	infinity	0.012	0.000	infinity

Source: Author’s calculations from results estimated from DAD

Note: μ=Mean Value σ= Standard Deviation $t = \frac{\mu}{\sigma}$

The above figures have been round off in calculating the “t” values

Test of Significance: “t” values for Estate Sector

Household Group	Base Year			SAFTA						Unilateral Trade Liberalisation					
				Short-Run			Long-Run			Short-Run			Long-Run		
	μ	σ	t	μ	σ	t	μ	σ	t	μ	σ	t	μ	σ	t
Total **α =0**	24.2	0.017	1423	23.36	0.017	1374	23.02	0.017	1354	17.31	0.015	1154	16.3	0.015	1086
α =1	4.93	0.004	1232	4.66	0.004	1165	4.48	0.004	1120	3.44	0.004	860	3.27	0.004	817
α =2	1.65	0.002	825	1.56	0.002	780	1.5	0.002	750	1.17	0.002	585	1.11	0.002	555
Gini by Households															
Decile 1 **α =0**	100	0.000	infinity	100	0.000	infinity	100	0.000	infinity	100	0.000	infinity	100	0.000	infinity
α =1	35.73	0.018	1985	34.76	0.018	1931	34.14	0.018	1896	29.81	0.019	1568	28.91	0.02	1445
α =2	14.74	0.019	775	14.12	0.019	743	13.73	0.019	722	11.24	0.019	591	10.78	0.019	567
Decile 2 **α =0**	100	0.000	infinity	100	0.000	infinity	100	0.000	infinity	72.88	0.057	1278	62.71	0.063	995
α =1	12.09	0.005	2418	10.85	0.005	2170	9.98	0.005	1996	4.44	0.005	888	3.59	0.004	897
α =2	1.64	0.001	1640	1.36	0.001	1360	1.18	0.001	1180	0.37	0.005	74	0.27	0.001	270
Decile 3 **α =0**	42.37	0.064	662	33.89	0.061	555	30.05	0.059	509	-	-	-	-	-	-
α =1	1.36	0.002	680	0.82	0.002	410	0.52	0.001	520	-	-	-	-	-	-
α =2	0.05	0.000	infinity	0.02	0.000	infinity	0.01	0.000	infinity	-	-	-	-	-	-

Source: Author’s calculations from results estimated from DAD

Note: μ=Mean Value σ= Standard Deviation $t = \frac{\mu}{\sigma}$

The above figures have been rounded off in calculating the “t” values