

## **Chapter 5**

### **Construction of the Data Base for the Sri Lankan General Equilibrium Model**

Researchers must have access to an economy-wide data set to weigh up the effects of policy adjustments in an economy-wide setting or to recognise the most appropriate policies for an economy that would achieve goals, such as employment generation, GDP growth and poverty alleviation. This type of data set represents the overall socio-economic structure of the economy. This chapter illustrates the process of compiling the data base used in executing the model developed as explained in Chapter 4. As Bandara (1989) highlights, the compilation and construction of an adequate data base in order to implement a CGE model is a cumbersome and extremely time consuming task, particularly in the context of developing countries. There are several steps in producing a data base that meets the requirements of a general equilibrium model. It is imperative to make decisions regarding aggregation of data such as the types of commodities, industries, households, sources of supply of commodities and types of factors of production to be included in the model. National I-O tables and SAMs generally supply the data for CGE models. Other data required including various elasticity parameters are taken from available literature.

This chapter is organised as follows. Section 5.1 describes the main data requirements of the model. Construction of the input-output data base of the model is described in Section 5.2. The extensions made to the original I-O data are examined in Section 5.3. Section 5.4 explains the process of obtaining elasticities and other parameters required for the model. The development of the data set supporting tops-down regional extension of this Sri Lankan model is explained in Section 5.5. Section 5.6 presents a summary of the chapter.

#### **5.1 Data requirements of the model**

While Sri Lanka started collection and publication of primary socio-economic data a long time before many other developing countries, the quality and reliability of some of those published data seem to be the same as in other developing countries. That is, poor. There are many organisations in Sri Lanka that publish primary socio-economic data such as the CBSL, the

DCS, the IPS and several other relevant government authorities (Ministry of Finance and Planning, Fertiliser Secretariat, Department of Agriculture...etc). Other than these, some international organisations such as the Food and Agriculture Organisation (FAO), the WB, the ADB and the IMF also have a variety of publications on Sri Lanka.

### **5.1.1 The I-O structure**

An I-O table describes the flow of goods and services between all the individual sectors of a national economy over a stated period of time, usually for a calendar or financial year (Leontief, 1986). It summarises the origin of all the various inputs and the destinations of all the various outputs of all industries in an economy (Yan, 1968). It shows goods and services produced by each industry and the destinations of those goods and services produced by a particular industry for different users which could be utilised as intermediate inputs by other industries or be used directly by final users (private consumption, government consumption, investment and exports).

Each column of the table shows the cost structure of an industry for intermediate and primary factor inputs plus taxes paid on production less any subsidies received. Each row of the table shows the total sales of output of each industry to different users. Although in principle the intersectoral flows as represented in an I-O table can be thought of as being measured in physical terms, in practice most I-O tables are constructed in value terms. They are based on the principle that the value sum of all outputs must be equal to the value sum of all inputs for the production structure, and the total supply of goods and services must be equal to the total use for the economy as a whole (Amarasinghe & Bandara, 2005).

The structural details of the I-O data base for the Sri Lankan model follow closely that of the ORANI-G (Dixon, et al., 1982). Figure 5.1 represents the details of input-output data matrices used in the model. It consists of an absorption matrix and an import duty matrix. The columns in the absorption matrix represent six agents in the economy.

- 1) Domestic producers divided into I industries
- 2) Investors divided into I industries
- 3) Households divided into H household groups
- 4) An aggregate foreign purchaser of exports

- 5) Other demand category mainly corresponding to government sector
- 6) Changes in inventories

		Absorption Matrix					
		1	2	3	4	5	6
		Producers	Investors	Household	Export	Government	Change in Inventories
		← I →	← I →	← H →	← 1 →	← 1 →	← 1 →
Size	↑ C×S ↓	← I →	← I →	← H →	← 1 →	← 1 →	← 1 →
Basic Flows	↑ C×S ↓	V1BAS	V2BAS	V3BAS	V4BAS	V5BAS	V6BAS
Taxes	↑ C×S ↓	V1TAX	V2TAX	V3TAX	V4TAX	V5TAX	n/a
Labour	↑ O ↓	V1LAB					
Capital	↑ 1 ↓	V1CAP					
Land	↑ 1 ↓	V1LND					
Industry Subsidies	↑ 1 ↓	V1SUB					
Other Costs	↑ 1 ↓	V1OCT					

C = Number of Commodities

I = Number of Industries

S = Sources of commodities (Domestic, Imported)

O = Number of Occupation Types

H = Number of Household Groups

Size	Import Duty
← 1 →	← 1 →
↑ C ↓	V0TAR

**Figure 5.1: I-O database**

Source: Horridge (2007)

The records in each column explain the structure of the purchases made by the agents identified in the column heading. Each of the commodity types identified in the model can be found locally or from overseas imports.

Both foreign and domestic commodities used by industries as inputs for current production and capital formation are consumed by households and government and exported, or are added

to or subtracted from inventories. Only domestically produced commodities are used for export. Commodity taxes are payable on the purchases. Current production of commodities uses intermediate inputs as well as primary factors (that is labour divided into O occupations, fixed capital and agricultural land). Subsidies include subsidies provided for different industries. The other cost category covers various miscellaneous taxes. Primary factors are utilised only in current production according to the requirements of the model as stated in the previous chapter. Hence, there are no accounts of labour, capital, land and subsidies in the final demand columns.

Each cell in the absorption matrix of Figure 5.1 represents the corresponding data matrix. For example, VIBAS is a three-dimensional array showing the value of the basic demand quantity of commodity C, from source S, by industry I for current production. It is considered that each industry is producing only a single commodity in this study. Therefore, there is no MAKE matrix<sup>11</sup> as in the case of ORANI-G. Tariffs on imports are assumed to be levied at rates which vary by commodity, but not by user. The vector V0TAR represents the tariff revenues collected.

### **5.1.2 Sources of data in the model**

#### **I-O table**

According to the available literature, there have been approximately 20 I-O tables and SAMs produced and/or published in respect of the Sri Lankan economy. Of them, the first table was compiled for the year 1963 and this was published by the CBSL (Bandara & Kelegama, 2008). Since then, many attempts have been made by other organisations and individuals to compile or update I-O tables and SAMs for Sri Lanka. Table 5.1 describes the history of I-O tables and SAMs prepared for the Sri Lankan economy. To implement the model in this study, year 2000 I-O table for Sri Lanka published by the IPS (Amarasinghe & Bandara, 2005) is used as the primary source as it is the most recent I-O table developed for Sri Lanka which reflects the production structure of the Sri Lankan economy (Table 5.1).

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<sup>11</sup> MAKE matrix shows the value of output of each commodity by each industry when multi-production occurs.

**Table 5.1: History of I-O tables and SMAs prepared for the Sri Lankan economy**

No	Author	Base year	Year of publication	No. of Sectors
1	Perera	1963	1964 published	39
2	Ministry of Finance and Planning	1965	1966 unpublished	41
3	Ministry of Finance and Planning	1968	1970 unpublished	41
4	Pyatt et al.	1970	1977 published	48 (SAM and I-O table)
5	DCS	1970	Undated and unpublished	23
6	National Planning Department (NPD)	1976	Undated and unpublished	44
7	DCS	1980	Published and undated	23
8	Mertens	1980	1984 published	20 (SAM)
9	DCS	1980,1981, 1982,and 1983	1987 published	27
10	Maasland	1981	1990 published	4 (SAM)
11	NPD	1981	Undated and unpublished	24
12	Herat	1981	1994 published	6 (SAM)
13	NPD	1981	Undated and unpublished	38
14	Blitzer and Eckuas	1983	1986 published	11
15	NPD	1986	undated	24
16	CIE	1989	Undated and unpublished	37
17	ESCAP	1990	1993 published	33
18	DCS	1995	2000published	
19	Amarasinghe and Bandara	2000	2005 published	48
20	Naranpanawa and Bandara	1995	2006 published	38 (SAM)

Source: Bandara and Kelegama (2008)

A schematic representation of year 2000 I-O table for Sri Lanka is illustrated in Figure 5.2. The structure of the domestic absorption matrix of the I-O table is shown in Figure 5.2a. There is a square matrix describing the input-output relations among different sectors and five

vectors describing final demands. There are three vectors explaining payments to factors of production (labour, capital and land), indirect taxes and industry subsidies. Further, there is a separate import matrix (Figure 5.2b). A separate vector is there representing the import duty data. This I-O table does not provide information on margins. The margins are modelled as direct flows. There is no available published data on margins<sup>12</sup>. Therefore, we follow the ORANI no margin (ORANI-NM) version (Horridge, 2002). The I-O table 2000 aggregates the Sri Lankan economy into 48 sectors. An aggregated version of the I-O table is presented in Table 5.2a with its 48 commodities/industries grouped into three broad sectors, agriculture, industry and services.

## **5.2 Construction of the I-O data base**

### **5.2.1 Sector aggregation**

The original I-O table consists of 48 industries. This study deals only with 40 industries aggregated from the original I-O table. Most of the industries and commodities in this aggregation are agricultural production and processing sectors, as the primary focus of the study is the agricultural sector. This includes 16 agricultural production sectors, 14 manufacturing sectors of which 6 are agricultural processing and 10 services sectors. The aggregation of 48 sectors into 40 sectors is illustrated in Table 5.3. These industries produce 40 commodities so that there is no multi-production. The main reasons for this aggregation were to keep the agriculture sector highly disaggregated and to overcome data limitations.

### **5.2.2 Conversion from producers' prices to basic prices**

The year 2000 I-O table for Sri Lanka was valued at producers' prices rather than basic prices net of tax. To implement this model, it is essential that the data base should be in basic prices. "Producers' prices" indicates that the values of the commodity flows include indirect taxes and basic prices. Therefore, it is important to convert the data matrices from producers' prices to

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<sup>12</sup> In ORANI-G, M of the domestically produced goods are assumed to be used as margin services (wholesale and retail trade, and transport) which are required to transfer commodities from their sources to their users. In this model these margin services are modelled as direct flows.

basic prices. To convert, the indirect tax matrix for each user was subtracted from the commodity flows in producers' prices.

### 5.2.3 Construction of tax flows

There are no separate tax matrices provided in the 2000 I-O table. Indirect taxes are presented only as a row vector in the primary factor quadrant of the I-O table (Figure 5.2 a). Thus, this tax row can be regarded as taxes associated with industries. Entry in each column of this row represents taxes linked with each industry's sales to different users. The model needs information on indirect taxes charged on each of the commodities. Therefore, it is necessary to identify various components of sales taxes and split it among users. The indirect tax row includes taxes on sales of intermediate inputs and consumer goods for each industry and export duties on exports.

Intermediate Demand (C×I)	Private Consumption (C×1)	Government (C×1)	Capital Formation (C×1)	Change in Inventories (C×1)	Exports (C×1)
Primary Factors (2×I)	C = 48 Commodities  I = 48 Industries				
Indirect taxes (1×I)					
Industry Subsidies (1×I)					

(a) Domestic absorption matrix

Intermediate Demand (C×I)	Private Consumption (C×1)	Government (C×1)	Capital Formation (C×1)	Change in Inventories 0	Exports 0
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(b) Import absorption matrix

**Figure 5.2: Schematic representation of year 2000 I-O table for Sri Lanka**

**Table 5.2: Aggregate I-O table of Sri Lanka 2000 at producers' price (Rs. Million)**

Industry	Agriculture	Industry	Services	Private consumption expenditure	Govt. consumption expenditure	Investment	Inventory changes	Exports	Imports	Import duty	Total supply
Commodities											
Agriculture	8723	82421	4618	129053	3574	5403	5319	18813	0	0	257928
Industry	31837	112664	93882	263437	21512	104436	-85299	396303	0	0	257928
Services	7351	82204	201421	300145	141220	98971	90404	77185	0	0	257928
Import	9303	322131	9099	186232	10550	109938	0	0	623569	23684	647253
Land	67439	0	0								
Capital	46070	228659	280475								
Compensation of employees	88388	107614	297812								
Indirect tax	0	6128	116192								
Subsidy	-1183	-3061	-4595								
Total input	257928	938760	998904								

(a) Domestic absorption table

Industry	Agriculture	Industry	Services	Private consumption expenditure	Govt. consumption expenditure	Investment	Inventory changes	Exports	Imports	Import duty	Total supply
Commodities											
Agriculture	1618	23896	693	26370	717	0	0	0	50131	3163	53294
Industry	7685	298235	8406	90578	9833	109938	0	0	504154	20520	524674
Services	0	0	0	69284	0	0	0	0	69284	0	69284
Imports	9303	322131	9099	186232	10550	109938	0	0	623569	23684	647253

(b) Import matrix (CIF values)

Source: Compiled based on Amarasinghe and Bandara (2005)

**Table 5.3: Sector aggregation**

Sectors in the original I-O table		Sector aggregation	
No.	Sector	No.	Sector
1.	Tea Growing- High elevation	1.	Tea Growing
2.	Tea Growing- Medium elevation	1.	Tea Growing
3.	Tea Growing- Low elevation	1.	Tea Growing
4.	Rubber Growing	2.	Rubber Growing
5.	Coconut and Toddy	3.	Coconut and Toddy
6.	Paddy	4.	Paddy
7.	Vegetables	5.	Vegetables
8.	Fruit	6.	Fruit
9.	Highland Crops	7.	Highland Crops
10.	Potatoes	8.	Potatoes
11.	Minor Export Crops	9.	Minor Export Crops
12.	Tobacco	10.	Tobacco
13.	Betel and Areca nuts	11.	Betel and Areca nuts
14.	Miscellaneous Agriculture Products	12.	Miscellaneous Agriculture Products
15.	Livestock	16.	Livestock and Fish
16.	Plantation Development	13.	Plantation Development
17.	Firewood	14.	Firewood
18.	Forestry	15.	Forestry
19.	Fisheries	16.	Livestock and Fish
20.	Mining and Quarrying	30.	Other Industries
21.	Tea Processing	17.	Tea Processing
22.	Rubber Processing	18.	Rubber Processing
23.	Coconut Processing	19.	Coconut Processing
24.	Rice Milling	20.	Rice Milling
25.	Flour Milling	21.	Flour Milling
26.	Food, Beverages and Other	22.	Food, Beverages and Other
27.	Textiles, Footwear and Leather	23.	Textiles, Footwear and Leather
28.	Garment Industry	24.	Garment Industry
29.	Wood and Wood Products	25.	Wood and Wood Products
30.	Paper and Paper Products	26.	Paper and Paper Products
31.	Chemicals and Fertiliser	27.	Chemicals and Fertiliser
32.	Petroleum Industry	28.	Petroleum Industry
33.	Plastic and Rubber Products	29.	Plastic and Rubber Products
34.	Non-Metallic and Other Mineral	30.	Other Industries
35.	Basic Metal Products	30.	Other Industries
36.	Fabricated Metal Products	30.	Other Industries
37.	Other Manufacturing	30.	Other Industries
38.	Electricity, Gas and Water	31.	Electricity, Gas and Water
39.	Construction	32.	Construction
40.	Wholesale and Retail Sales	35.	Trade and Transport
41.	Hotels and Restaurants	33.	Hotels and Restaurants
42.	Tourist Shops and Travel Agents	34.	Tourist Shops and Travel Agents
43.	Transport	35.	Trade and Transport
44.	Post and Communications	36.	Post and Communications
45.	Banking, Insurance and Real Estate	37.	Banking, Insurance and Real Estate
46.	Ownership of Dwellings	38.	Ownership of Dwellings
47.	Public Administration and Defence	39.	Public Administration and Defence
48.	Other Personal Services	40.	Other Services

Source: Compiled based on 2000 I-O table (Amarasinghe & Bandara, 2005)

There are no available published data on these tax items that are consistent with the I-O industry classification in Sri Lanka, hence, splitting was undertaken using other ad-hoc data sources and our own best judgments. The total indirect tax levied on the sale of each commodity was allocated proportionally across all users apart from 'inventory changes'. This type of allocation assumed that all users of a certain commodity paid the same tax rate. The indirect tax was not allocated to 'inventory changes' because of the assumption that tax collected is proportional to these flows would sit uneasily with the possibility of negative flows in the 'inventory changes' (Harrison & Horridge, 2001).

The ultimate task was to generate indirect tax matrices for intermediate input sales and private consumption so as to produce an I-O table valued at basic prices. Thus, the tax row in the I-O table was expanded into a 40×40 matrix by taking into account shares of intermediate inputs by each industry and final consumption, assuming total tax collected by industry should be equal to total tax collected by commodity, as there is a one-to-one relationship between commodities and industries.

### **5.3 Major extensions from the original I-O data base**

#### **5.3.1 Sectoral employment and construction of the wage bill matrix**

The 2000 I-O table has only a row vector to represent the wage bill for each industry as part of value-added. The present study focuses on disaggregating employment into different occupational categories to generate the wage bill matrix. Nevertheless, such an employment matrix for all industries and with all occupational groups is not available for the Sri Lankan economy. Therefore, ad-hoc data sources were used to derive this wage bill matrix by expanding the wage bill vector into a 7×40 matrix.

The main data source used in disaggregating sectoral employment was reports from the CFS surveys conducted by the CBSL for the years 1996/97 (CBSL, 1999) and 2003/2004 (CBSL, 2005b). The identified occupational categories are,

1. Professional, technical and related workers
2. Administrative and managerial workers
3. Clerical and related workers

4. Sales and service workers
5. Agricultural, animal husbandry, forestry and fishermen
6. Production and related transport equipment operators and labourers
7. Other workers

These categories were selected as they were consistent with CFS reports and for the convenience of mapping the available data. The CFS report 1996/97 (CBSL, 1999) provides information on the employed population in major industry groups by different occupational categories (Appendix Table A.1). This information on the employed population could be matched to 22 industries in the 2005 I-O table. Table 5.4 presents these 22 industries. These industries were then mapped with 40 industries in our data base.

**Table 5.4: Major industry groups from CFS survey reports**

Major industry groups	
Agriculture	Other manufacturing
Forestry and logging	Electricity, gas and water
Fishing	Construction
Crude petroleum	Wholesale and retail trade
Mining	Restaurants and hotels
Manufacture of food, beverages and tobacco	Land transport and storage
Textile, wearing apparel and leather	Communications
Manufacture of wood and furniture	Banking, insurance and real estate
Manufacture of chemicals, rubber and plastic	Public administration and defence
Non-metallic minerals	Other services
Basic metal industries	
Fabricated metal products	

Source: CBSL (1999)

Information on average earnings received by each occupational group was obtained from the CFS report 2003/04 (CBSL, 2005b) (Appendix A.2). Here we assume that average earnings received by each occupational group do not vary with the type of industry. These data were used to convert the number of people employed into labour costs for each occupational group. Shares of labour cost in all occupational groups for each industry were then generated and

were used to disaggregate the labour cost row in the 2000 I-O table into a  $7 \times 40$  labour cost matrix. The shares of labour cost by industry and occupation and the total labour cost matrix are presented in Appendix Table A.3 and A.4, respectively.

### **5.3.2 Household accounts**

The 2000 I-O table for Sri Lanka represents only a single household. However, our study identifies nine household groups. These households are classified by their geographic location, representing the nine provinces in the country. Having this kind of household disaggregation may generate different results as some provinces are considered as relatively poor areas and have the majority of the population involved in agricultural activities. Therefore, it is important to disaggregate the private consumption expenditure vector in the I-O table into a  $40 \times 9$  matrix.

There were a few steps involved in this process. All 48 commodities in the I-O table were aggregated into 40 commodities as the first step. Then CFS survey data were used to disaggregate the households by province. This report provides detailed information on income generation and expenditure patterns of households in each province. After defining the different household groups, different consumption categories expressed in CFS were organised and mapped so as to match with the 40 commodity classifications in the model. Once it was mapped, the shares of each household group in total consumption expenditure of each of the 40 commodities were obtained. For the commodities not listed in CFS, population shares of each province were used as proxies. Appendix Table A.5 presents the household consumption shares. Finally, we use these derived shares to split the private consumption expenditure vector into a  $40 \times 9$  matrix. The same procedure was followed to derive the private consumption expenditure of imported goods.

Households obtain their incomes as returns from primary factors of production, from remittances and transfers from the government and from abroad. However, all household income sources are not clear for the selected year 2000. Therefore, it was assumed that incomes for households mainly come from factor incomes. The direct taxes on income for the year were obtained from the national accounts of Sri Lanka for 2000 (DCS, 2002c).

### **5.3.3 Construction of capital flow matrices**

Investment is represented as a column vector of investment goods in the original I-O table. There are two such vectors for both domestic and imported investments. As this study models investors as the industries themselves, it was necessary to construct a commodity by industry capital flow matrix. This type of complete capital flow matrix is not available for Sri Lanka and to our knowledge there was no adequate information available to disaggregate these two vectors in the form of two matrices showing the domestic and imported capital flow in the 40 industries. The value of total gross domestic capital formation is revealed in the national accounts published by the DCS.

The National Accounts of Sri Lanka for the year 2000 (DCS, 2002c) provides information on gross capital formation by type of good for both the government and private sectors. For example, it offers information on purchases of capital goods such as construction goods (residential buildings, non-residential buildings and other constructions), machinery and equipment (transport equipment, non-electrical machinery and equipment, electrical machinery and appliances and other durable furnishing and equipment) and land improvement (land improvement and plantation and orchard development) as a whole. As there are no details provided in order to split these among different industries, the industry shares derived from returns to capital vector in the I-O table was used to convert  $40 \times 1$  investment vector in the original I-O table into  $40 \times 40$  investment matrix for both domestic and imported goods. This approach has been used in Harrison and Horridge (2001) to construct the capital formation matrices of the data base supporting an Indonesian model of the ORANI tradition.

### **5.3.4 Gross operating surplus**

The 2000 I-O table has only two value-added components namely, compensation of employees and gross operating surplus. This study employs land as a primary input in addition to labour and capital. Since the original I-O table provides information only on two primary inputs, cost of land is extracted from the gross operating surplus. It was assumed that only agricultural industries, the firewood and forestry industry and mining industries use land as a primary factor for current production. To obtain the cost of land in those industries, the rental share of land was assumed to be some percentage of the gross operating surplus. The

percentages used were based on the values obtained from GTAP version 7 data base (Narayan & Wamsley, 2008). The sectors specified in the study were mapped with the sectors in the Sri Lankan I-O table in the GTAP data base which is a converted version of original 2000 I-O table for Sri Lanka (Table 5.5). The document provided by Weerahewa and Bandara (2008) of this conversion for the GTAP7 data base documentation was used for this mapping. The land payments were deducted from the GOS and the difference is the cost of capital added to each industry. The shares of capital and land in GOS of each industry are listed in Appendix Table A.6.

#### **5.4 Elasticities of substitution and other parameters**

All the elasticity parameters and coefficients used in the model are explained in the Chapter 4. Past studies have used various ways to gather values for elasticities of substitution. Some are estimated econometrically or assumed on the basis of existing studies. This study adopts elasticity values from the existing literature on Sri Lanka, values assumed in other relevant CGE models and guesstimates. This is a general practice adopted by most CGE studies on developing countries.

##### **5.4.1 Substitution elasticities between domestic and imported goods**

Elasticities of substitution between domestic and imported goods are needed in order to implement the model. In this model it is assumed that domestic and imported goods are imperfect substitutes in production, investment and consumption. The level of substitution between domestic and imported sources is depicted by the Armington elasticity (Armington, 1969). When the value of Armington elasticity is higher, two sources become closely substituted. The lower values for this parameter indicate that the substitution is weak. Empirical estimates of Armington elasticities are fairly rare for the developing countries and Sri Lanka is no exception. Therefore, the only way to set desirable values is to examine the literature on CGE models for developing countries. This study adopts Armington elasticities from previous studies by Naranpanawa (2005) based on the values compiled by the CIE (1991) and Bandara (1989). These values are reported in Table 5.6.

**Table 5.5: Mapping procedure from GTAP data base**

No.	Name	GTAP Sectors	Sector number in original I-O table
1	Paddy rice		6
2	Wheat		49 (new sector)
3,4,5	Other grains, vegetables & fruits, oilseeds		7,8,9
6,8	Cane and beet, other crops		1,2,3,4,5,10,11,12,13,14,16
7	Plant fibres		50(new sector)
9,10,11	Cattle, other animal products, raw milk		15
12	Wool		51 (new sector)
13	Forestry		17,18
14	Fishing		19
15	Coal		52 (new sector)
16	Oil		53 (new sector)
17	Gas		54 (new sector)
18	Other mining		20
19,20,21,22,24,25,26	Cattle meat, other meat, vegetable oils, milk, sugar, other food, beverages and tobacco products		21,23,25,26
23	Processed rice		24
27,29	Textiles, leather		27
28	Wearing apparel		28
30	Lumber		29
31	Paper and paper products		30
32	Petroleum and coke		32
33	Chemical rubber products		22,31,33
34	Non-metallic minerals		34
35,36,37,42	Iron and steel, non-ferrous metals, fabricated metal products, other manufacturing		35,36
38,39,40,41	Motor vehicles, other transport equipment, electronic equipment, other machinery and equipment		37
43,44,45	Electricity, gas distribution, water		38
46	Construction		39
47	Trade		40
48,49,50	Other transport ,water transport, air transport,		43
51	Communications		44
52,53	Other financial intermediation, insurance		45
54,55	Other business services, recreation and other services		41,42
56	Other services (government)		47,
57	Dwellings		46

Source: Narayan and Wamsley (2008), Weerahewa and Bandara (2008)

#### **5.4.2 Substitution elasticities between primary factors**

There are no available econometric estimates for elasticities of substitution between primary factors (aggregate labour, land and capital) for Sri Lanka. Therefore, it was assumed that elasticity of substitution between primary factors for all industries is 0.5 (Horridge, 2007). This is the same as those used in previous studies for Sri Lanka by Naranpanawa (2005) and Bandara (1989).

#### **5.4.3 Substitution elasticities between different occupational categories of labour**

Labour is categorised into seven occupational groups based on skills. Thus, the elasticity of substitution between labour groups is required in the model. However, as in the case of the other elasticity of substitution parameters, there are no econometrically estimated values for substitution elasticities between different occupational categories of labour for Sri Lanka. Therefore, 0.5 was set as the substitution elasticity of occupational groups, based on Naranpanawa (2005).

#### **5.4.4 Reciprocals of export demand elasticities**

Prior to obtaining the estimates for export demand elasticities, it was crucial to divide the 40 commodities in the data base into two basic groups: individual export commodities and collective export commodities. Traditional export commodities whose foreign demand is assumed to be inversely related to individual commodities' price are grouped as individual export commodities. Collective export commodities can be described as non-traditional export commodities, the export volumes of which do not depend largely on corresponding prices. The commodities in our data base were allocated to individual and collective export groups by some personal judgement of the industries as suggested by Dixon, et al. (1982, p. 290) based on the general export pattern of the country in the annual reports of the CBSL. Accordingly, minor export crops, tea processing, rubber processing, coconut processing, food, beverages and tobacco, textile, garments and other manufacturing industries were assigned to the individual export category and the rest of the 32 industries were categorised under collective exports.

The export demand elasticity determines the market power of a particular commodity in the world market. It was assumed that Sri Lanka is a small country and it cannot influence world prices except in the case of tea for which Sri Lanka has an export share of 22 per cent of the world tea market (Wickramasinghe, 2005). The information on essential elasticity values was scarce and not readily available as mentioned in many of the CGE studies on developing countries (Bandara, 1989; Butt, 2006). Therefore, it was decided to extract credible values of the elasticities from the existing studies and use personal judgements.

An export demand elasticity of -20.0 has been used in many CGE models for small developing countries like Sri Lanka. Bandara (1989) and Naranpanawa (2005) treated -20.0 as the value for export demand elasticity for all commodities except for processed tea in their Sri Lankan CGE models. Centeno (2001) used the same value for all the commodities other than agricultural crops and services, mining and log exports. Due to a lack of empirical estimates, we used -20.0 as export demand elasticity for all the commodities except for processed tea as in Bandara (1989) and Naranpanawa (2005). A value of -0.6 was taken as the reciprocal of export demand elasticity for tea as in Naranpanawa (2005). The elasticity values are reported in Table 5.6.

#### **5.4.5 Marginal household budget shares and household expenditure and price elasticity of demand**

In order to implement the LES function in household consumption demand, it is essential to estimate marginal budget shares for all the commodities. This estimation of marginal budget shares requires data on household expenditure elasticities and budget share of each commodity consumed by household  $h$  from both domestic and imported sources. Unlike other elasticity parameters some attempts have been made to estimate the expenditure and price elasticities in Sri Lanka.

**Table 5.6: Elasticities of substitution parameters**

Sectors		Elasticities of substitution parameters		
No.	Name	Armington	Labour sigma and primary factor sigma	Export
1	Tea Growing	0	0.5	-20
2	Rubber Growing	0	0.5	-20
3	Coconut and Toddy	0	0.5	-20
4	Paddy	0	0.5	-20
5	Vegetables	0	0.5	-20
6	Fruit	0	0.5	-20
7	Highland Crops	0	0.5	-20
8	Potatoes	0	0.5	-20
9	Minor Export Crops	2	0.5	-20
10	Tobacco	2	0.5	-20
11	Betel and Areca nuts	0.5	0.5	-20
12	Miscellaneous Agriculture Products	0	0.5	-20
13	Plantation Development	0	0.5	-20
14	Firewood	0	0.5	-20
15	Forestry	0	0.5	-20
16	Livestock and Fish	0	0.5	-20
17	Tea Processing	0	0.5	-1.667
18	Rubber Processing	0	0.5	-20
19	Coconut Processing	0	0.5	-20
20	Rice Milling	5	0.5	-20
21	Flour Milling	5	0.5	-20
22	Food, Beverages and Other	2	0.5	-20
23	Textiles, Footwear and Leather	2	0.5	-20
24	Garment Industry	2	0.5	-20
25	Wood and Wood Products	2	0.5	-20
26	Paper and Paper Products	2	0.5	-20
27	Chemicals and Fertiliser	2	0.5	-20
28	Petroleum Industry	5	0.5	-20
29	Plastic and Rubber Products	2	0.5	-20
30	Other Industries	2	0.5	-20
31	Electricity, Gas and Water	0	0.5	-20
32	Construction	0	0.5	-20
33	Hotels and Restaurants	0	0.5	-20
34	Tourist Shops and Travel Agents	0	0.5	-20
35	Trade and Transport	0	0.5	-20
36	Post and Communications	0	0.5	-20
37	Banking, Insurance and Real Estate	0	0.5	-20
38	Ownership of Dwellings	0	0.5	-20
39	Public Administration and Defence	0	0.5	-20
40	Other Services	0	0.5	-20

There is some literature on the estimation of expenditure elasticity and price elasticity of demand for Sri Lanka. Most of these studies have focused on aggregate food demand in the country. For this reason, parameters compiled by Naranpanawa (2005) were used in this study. In his study, Naranpanawa (2005) used the expenditure elasticity estimates of Bandara (1989) for 24 commodities within three socio-economic groups and mapped into 38 commodities.

The parameter estimates used in Naranpanawa (2005) are shown in Appendix Table A.7. The next step was to transform the elasticity parameters according to the requirements of the present model. Since the commodity aggregation of this study is comparable to commodity classification of the Naranpanawa model, it was possible to adopt its values for our purpose.

Parameters used in Naranpanawa (2005) are specific to three socio-economic groups in Sri Lanka, namely urban, rural and estate. The present model has nine household groups, representing nine provinces in Sri Lanka. The following procedure was used to map the household groups based on the monthly per capita income by sector in the CFS survey 2003/04 (CBSL, 2005b). Western Province was treated as similar to the urban sector; Central, Southern, Northern, North Western and North Central Provinces as similar to the rural sector and Eastern, Uva and Sabaragamuwa Provinces as the same as the estate sector. Sector mapping is shown in Table 5.7. Estimates of expenditure elasticities for 40 commodities are listed in the Appendix Table A.8.

**Table 5.7: Sector mapping**

Sector	Monthly per capita income (Rs)	Provinces	Monthly per capita income (Rs)
Urban	6,777	Western	5,999
Rural	3,650	Central	3,222
Estate	2,014	Southern	3,060
		Northern (a)	3,208
		Eastern	2,905
		North Western	3,872
		North Central	3,814
		Uva	2,570
		Sabaragamuwa	2,894

(a) Excluding Kilinochchi, Mannar and Mullaitivu districts

Source: CBSL (2005b)

Next, the budget shares were calculated from the I-O database. It is the share of expenditure in each commodity in the total expenditure of each household group in the model. After deriving both 40×9 matrices (expenditure elasticity matrix and budget shares matrix), we used the method used by Centeno (2001) to obtain the weighted expenditure elasticities. We multiply the two matrices to calculate the weighted expenditure elasticities for each household group and scale those weighted elasticities to make sure that their share-weighted sum is equal to one. Then the marginal budget shares were calculated.

$$T_{ch} = \frac{X3_{c\_sh}}{\sum_{c \in COM} X3_{c\_sh}} \times EXPELAST_{ch}$$

$T_{ch}$  = weighted expenditure elasticity of household  $h$  for commodity  $c$

$X3_{c\_sh}$  = commodity  $c$  consumed by household  $h$  from both domestic and imported sources

$EXPELAST_{ch}$  = assigned expenditure elasticity of household  $h$  for commodity  $c$

Scale by getting,

$$EXPELAST^*_{ch} = EXPELAST_{ch} / T_h$$

Where  $T_h$  = sum of  $T_{ch}$  across all commodities

$$T_{ch}^* = \frac{X3_{c\_sh}}{\sum_{c \in COM} X3_{c\_sh}} \times EXPELAST^*_{ch}$$

So that  $\sum_{c=1}^{27} T_{ch}^* = 1$

The marginal budget shares (S3LUX) are calculated as:

$$S3LUX = \frac{X3_{c\_sh}}{\sum_{c \in COM} X3_{c\_sh}} \times T_{ch}^*$$

#### 5.4.6 The Frisch parameter

In order to derive own and cross price elasticity of demands and super numerary expenditure, we need the Frisch parameter ( $\varpi$ ). It is defined as the elasticity of marginal utility of total expenditure with respect to total expenditure. First, we estimate the Frisch parameter for the whole country. This estimate was mainly based on Lluch, Powell, and Williams (1977, p. 248-250) that approximates the relationship between the per capita income in 1970 US\$ (X) and the Frisch parameter. The formula used in the estimation is,

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

The per capita income for Sri Lanka in 1970 was US\$170 (World Bank, 2012) and the resulting estimate of the Frisch parameter is -5.67. This estimated value is well within the range of values adopted in other CGE studies on developing countries (Bandara, 1989, p. 245). Dimaranan, McDougall, and Hartel (1998) show that Frisch parameters for developed countries are generally low when compared with those of developing countries. Furthermore, Xiang, Huang, Kancs, Rozelle, and Swinnen (n.d.) use relatively higher Frisch parameters for poor and rural households compared to urban households in China. Naranpanawa (2005) and Bandara (1989) have used the values of -4.57, -5.45 and -6.43 for the Frisch parameters of urban, rural and estate sectors in Sri Lanka respectively.

Therefore, this relationship was used to estimate Frisch parameters for nine provinces. Per capita annual incomes for different household groups were calculated using the information from the CFS report 2003/2004 (CBSL, 2005b). These values were then deflated to derive the values at 1970 prices using the GDP deflators. The exchange rate value for 1970 of US\$ 5.95, reported in the “Macroeconomic policies, crises and growth in Sri Lanka, 1969-90” (Athukorala & Jayasuriya, 1994) was used to convert these annual per capita income values into US dollar terms. The details of calculation and resulting Frisch parameters are depicted in Table 5.8. These values are broadly in line with the values adopted by other studies as explained above.

**Table 5.8: Estimation of Frisch parameters**

Household group	Annual income (Rs)	Annual income at 1970 prices	Per capita income (US\$)	Frisch Parameters
Western	71,988	2,337	393	-4.19
Central	38,664	1,255	211	-5.24
Southern	36,720	1,192	200	-5.34
North Western	46,464	1,509	254	-4.91
Uva	30,840	1,001	168	-5.69
North Central	45,768	1,486	250	-4.93
Sabaragamuwa	34,728	1,128	190	-5.45
Northern	38,496	1,250	210	-5.25
Eastern	34,860	1,132	190	-5.44

## 5.5 Construction of data base for regional extension

As described in the previous chapter, a tops-down approach was used for the purpose of estimating the impacts on different regions of Sri Lanka. The first step towards constructing the data base of the tops-down regional extension involves the allocation of commodities/industries in the model to local or national groups. Then we need data for each industry's regional shares in output or value-added and data for each local industry's regional shares in investment demand, consumption demand, export demand, government demand and inventories. However, such detailed regional data matrices are not available for the Sri Lankan economy and constructing such matrices is difficult. Therefore, ad-hoc data sources were used in order to estimate the regional data needed. This section describes allocation of commodities/industries in the model to local or national groups and the development of those regional data matrices.

### 5.5.1 Allocation of commodities/industries to local and national groups

As explained in the previous chapter, national industries produce commodities that are widely traded across regions, while local industries produce commodities that are essentially not traded across regions. In the Australian model of ORANI, local commodities comprised mainly of services, such as, construction, repairs, communication services, dwelling, cultural

and recreational services, electricity, gas and water, trade, hotels and cafes, finance and insurance, bus services, health, other services and drinks and smokes industry. All the other industries including agricultural and manufacturing goods, transport and government administration and defence are considered as national industries (Centre of Policy Studies, 2010). Using a similar approach, construction, dwelling and other personal services were considered as local commodities in the Sri Lankan model. Other remaining commodities were treated as national commodities.

### **5.5.2 Regional shares of industry output, investment, consumption, government expenditure, exports and inventory changes**

The data base of the model consists of 16 agricultural, 14 manufacturing and ten services sectors. Numerous data sources were used to gauge each industry's regional output shares. The Sri Lanka Census of Agriculture (DCS, 2008e) report was directly used to calculate the regional output shares of four agricultural industries (tea growing, rubber growing, coconut growing and the paddy industry). Apart from that, other publications and online sources published by the DCS were used to obtain the agricultural production shares. Industry survey reports from the DCS were used to derive the regional production shares of manufacturing industries. Production of highland crops time series data published in the DCS web site (DCS, 2011a) were used to calculate the regional output shares of six other agricultural industries (vegetables, fruits, highland crops, minor export crops, tobacco, and betel and areca nuts).

Production data for major crops published by the Hector Kobbakaduwa Agrarian Research Institute data bank (HARTI) (HARTI, 2010) was the major resource used to compute the regional output shares of another agricultural industry, the potato industry. To estimate the regional output shares of the livestock and fishery industry, two major sources, livestock population by type provided by the DCS (DCS, 2011b) and fisheries year book published by the National Aquatic Research and Development Agency (NARA) (NARA, 2011) were used. Value of output for each industry was used as the proxy for the production in all of these industries. To our knowledge, no data sources were available to estimate the regional output shares of the remaining four agricultural industries, miscellaneous agricultural products, plantation development, firewood and forestry. Therefore, regional GDP shares of the respective industries for 2001 (CBSL, 2002) were used as a proxy for regional production shares of those industries.

The regional output shares of the 14 manufacturing industries were calculated based on the annual survey of industries report 2007 (DCS, 2008a) and annual survey of construction industries report (DCS, 2007). It was assumed that the structure of the industries did not change during 2000 to 2007 period. On the other hand, to our knowledge, no reliable data sources were available to estimate the regional output shares of eight services industries. Consequently, regional GDP shares of the respective industries for 2001 (CBSL, 2002) were used as a proxy for regional production shares of those industries.

Due to unavailability of data on the regional shares of investment and regional shares of inventories for the majority of the industries in the data base, it was decided to assume that the regional investment shares and regional shares of inventories for all 40 industries follow their regional output shares. Similarly, there is no information available on Sri Lanka's regional shares in exports. As a result, based on the knowledge of the country's economic structure, it was assumed that each industry's regional share in exports was equivalent to its regional shares in output. Regional industry output, industry investment and commodity export shares are presented in Appendix Table A.9.

The CFS survey report 2003/2004 (CBSL, 2005b) was primarily used to determine the regional consumption shares. Population shares in each region (DCS,2012) were taken as the proxy to gauge the regional consumption shares of industries where the data was not available in the CFS survey report, especially for services industries. Regional commodity consumption shares are recorded in Appendix Table A.10.

No data sources were available for the calculation of government regional expenditure shares for all the industries. Therefore, there was no choice but to use proxies for the government regional expenditure shares. It was decided to use regional GDP shares of the respective industries for 2001 as proxies for the government regional expenditure shares. Regional government expenditure shares are listed in Appendix Table A.11.

## **5.6 Chapter summary**

In this chapter, compilation of the data base required for implementing the model explained in the previous chapter is described. The latest available I-O table (for the year 2000) and other information and data from a variety of supplementary sources were employed to construct the data base as accurately as possible. Data needed by the model can be classified into two broad groups, baseline data and behavioural parameters. This chapter explains how those two types of data were obtained. Since this data base contains data matrices on each industry's regional shares in output and investment, each commodity's regional shares in consumption, exports, government demand and inventories, it is possible to disaggregate impacts of an economy-wide policy shock into regional level. With this data base and the model described in Chapter 4, we conduct model simulations in the next chapter.

## Chapter 6

### **Application of the Model for Agricultural Policy Analysis**

The most significant structural change in the Sri Lankan economy since independence has been the diminished importance of agriculture. Agriculture was the predominant sector contributing nearly half of the GDP in the 1950s with greater contributions to employment generation and exports. However, it contributed only 12 per cent to GDP in 2009. One can question whether agriculture has a significant role in the future of the Sri Lankan economy. This chapter uses the model developed in Chapter 4 to estimate the effects of a set of domestic agricultural policies on the economy of Sri Lanka in both the short and long-run. The agricultural policies analysed in this chapter includes productivity improvement in agricultural sub-sectors, 100 per cent reduction of prevailing agricultural tariffs and expansion of land in agricultural sub-sectors. First, the impacts of these policies at national level are analysed. Then this chapter estimates the regional impacts of the policies identifying winning and losing regions under different policy scenarios.

The rest of the chapter is organised as follows. Section 6.1 describes the background of agricultural policies that we intend to analyse. Section 6.2 introduces the economic environment specified in analysing the impacts of policies explained in the previous section. Based on the simulation results, we discuss macroeconomic, sectoral, household and regional level impacts of agricultural policies in Section 6.3. The sensitivity of the model results for different parameter values used in the model under the systematic sensitivity analysis is described in Section 6.4.

#### **6.1 Policy experiments**

Agriculture is no longer necessarily the dominant source of generating surpluses for economic growth and diversification. As described in Chapter 2, owing to the reasons that a third of the population are dependent on agriculture and it provides a livelihood for the majority of the rural population, several governments of Sri Lanka placed a high priority in developing the agricultural sector to achieve the objectives of development and poverty reduction. This section describes the major agricultural policies that we intend to analyse.

### **6.1.1 Scenario I: Increase in productivity**

Because of the significance of the agricultural sector in Sri Lanka, as in most developing economies, increase in agricultural productivity seems to represent a logically appealing option for policy makers to promote economic growth. There are many sources of productivity growth including contribution of domestic research and development, efficiency gains, economies of scale, farmer education, and investment in public infrastructure, such as transport and communication (Mullen, 2007). Improving agricultural productivity leads to agricultural growth that would help in raising rural income and alleviating poverty. This would generate increased demand for both agricultural products and other industrial goods and services through intermediate and final demand linkages (Adelman, 1984; Mellor, 1976).

The historical importance of the agricultural sector in the Sri Lankan economy was emphasised in the Chapter 2. However, the relative importance of the agricultural sector has been shrinking over time showing a low contribution to the national output and low productivity in the sector. Notably, as about one third of the labour force is engaged in agriculture, its total output is distributed among a large number of workers. Therefore, the income of agricultural workers has been very low, keeping them below the poverty line. Furthermore, there is a high concentration of the agricultural workforce on a limited amount of arable land. Increase in agricultural productivity has been identified as the obvious strategy to overcome these problems. According to Sandaratne (2011, p. 137), steps have to be taken to increase productivity through policy reforms, improved research, infrastructure development, and better extension and marketing facilities, if agriculture is to contribute more towards economic growth, reduce poverty and improve household food security.

The most recent ten-year development plan of the government of Sri Lanka (Ministry of Finance and Planning, 2006) identifies improving productivity in the agricultural sector as an important strategy to strengthen the balance of payment situation in the country by creating exportable surplus or import substitution products while improving income levels of the agricultural work-force. This aim is to be achieved by increasing the extent of production and improving the productivity of all sub-sectors. The expected productivity growth of individual sub-sectors is summarised in Table 6.1. The government aims to achieve these productivity increases in the long-run (over ten year period). In order to get a meaningful productivity

increases in the short-run (2-3 years), average values over a two-year period were calculated using these targeted productivity increases described in Table 6.1. The same values are used for the long-run for the purpose of comparing results with those of the short-run.

**Table 6.1: Targeted productivity increases according to the ten-year development plan**

Sub-sector	Rate of increase for the ten-year period (%)
Plantation sector	
- Tea	20
- Rubber	5
- Coconut	20
Non-plantation crop sector/domestic agricultural sector	
- Paddy	10
- Field crops, vegetables, fruits and others	25
- Export agricultural crops	30
- Livestock	5

Source: Ministry of Finance and Planning (2006)

For the purpose of this simulation it is assumed that this productivity increase is gained through an increase in primary factor productivity. Therefore, the following productivity increases were assumed for both the short-run and long-run based on the above targets.

- 1) Simultaneous productivity increases in the following sectors (simulation1)
  - a) 4 per cent increase in primary factor productivity of tea sector.
  - b) 1 per cent increase in primary factor productivity of rubber sector.
  - c) 4 per cent increase in primary factor productivity of coconut sector.
  - d) 2 per cent increase in primary factor productivity of paddy sector.
  - e) 5 per cent increase in primary factor productivity of highland crops, vegetables and fruits sectors.
  - f) 6 per cent increase in primary factor productivity of minor export crop sector.
  - g) 1 per cent increase in primary factor productivity of livestock and fisheries sector.

### **6.1.2 Scenario II: Agricultural trade reforms**

Sri Lanka was the first country among South Asian countries to initiate policy reforms in order to move away from protectionist import-substitution trade policies to integrate into the world economy (Athukorala & Rajapatirana, 2000). This began with a major policy reform package implemented in 1977. As described in Chapter 2, trade liberalisation was a basic and essential part of the policy package. According to Pursell and Ahsan (2011), it included an initial sharp devaluation along with unification of the exchange rate, drastic cuts in the scope of the import licensing system, use of tariffs rather than quantitative restrictions to control imports, simplification of the tariff structure, removal of export taxes and controls, and streamlining of customs procedures for exporters. This reform process has continued and tariffs have fallen at varying degrees up to date with changes in governments. An historical overview of the country's trade policy regime is summarised in Table 6.2. These policy regimes were directed in an inconsistent and ad-hoc manner in response to demands from various political institutions. The direction of the trade liberalisation process has somewhat reversed since 2001. Regardless of this backward policy shift in trade liberalisation, the country has accomplished significant advancement in liberalising its trade during the last few decades.

Even though general tariff levels were lowered and quantitative restrictions were removed with the trade liberalisation policies introduced in 1977, agricultural commodities were subjected to comparatively higher tariff rates with a significant number of seasonal quantitative restrictions (Samaratunga, 2009). In line with the liberalised trade regime and other agricultural policy reforms, import tariff protection provided to Sri Lankan agriculture has been gradually reduced with the objective of increasing the international competitiveness of Sri Lankan agricultural products (Somaratne, 2000). Sri Lanka significantly liberalised agricultural trade to low duty levels to comply with the new Uruguay Round AoA. This move laid the foundation for further trade liberalisation with the aim of restructuring the agricultural sector in accordance with Sri Lanka's comparative advantage. The agricultural sector began to open up in the mid-1990s with the removal of export taxes on plantation crops, import licences on rice, chilli, onion and potato and granting permission for private traders to import rice (Pursell & Ahsan, 2011; Weerhewa, 2006). Compared to other South Asian countries, Sri Lanka had the most liberal trade regime for agriculture in spite of various distortions in the agricultural markets (Athukorala & Kelegama, 1998; Samaratunga, Karunagoda, &

Thibbotuwawa, 2007). In contrast to this idea, Pursell and Ahsan (2011) state that, since 2001, import policies have become more restrictive, especially tariff protection of import substitution agricultural sectors.

**Table 6.2: Changes in trade policy regime since independence**

Historical period	Policy regime	Average real economic growth (%)
1948-56: continuation of colonial globalised economy	Continuation of open economy with “populism”	3.2
1956-77: closed economy with restrictions to globalisation	1956-60: closing up with “populism”	2.5
	1960-65: continuation of closed economy	7.8
	1965-70: partial departure from the closed economy	4.0
	1970-77: back to closed economy	
1977 to date: globalisation following the world trend	1977-89: opening up - first phase	4.6
	1990-94: opening up - second phase	5.3
	1995-2001: continuation of open economy	2.9
	2002-2004: continuation of open economy	5.0
	2004 to date: continuation of open economy	

Source: Bandara and Naranapanawa (2006, p. 172)

According to Kelegama (2003) and Samarathunga, et al. (2007), Sri Lanka’s agricultural trade is administered largely by a progressive tariff regime. Tariffs on agricultural commodities are currently bound at 50 per cent (according to Sri Lanka’s Uruguay Round commitment), while applied tariff rates are well below the bound rate. With the introduction of the Harmonized System (HS) of coding in 1989, the number of tariff bands applied and the maximum tariff rate was reduced. The four-band tariff structure of 2.5, 6, 15 and 28 per cent introduced in 1994 remained as the main trade policy instrument until recently (Samaratunga, 2009). This was changed in 2010 when the maximum nominal rate was changed from 28 to 30 per cent

and replaced the previous 2.5 per cent slab with zero (Pursell & Ahsan, 2011). Table 6.3 describes the distribution of agricultural tariff bands in 2009. As can be seen from Table 6.3, more than half of the agricultural tariff lines have been set at the 28 per cent level. In addition to these rates there is a significant proportion of specific tariffs (5 per cent) and numerous other levies like Value Added Tax (VAT), Ports and Airports Development Levy (PAL), Social Responsibility Levy (SRL) and surcharges which were changed frequently on ad-hoc bases. These existing ad-hoc duty levies, waivers and exemptions for some agricultural commodities have distortionary effects on agricultural commodity markets and domestic production.

**Table 6.3: Distribution of agricultural tariff bands-2009**

	Tariff lines						
	Free	2.5	6	15	28	Specific	Ad valorem / specific
Number of items (HS codes)	13	53	31	244	548	48	12
Percentage of total	1	6	3	26	58	5	1

Source: Samarathunga (2009)

Pursell and Ahsan (2011) point out that the present import tariff structure which can be considered as a protectionist structure, and resulting breaches in Sri Lanka's WTO commitments, especially in agriculture, would cause serious costs for Sri Lanka's economic welfare and growth in the future. The 'ten-year development plan 2006-2016' (Ministry of Finance and Planning, 2006) identifies international trade as one of the significant macroeconomic instruments to achieve the country's development goals. It envisages closer integration of trade promotion in the national development framework by further rationalisation of trade and tariff policies, facilitation of a fair trading environment and encouragement of investment. The trade objectives within the ten-year development plan also focus on increasing integration of the Sri Lankan economy with global markets.

Among few policy instruments available for shaping trade policies, tariff reforms can be regarded as one of the most extensively applied policy instruments in many countries (Naranpanawa, 2005). Since the attention of this study is on economy-wide impacts of

agricultural policies, the main focus on this policy scenario is to ascertain the likely impacts of tariff reduction in agricultural sectors. To achieve this, the following simulation experiments were carried out with the intention of quantifying both the short- and long-run impacts of agricultural trade reforms on the Sri Lankan economy.

- 1) A 100 per cent reduction in prevailing tariffs in the agricultural sectors.

### **6.1.3: Scenario III: Increased cultivated land extent**

Presently, Sri Lanka produces most of its food requirement (such as cereals, pulses, fish, meat, vegetables and fruit) within the country. For instance, 95 per cent of the total rice requirement, which is the country's staple food, is produced within the country. The requirement of wheat flour is completely met through imports. Almost the entire requirement of fresh fish is produced within the country, although some fish products, such as canned fish and dried fish are imported. Only 30 per cent of the country's demand for milk is fulfilled within the country. Even though the country has the potential to produce maize, and other cereals and other crops such as potatoes, chillies and onions within the country, the current level of local production of such crops is not adequate to meet the national need. Therefore, a part of the country's food requirement is met through imports (CBSL, 2009).

Several governments of Sri Lanka promoted local agricultural production to assure food security and self-sufficiency and to substitute food imports. The need for an increase in agricultural production has been identified as a key contributing factor for ensuring food availability and enhancing consumption of calorie intake of the people in the current government's ten-year development policy framework. Accordingly, in 2007, a national campaign to motivate domestic food production named "Api wawamu-rata nagamu" (let's cultivate and uplift the nation) was implemented to promote domestic food production, which contributed to the increased extent and methodology of cultivation, thereby contributing to increased production. The main objectives of the programme are increasing the production of essential crops, enhancing the contribution of agriculture to the GNP, ensuring food and nutrition security of the people, reducing foreign exchange spent on food imports, and disseminating modern and appropriate technologies. Under this programme, uncultivated fallow lands and barren lands are utilised and home gardening is promoted with the aim of

increasing domestic food production (Ministry of Agriculture, 2011). According to the Central Bank annual reports, a total of 18,511 acres of fallow lands were brought under paddy cultivation in addition to 75,752 acres of fallow lands cultivated in 2009. Moreover, more than 300,000 home gardens were developed (CBSL, 2009, 2010a).

The liberation of the Northern and Eastern Provinces has also provided an unprecedented opportunity to revive economic activities in these regions, the benefits of which are bound to spill over into the entire country. These two provinces account for over two thirds of the country's coastal and maritime resources and about one third of the country's fertile land area. Unrestricted access to these areas has offered a tremendous potential for the development of agricultural and fisheries activities and related industries in these areas.

The expected increase in land extents of the agricultural sub-sectors according to the ten year development plan are shown in Table 6.4. The same targeted increase in extent of land was used for both the short- and long-run for the purpose of this simulation.

**Table 6.4: Targeted increases in cultivated land**

Sub-sector	Rate of increase (%)
<b>Plantation sector</b>	
- Tea	0.1
- Rubber	2
- Coconut	5
<b>Non-plantation crop sector/domestic agricultural sector</b>	
- Paddy	0.1
- Field crops, vegetables, fruits and others	0.8
- Export agricultural crops	3

Source: Ministry of Finance and Planning (2006)

Simultaneous land extent increases in the following sectors (simulation III)

- a) 0.1 per cent increase in land extent of tea sector.
- b) 2 per cent increase in land extent of rubber sector.
- c) 5 per cent increase in land extent of coconut sector.
- d) 0.1 per cent increase in land extent of paddy sector.

- e) 0.8 per cent increase in land extent of highland crops, vegetables and fruits sectors.
- f) 3 per cent increase in land extent of minor export crop sector.

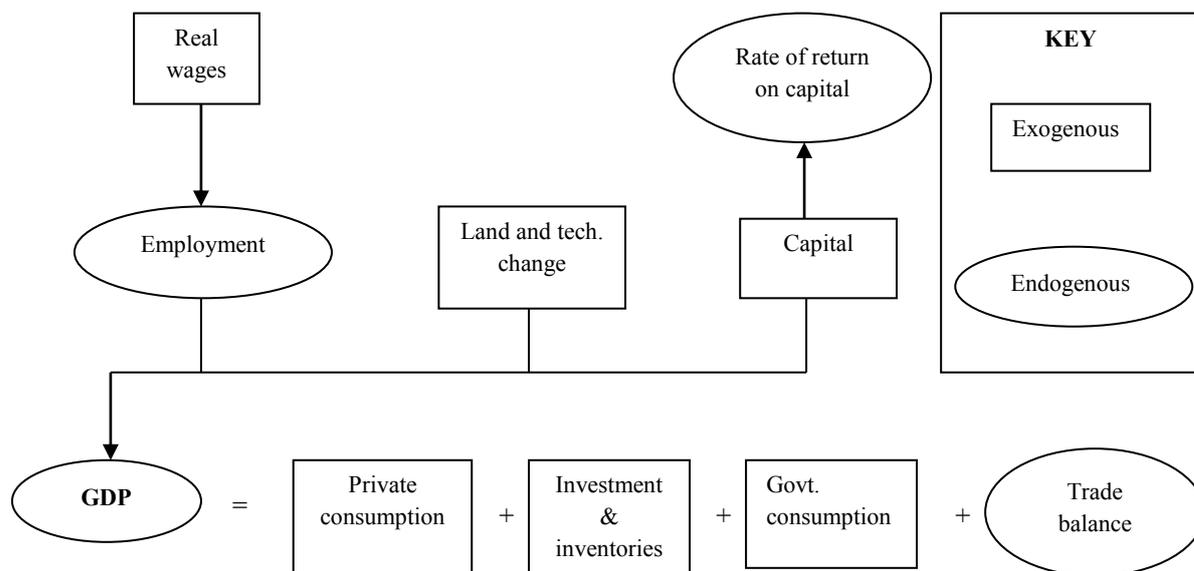
## **6.2 Model closure**

The simulations explained in the previous section are conducted in two different economic environments representing the short-run and long-run effects. Selection of a closure reflects two different types of concerns (Horridge, 2007). First, the closure is associated with the notion of simulation time scale, which is the period of time which would be needed for economic variables to adjust to a new equilibrium. This often affects the way that factor markets are modelled. Second, the choice of closure is shaped by the needs of a particular simulation. Considering the simulation time scale, the length of the short-run is not explicit. The elapsed time in the short-run is assumed to be sufficiently short to allow one to ignore the impact of the shock under analysis on capital stocks in use in each industry, but sufficiently long for price changes to be transmitted throughout the economy and reach a new equilibrium (Cooper, McLaren, & Powell, 1985). Horridge (2007) suggests it to be between one and three years, while Cooper, et al. (1985) consider it to be about two years. The set of assumptions used in both short-run and long-run closures are described in this section.

### **6.2.1 Short-run closure**

The short-run closure is summarised in Figure 6.1 and defines the macroeconomic environment in both the supply and demand sides of the economy. On the supply side of the economy, capital stocks at the aggregate level and industry level, the real wages, other primary factors, such as land and technology used in the production, are fixed during the planned period. The capital stock is fixed in each industry assuming industry-level output can be changed only through changes in labour input. With the given fixed capital stock, the model can determine the rate of return on capital. Furthermore, in the short-run it is assumed that the period of concern is not long enough for investment decisions to greatly affect the useful size of sectoral capital stock. Similarly, short-run closure allows for rigidities in the labour market. It is assumed that the economy faces a slack labour market allowing the model to determine the aggregate employment level as well as the employment levels of various categories of labour while real wages are considered to be fixed.

On the demand side, all the components of domestic absorption are assumed to be determined exogenously. However, balance of trade is allowed to be determined endogenously in order to determine changes in GDP due to the shock from the demand side (Horridge, 2007). Moreover, the nominal exchange rate is fixed and considered to be the numeraire.



**Figure 6.1: Schematic representation of the short-run closure**

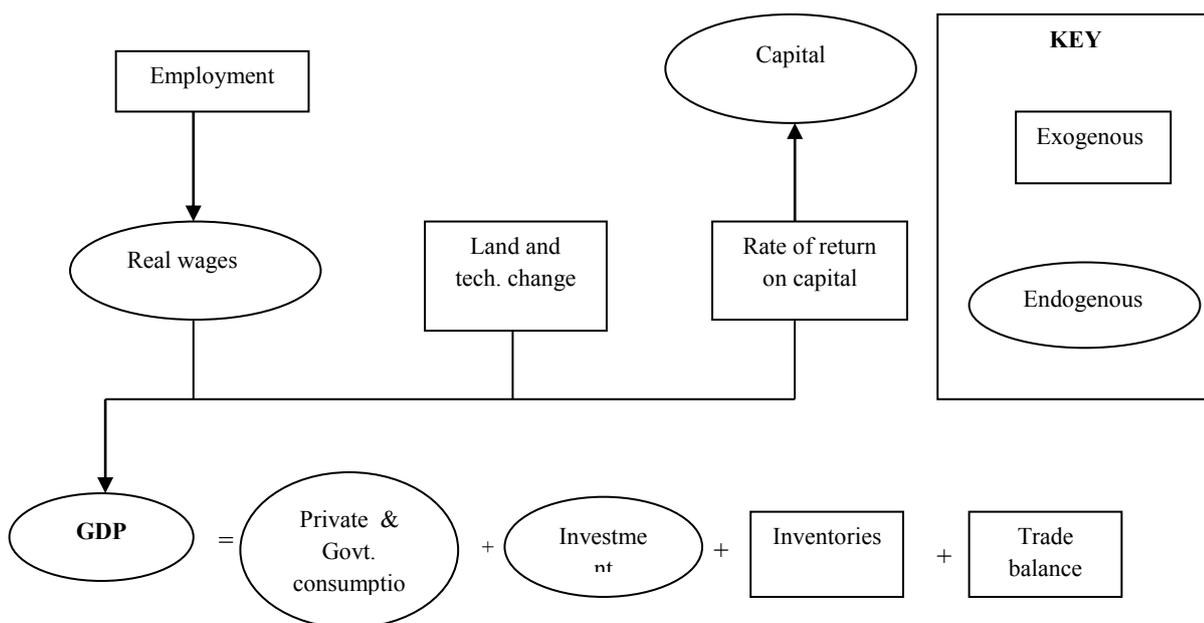
Source: Horridge (2007)

### 6.2.2 Long-run closure

Figure 6.2 illustrates the assumptions of long-run closure. Rate of return on capital, aggregate employment, and other primary factors, such as land and production technology, are exogenously determined in the long-run. Although aggregate employment is held fixed assuming full employment in the economy, labour is mobile between industries. Thus, we allow real wages to be determined endogenously. Since the rate of return on capital is assumed fixed, capital stocks at the aggregate and industry level can adjust over a longer period in order to maintain the given rate of return on capital.

On the demand side of the economy, most of the components of real domestic absorption are determined endogenously. For instance, we allow real private consumption expenditure to be determined endogenously, while real government consumption expenditure is allowed to

follow real private consumption expenditure. Aggregate investment is permitted to be decided by the industry-specific rules as described in Chapter 4. The balance of trade is determined exogenously, while inventory demand is set to be fixed. Therefore, changes in GDP due to the shock are matched by the changes in the domestic consumption. The nominal exchange rate is fixed and acts as the numeraire.



**Figure 6.2: Schematic representation of the long-run closure**

Source: Horridge (2007)

### 6.3 Simulation results

Policy simulation is a means of evaluating different equilibrium states when the model is subjected to changes in policy variables or exogenous shocks. As described by Nitsmer (1992), it presents a comparison between the status quo and the situation that arises as a consequence of a substantial policy change. The nature and the magnitude of the changes imposed are at the discretion of policy makers, and are usually made to explore variations of goal or target variables. This section presents the results of the policy simulations described in the previous section. While many variables were affected by policy simulations, only certain key indicators were used to analyse the major economic effects of each experiment.

### 6.3.1 Scenario 1: Productivity increase

This section describes the effects of increased agricultural productivity as detailed in Section 6.1.1. It operated through an increase in primary factor productivity in agricultural sectors.

#### 6.3.1.1 Macroeconomic effects

This section reveals the likely macroeconomic implications of the productivity improvement. The results, apart for a few variables, are stated as the percentage changes of respective endogenous variables with respect to their base values. Table 6.5 presents the projected macroeconomic effects of increased agricultural productivity on selected macro variables.

The results shown in Table 6.5 reveal that both scenarios under simulation I yielded a positive increase in real GDP. In the short-run, real GDP has increased by 0.46 per cent. The aggregate employment has decreased by 0.04 per cent. This can be explained through the implications on different industries in the economy. A detailed analysis of industry results is given in Section 6.4.1.2. Industry results reveal that productivity shock in agricultural sectors resulted in loss of employment in those sub-sectors, while boosting the employment generation in the industry and services sectors and in some other agricultural sectors. Reduction of agricultural employment reflects the normal pattern of structural change in economic development. This has not been matched by the employment creation in non-agricultural sectors. Therefore, the end result is aggregate employment loss due to reduction in agricultural employment.

It is important to understand how real GDP is increasing despite the decline in aggregate employment due to the productivity shock. GDP can be seen as a quantity index of the flow of goods and services produced in the economy. Percentage change in real GDP can be equated to weighted average of percentage changes of primary factors. Therefore, in percentage-change form:

$$GDP_Q = S_L l + S_K k + S_N n \quad (6.1)$$

**Table 6.5: Projected macroeconomic effects of increased agricultural productivity on selected macro variables (percentage changes)**

Macro variable	Simulation I	
	Short-run	Long-run
Real GDP	0.46	0.73
Aggregate employment	-0.04	Exogenous
Average real wage	Exogenous	1.12
Aggregate capital stock	Exogenous	0.41
CPI	-1.56	-0.69
Aggregate real household consumption	Exogenous	0.74
Aggregate real government consumption	Exogenous	0.74
Aggregate real investment expenditure	Exogenous	0.20
Export volume index	1.46	0.36
Import volume index (C.I.F. weights)	0.22	0.17
Real devaluation	1.50	0.47
Terms of trade	-0.26	-0.21
GDP price index	-1.48	-0.47
Export price index	-0.26	-0.21
Ordinary change to nominal trade balance to GDP ratio	0.0025	Exogenous
Ordinary change in the real trade balance *	5815.74	712.22

Source: Model simulations

Notes: \* in Rs Millions

where  $l$ ,  $k$  and  $n$  are the percentage changes in employment of labour, capital and agricultural land; and  $S_L$ ,  $S_K$  and  $S_N$  are the shares of returns to labour, capital and agricultural land in GDP.  $GDP_Q$  is the percentage change in real GDP. Under the short-run macroeconomic environment, it is assumed that,

$$k = n = 0 \quad (6.2)$$

The value of  $S_L$  from our data base is 0.44. Equations (6.1) and (6.2) suggest a value of -0.02 for the real GDP, given the change of aggregate employment as -0.04 in Table 6.5. Short-run real GDP under the simulation I is 0.46. Therefore, the change in real GDP is not fully

explained by change in labour. Simulation results show other factors, technical change (0.474) and indirect tax (0.009) contribute to the change in real GDP. All these three factors (-0.02+0.474+0.009) are accountable for the value of 0.463 approximating to our model simulation result of real GDP change of 0.46.

When the GDP from the expenditure side is considered, balance of trade is the only one variable allowed to be adjusted with domestic absorption held fixed. Table 6.1 shows, in the short-run, a marginal improvement (0.0023) in the balance of trade as a proportion of GDP. Moreover, productivity improvement generates Rs Million 5815.74 worth of ordinary change in the real trade balance. The behaviour of total exports and total imports proves that the balance of trade improvement occurs as a result of the increase in exports relative to increase in imports. The projected increase in import volume index of 0.22 per cent has been more than offset by an effect of a 1.46 per cent increase in the export volume index and a 0.26 per cent reduction in the export price index. This results in a movement towards a surplus in the balance of trade.

Since we assume that domestic absorption is fixed in the short-run, real GDP from the expenditure side can be considered as an index that accounts for changes in the rate at which Sri Lanka is able to trade exports for imports. In the percentage form we may write,

$$gdp_R = S_E e - S_M m \quad (6.3)$$

Where  $gdp_R$  is the percentage change in GDP,  $e$  and  $m$  are the percentage change in the foreign currency value of aggregate exports and imports, respectively, and  $S_E$  and  $S_M$  are the shares of exports and imports in GDP, respectively. From the values in our data base,  $S_E = 0.39$  and  $S_M = 0.49$ . Using the projected values for  $e$  (1.46) and  $m$  (0.22) from Table 6.5, we can say productivity increase yielded a 0.46 per cent increase in real GDP.

$$gdp_R = (1.46 * 0.39) - (0.22 * 0.49) = 0.46$$

It is revealed that productivity improvement led to real exchange rate depreciation of 1.5 per cent implying that the country would experience an increase in its competitiveness in the

export market as a consequence of a decrease in production costs. Furthermore, productivity improvement triggered agricultural supply curves to shift outwards and to the right resulting in an increase in output, and the prices tended to decline. The CPI drops as a result of declining prices. Because of the model's assumption of a fixed real wage, reduction in CPI led to a 1.56 per cent reduction in nominal wages. Therefore we can say that productivity improvement in agricultural sectors helps to achieve lower domestic prices and an increase in output and employment in export-oriented sectors.

In the long-run, most macroeconomic variables show a similar direction of change to the short-run, but in different magnitudes reflecting greater economic activity and a reduction in overall prices. However, economic activity becomes higher, but the reduction in overall prices turns out to be lower than those in the short-run. For example, the percentage change in long-run real GDP is 0.73 which is higher than short-run GDP of 0.46. In response to a fall in domestic prices due to productivity improvement, the CPI and GDP price indices decline by 0.69 and 0.47 per cent, respectively, in the long-run, lower than their short-run reductions.

In contrast to the short-run, we assume that the aggregate employment is fixed and the real wages are determined endogenously in the long-run simulations. However, labour is allowed to move between industries and among different labour categories. Table 6.5 shows that productivity improvement in the long-run stimulates a 1.12 per cent increase in real wages. Moreover, the economy's aggregate capital stock increases by 0.41 per cent.

With respect to the equation 6.1 in the long-run, we assume that

$$l = n = 0 \quad (6.4)$$

From our data base,  $S_K = 0.49$ . If we substitute the above, with the aggregate capital stock projection of 0.41 from Table 6.5 into (6.1), it would give a value of 0.19 ( $0.49 * 0.41$ ) which falls short of the simulation result of 0.73 increase in real GDP. Other additional factors, technical change (0.48) and indirect taxes (0.06), contribute to this in order to explain the change in GDP of 0.73 ( $0.19 + 0.48 + 0.06$ ).

Furthermore, domestic absorption is determined endogenously, apart from the demand for inventories, and the trade balance has been set fixed contrary to the short-run. Accordingly, real aggregate consumption has increased by 0.74 per cent due to lower prices and high income levels. This higher level of aggregate consumption enjoyed by the consumers can be seen as an indicator of welfare improvement due to an increase in agricultural productivity. Aggregate real government consumption also increases by the same percentage (0.74 per cent) as it is assumed to move together with aggregate real consumption in the long-run. Aggregate real investment demand grows by 0.2 per cent.

Therefore, GDP identity in the long-run can be written as

$$GDP = A + (X - M) \quad (6.5)$$

which is an extension of (6.3).  $A$  is domestic absorption,  $X$  is aggregate export earnings and  $M$  is aggregate import expenditure in foreign currencies. The percentage change form of (6.5) is

$$GDP_R = S_A a + S_E e - S_M m \quad (6.6)$$

where,  $S_A$  is share of domestic absorption and  $a$  is percentage change in domestic absorption.

Furthermore,

$$S_A a = S_C c + S_I i + S_G g \quad (6.7)$$

where  $S_C$ ,  $S_I$  and  $S_G$  are the shares of aggregate real private consumption, aggregate real investment and real government expenditure in GDP, respectively.  $c$ ,  $i$  and  $g$  are the percentage changes in aggregate real private consumption, aggregate real investment and real government expenditure. From our data base,  $S_C = 0.7$ ,  $S_I = 0.25$  and  $S_G = 0.14$ . Using the projected values from Table 6.5 for  $c$  (0.74),  $i$  (0.2),  $g$  (0.74),  $e$  (0.36) and  $m$  (0.17), equation (6.6) and (6.7) give:

$$GDP_R = (0.7 * 0.74) + (0.2 * 0.25) + (0.14 * 0.74) + (0.39 * 0.36) - (0.49 * 0.17) = 0.73$$

which is the value of our simulation result in Table 6.5.

While keeping the balance of trade fixed in the long-run, the export volume index increases by 0.36 per cent compared to 0.17 per cent increase in the import volume index. It is observed that the real exchange rate depreciates by 0.47 per cent which is less than in the short-run and export prices decrease by 0.21 per cent indicating an improvement in competitiveness leading to an increase in exports. Decline in the export price index instigates an equivalent deterioration of terms of trade of 0.21 per cent.

As discussed above, the overall macro results bring to light that improvement in agricultural productivity promotes the economy in both the short- and long-run. Nevertheless, economic activity becomes higher in the long-run, but the decline in overall prices is lower in the long-run than in the short-run.

### **6.3.1.2 Sectoral effects**

This section presents the sectoral impacts of the agricultural productivity improvement on variables such as output and employment levels of industries. They are interpreted in view of the previously explained macroeconomic results. Given the large number of production sectors, it is essential to summarise the industry results without losing important details in order to understand the impacts at the national level. Therefore, it was first summarised so as to provide the averages of the individual industry results for three sectors of the economy - agriculture, manufacturing and services<sup>13</sup>. The impacts on important individual industries are discussed.

The major components of domestic absorption (household demand, investment demand and government demand) are fixed at the aggregate level in the short-run. As a result of this, the key opportunities for output growth are to increase exports, substitute imports and/or sell more to other industries as an intermediate input for their production process.

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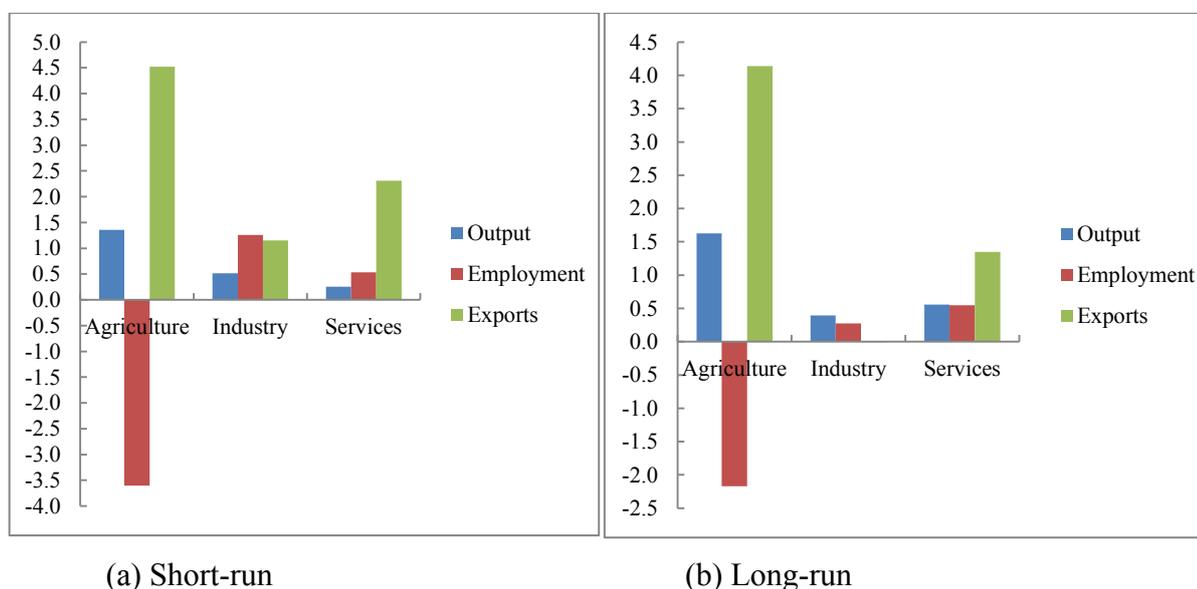
<sup>13</sup> These are weighted averages of individual industry results for the three sectors of the economy. Weights used to aggregate variables industry output, employment, imports, exports and domestic prices are total value added, total labour bill, total ex-duty import value, total export valued at purchasers' prices and total cost of each industry, respectively.

Figure 6.3 describes the summarised sectoral impacts of productivity improvements on output employment and exports. Firstly, agricultural productivity improvement leads to output expansion in all three broad industry groups -agriculture, industry and services in both the short- and long-run. Output growth in agricultural industries is the highest as the productivity improvement took place in the agricultural sectors. Similarly, productivity growth induces all three aggregate sectors to expand in terms of exports with the highest export growth recorded in the agriculture sector. However, there is a decline in overall employment in that sector. This decline is lower in the long-run compared to the short-run. In the short-run there is 3.6 per cent reduction in overall employment in the agricultural sector, while in the long run there is a 2.1 per cent reduction. Both industry and services sectors showed an increase in employment in both scenarios. Increased employment in industry and services could not outweigh the reduction of employment in the agricultural sector reflecting the negative impact on aggregate employment at the national level. Therefore, it can be said that productivity improvement in the agricultural sector promotes not only that sector, but it also stimulates the expansion of other sectors in the economy.

When the behaviour of individual industries is considered, improvement in agricultural productivity in the context of a slack labour market and fixed sectoral capital, most of the industries show an expansion in the level of output (Table 6.6). In the short-run, minor export crops, tea growing, vegetables and highland crops are the major expanding agricultural industries. Other than those sectors, rubber growing and coconut growing industries also show a considerable expansion. In the industry sector, tea processing, wood and wood products, and textile, footwear and leather products are the largest gainers in output growth. Rubber processing and plastic and rubber products sectors also demonstrate a sizeable growth. Amongst these industries, tea processing, rubber processing and minor export crops are export-oriented industries. Expansion of tea growing and rubber growing industries has stimulated the growth of export-oriented tea processing and rubber processing industries. Vegetables and highland crops are among the sectors that mainly cater to the domestic market to compete with imports.

A sales decomposition analysis of the changes in output results presented in Table 6.6 is reported in the Appendix Table B.2 for both the short- and long-run. Sales decomposition reveals that the highest fraction of output increase recorded in tea growing and rubber growing

industries are contributed as intermediate inputs, while the highest fraction of output increase in vegetable and highland crops is due to increased sales for household consumption. Export-oriented industries, such as tea processing, minor export crops, textile, footwear and leather products, and wood and wood products, show an increase in sales for exporting.



**Figure 6.3: Summarised impacts of productivity improvements on output, employment and exports (percentage changes)**

Source: Model simulations

It is clear from Table 6.6 that there was a reduction in employment in almost all the industries where the productivity improvement took place. One can expect an increase in demand for agricultural employment with the boost in production of those sectors due to a rise in productivity. This is not always the case. As Schneider and Gugerty (2011, p. 57) explain “a new technology/ productivity improvement can have a variety of impacts with different consequences for output, profits and employment. If the technology reduces needed inputs, production cost will decrease (raising profits), but output may not be affected and employment could be reduced. If instead technology raises yields, output and (most likely) employment will increase, but profits will not necessarily increase. Alternatively, if the technology raises labour productivity, wage rates will increase but probably at the expense of the quantity of labour employed and with unclear effects on output and profits”. Since we shock agricultural productivity in terms of a rise in primary factor productivity, we can think of it as a technology that raised labour productivity in the agricultural sectors. Therefore, we can see a negative

impact on the employment of rubber growing, coconut growing, paddy, vegetables, fruit, highland crops, and livestock and fisheries sectors.

On the other hand, manufacturing industries which primarily depend on those agricultural products as intermediate inputs show a clear expansion of employment. For example, overall employment in tea processing, rubber processing, coconut processing, rice milling, and food, beverages and tobacco sectors have expanded. Almost all of the other manufacturing industries also contribute to the expansion of employment. For instance, chemicals and fertiliser and petroleum are used as intermediate inputs for agricultural and other industries. Therefore, the expansion of those industries in turn triggers growth of these two industries (Appendix Table B.2).

Even though most industries expanded in the short-run, overall output effects are less pronounced due to the capital constraint in the short-run. Under the long-run closure with full employment and mobile capital, we can expect industries to expand more than they do in the short-run. Most rapidly expanding agricultural industries in the long-run are minor export crops, tea growing, coconut growing, vegetables and highland crops. Coconut processing, tea processing, wood and wood products, chemicals and fertiliser, textile, footwear and leather products, and electricity, gas and water are the major expanding manufacturing industries.

The coconut growing sector shows a significant expansion of output in the long-run compared to the short-run triggering huge development of the coconut processing industry as well. Sales decomposition results reveal that the output of the coconut processing sector in the short-run is mainly directed towards household consumption, while that of the long-run is mainly sold as intermediate inputs. That is the reason for the expansion of the coconut processing sector that has direct backward linkages with the coconut growing sector. In contrast to the short-run case, garment industry and other manufacturing industry output and employment show a contraction in the long-run (Table 6.6). The reason behind this contraction could be viewed as a consequence of the attraction of resources to more profitable manufacturing industries which now receive more intermediate inputs at a lower cost. Similar to the short-run case, all services sectors have experienced gains in both output and employment in the long-run (Table 6.6). The reason for this could be the direct linkages of those services industries with expanding

agricultural and manufacturing industries where outputs of those services industries are used as inputs for expanding industries.

Figure 6.4 shows the impact on price of output as a result of productivity improvement in agricultural sectors. It is shown that the output prices of agricultural industries where productivity improvement took place are significantly lower in both the short- and long-run. A decomposition analysis of output price ( $pl_{tot}$ ) with AnalyseGE shows that the shock of technological improvement of primary factors ( $al_{prim}$ ) and resulting decline in price of primary factor inputs have mainly contributed to this reduction in output prices. The reduction in prices in the short-run is more prominent than in the long-run. The related processing industries such as the tea processing, rubber processing, coconut processing, rice milling and flour milling sectors also show a decrease in output prices.

All the agricultural industries and related agricultural manufacturing industries show a decline in output prices in the short-run. Decline in the price of primary factors causes the decline in output prices of agricultural industries, while decline in material output prices ( $pl$ ) causes the decline in output prices of related agricultural manufacturing industries. Other industrial sectors show an increase in output prices.

Total imports of aggregate agricultural and industry sectors increase in both short-run and long-run due to expansion of those sectors (Figure 6.5). Agricultural imports are higher in the long-run (0.74 per cent) compared to the short-run (0.41 per cent). Imports of industry sector is higher in the short-run (0.26 per cent) compared to the increase in the long-run (0.04 per cent). Total services imports show a decline (of 0.17 per cent) in the short-run, while there is an increase of 0.66 per cent in the long-run. A detailed description of total supply of imports to individual sectors is reported in the Appendix Table B.3. Total imports of all the agricultural sectors have increased except for the potato growing sector in both the short- and long-run. Among the agriculture-related industrial sectors, the rice milling sector shows a contraction in imports in both scenarios (16.67 and 8.36 per cent contraction in short-run and long-run, respectively) and the flour milling sector shows a 1.32 per cent contraction of imports in the short-run. This decline could be due to increased supply of raw materials as a result of increased domestic output of paddy and other related agricultural industries.

**Table 6.6: Projected effects of agricultural productivity improvement on sectoral output and employment (percentage changes)**

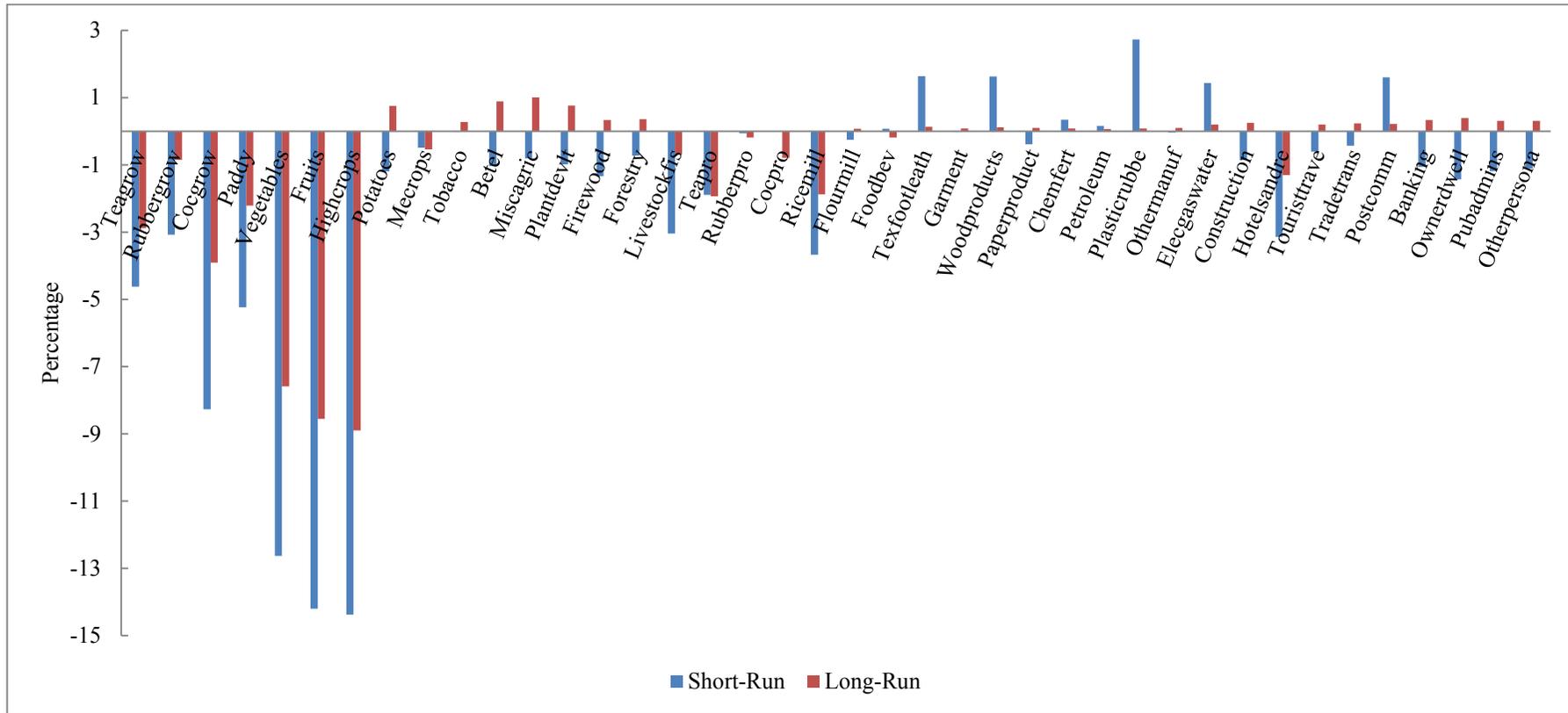
Sector	Industry category <sup>a</sup>	Short-run		Long-run	
		Output	Employment	Output	Employment
Tea growing	A	4.19	0.05	4.40	0.31
Rubber growing	A	0.82	-1.03	0.85	-0.45
Coconut growing	A	0.79	-5.63	2.71	-2.04
Paddy	A	0.40	-3.01	0.67	-1.90
Vegetables	A	1.47	-8.85	1.39	-6.39
Fruit	A	0.53	-9.43	0.81	-6.77
Highland crops	A	1.11	-8.47	1.14	-6.34
Potatoes	A	-0.02	-0.04	0.48	0.76
Minor export crops	A	9.39	6.63	10.57	6.65
Tobacco	A	0.63	1.42	0.38	0.59
Betel	A	0.20	0.44	0.46	0.72
Miscellaneous agricultural crops	A	0.33	0.73	0.65	1.04
Plantation development	A	0.13	0.26	0.59	0.91
Firewood	A	0.08	0.18	0.43	0.40
Forestry	A	0.34	0.75	0.52	0.49
Livestock and fisheries	A	0.55	-1.45	0.59	-0.64
Tea processing	ARM	4.20	11.36	4.40	4.33
Rubber processing	ARM	0.81	12.69	0.82	0.70
Coconut processing	ARM	0.24	2.60	16.70	16.57
Rice milling	ARM	0.43	5.55	0.75	0.63
Flour milling	ARM	0.03	0.34	0.51	0.40
Food, beverages and tobacco	ARM	0.15	1.59	0.60	0.49
Textile, footwear and leather	M	1.04	3.80	1.15	1.06

Garments	M	0.33	1.20	-1.69	-1.78
Wood and wood products	M	2.00	5.17	1.93	1.85
Paper and paper products	M	0.09	0.19	0.81	0.75
Chemicals and fertiliser	M	0.34	1.85	1.21	1.11
Petroleum	M	0.26	3.01	0.49	0.37
Plastic and rubber products	M	0.87	4.44	0.97	0.87
Other manufacturing	M	0.40	1.16	-0.47	-0.55
Electricity, gas and water	S	0.41	2.04	1.08	0.98
Construction	S	0.23	0.35	0.49	0.44
Hotels and restaurants	S	0.43	0.65	0.94	0.90
Tourist and travel	S	0.02	0.04	0.74	0.67
Trade and transport	S	0.28	0.80	0.47	0.39
Post and communications	S	0.00	3.94	0.75	0.63
Banking	S	0.52	0.69	0.65	0.62
Owner dwelling	S	0.12	0.12	0.50	0.50
Public administration and defence	S	0.03	0.03	0.70	0.70
Other personal services	S	0.20	0.25	0.82	0.80

Source: Model simulations

Note:

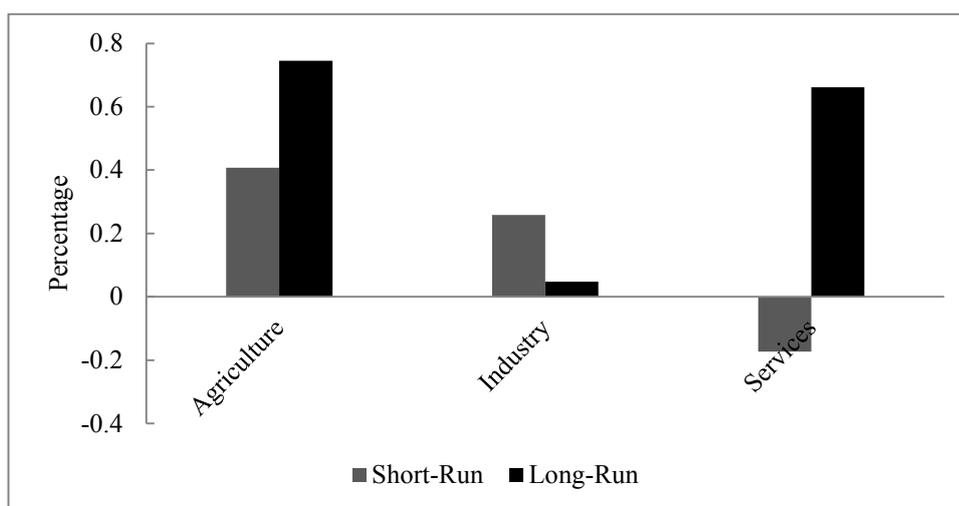
<sup>a</sup> Key A= Agricultural, AMR=Agriculture-related manufacturing, M=Manufacturing, S=Services



**Figure 6.4: Impact of productivity improvements on output price (percentage changes)**

Source: Model simulations

Amongst the other industry sectors, the textile, footwear and leather sector shows a slight contraction of imports in the long-run. A decomposition analysis of imports ( $x0imp$ ) with AnalyseGE shows that households account for most of those negative changes in agricultural imports. Increased domestic agricultural output due to productivity improvement is not enough to match the demand for agricultural products by households. Therefore, agricultural imports increase despite increased productivity in that sector. For the textile, footwear and leather industry, most of the decrease is in intermediate usage.



**Figure 6.5: Impact of productivity improvements on imports (percentage changes)**

Source: Model simulations

### 6.3.1.3 Impacts on employment by occupation

Table 6.7 depicts the changes that occur among different occupational labour categories. These projections reveal that the agricultural labour category shows a substantial contraction in both the short- and long-run (3.47 and 2.15 per cent, respectively). Industry results also show a reduction of employment in some agricultural sectors due to the productivity increase in those agricultural sectors. Therefore, we can see that reduction is caused by the drop in the agricultural-related workers category. All the other occupational categories show positive increases. The demand for unskilled labour, particularly production and related transport equipment operators and workers, benefits the most in the short-run, while skilled and semi-skilled workers (such as professional, technical and related workers, clerical and related workers, and administrative and managerial workers) benefit in the long-run due to the expansion of manufacturing industries.

**Table 6.7: Projected impacts of productivity improvement on employment by different occupational groups (percentage changes)**

Occupational group	SR	LR
Professional, technical and related workers	0.23	0.58
Administrative and managerial workers	0.69	0.51
Clerical and related workers	0.46	0.54
Sales and service-related workers	0.49	0.48
Agricultural, animal husbandry, fisheries and forestry workers	-3.47	-2.15
Production and related transport equipment operators and workers	0.98	0.33
Other workers	0.19	0.13

Source: Model simulations

#### **6.3.1.4 Household level effects**

Household income flows are determined by their ownership of factors. Therefore, the variation in factor remuneration affects the household income. Table 6.8 summarises the household income changes in both the short- and long-run as a result of productivity improvement. This shows that, in the short-run, real income for all the household groups, except for Uva Province households, increases. Households of Uva Province experience a 0.09 per cent decline in their real household income. As described in Chapter 2, Uva Province is primarily an agricultural province with the highest percentage of its population engaged in agricultural activities. Therefore, the decline in agricultural employment and output prices could lead to the reduction in real household income of this province. Households of North Central and Sabaragamuwa Provinces, which also have higher numbers of agricultural workers, show only a slight increase in real household income compared to other provinces. Here we observe that household income increases as the gain from the productivity increase outweighs the producer's losses due to lower agricultural prices and the low income elasticity of demand for agricultural commodities. Households in the Western Province where a majority of the population is engaged in manufacturing and services sector-related work (nearly 90 per cent of the population) experience the highest gain in real income. They benefit from expansion of manufacturing and services industries and lower food prices due to the increased agricultural productivity.

In the long-run however, all types of households experience an increase in their real household income. As stated in an earlier section, positive output effects in all three agricultural, industry and services sectors are more pronounced in the long-run. Furthermore, real wages are endogenously determined, while aggregate employment is held fixed in the long-run. The results show an increase in real wages as a consequence of the productivity rise. Therefore, even with a decline in farm employment, remaining agricultural workers benefit from this real wage increase in the long-run. A combination of all these factors leads to an increase in real household income of all the household groups. However, income gains are slightly lower for Uva, North Central and Sabaragamuwa Provinces.

**Table 6.8: The effects on real household income of productivity improvements (percentage changes)**

Household group	Short-run	Long-run
Western	0.72	0.97
Central	0.23	0.80
Southern	0.26	0.82
Sabaragamuwa	0.06	0.71
North western	0.51	0.91
Uva	-0.09	0.57
North central	0.01	0.64
Northern	0.38	0.96
Eastern	0.25	0.81

Source: Model simulations

### 6.3.1.5 Impact on household consumption

Table 6.5 showed that the rise in agricultural productivity induces a decline in the aggregate CPI by 1.56 per cent in the short-run and 0.69 per cent in the long-run. The variation in the change in consumer prices is not uniform across households. A decline in the CPI was observed in both the short-run and long-run in all households. The highest drops in the CPI are recorded for the Northern Province households (-1.83 per cent) followed by North Central (-1.81 per cent) and Uva Province households (-1.79 per cent). The lowest decline was for Western Province households (-1.14 per cent) in the short-run. Uva (-0.87 per cent), North

Central (-0.84 per cent) and Northern Provinces (-0.84 per cent) displays highest declines in the CPI, while Western Province records the lowest decline (-0.42 per cent) in the long-run.

Aggregate real household consumption is assumed fixed in the short-run. Table 6.9 depicts the changes in real household consumption in the long-run. Overall, an improvement in agricultural productivity induces real consumption of all household groups. This implies that productivity improvement enhances welfare of households. Gain in real household consumption is the largest in the Northern Province (1.03 per cent). This is followed by the households in North Western Province (0.8 per cent). Western Province households achieve the least. The simulation results reveal that largest price falls are observed in the agricultural/food-related industries in the long-run. Most other industry and service sectors exhibit an increase in output prices. Consumption shares of different commodities by households show that Western Province households consume most of those products. Therefore, Western Province households record the lowest increase in household consumption even with their record of the highest increase in real income.

**Table 6.9: Projected effects of productivity improvements on real household consumption in the long-run (percentage changes)**

Household group	Real consumption
Western	0.61
Central	0.72
Southern	0.74
Sabaragamuwa	0.74
North Western	0.80
Uva	0.67
North Central	0.71
Northern	1.03
Eastern	0.72

Source: Model simulations

### 6.3.1.6 Regional results

#### *Macro results*

The effect of productivity improvements on the regional GDP and employment is presented in Table 6.10. Regional GDP increases in all the provinces except for North Central Province in the short-run, while that of all the provinces increases in the long-run. Sabaragamuwa Province experiences the highest growth in output (by 1.06 per cent and 1.78 per cent) followed by the Central Province (by 0.73 per cent and 1.40 per cent) and Southern Province (by 0.65 per cent and 1.26 per cent) in the short-run and long-run, respectively. We notice that agricultural sectors where productivity improvement took place and related processing industries are located mainly in those provinces (Figure 6.4).

Among the regions recording positive regional GDP growth, Sabaragamuwa, Central, Southern and Western Provinces are the only regions whose GDP growth exceeds the national real GDP growth<sup>14</sup> (by 0.54, 0.21, 0.13 and 0.04 percentage points, respectively). In the long-run, Western Province experiences the lowest growth in regional GDP. The GDP growth rates in Sabaragamuwa, Central, Southern, Uva and North Western Provinces are higher than the national GDP growth, while Northern Province GDP goes along with national GDP.

There is an employment contraction in many provinces reflecting decline in national aggregate employment in the short-run. Western Province records the highest growth in regional employment (0.92 per cent). Sabaragamuwa Province also shows a slight positive growth in employment in the short-run (0.1 per cent). The highest employment contraction is in the Uva Province (-2.07 per cent) followed by the North Central Province (-1.65 per cent).

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<sup>14</sup> It is important to note that the model estimates the regional output growth at factor cost only. Therefore, national output growth at factor cost (which is 0.51 in the short-run and 0.75 in the long-run) is used to compare the regional output growth with the national output growth throughout the regional analysis.

**Table 6.10: Regional macroeconomic effects of productivity improvements  
(Percentage changes)**

Region	Short-run		Long-run	
	Growth in real gross regional product	Growth in aggregate regional employment	Growth in real gross regional product	Growth in aggregate regional employment
Western	0.56	0.92	0.39	0.27
Central	0.73	-1.04	1.40	-0.40
Southern	0.65	-0.31	1.26	0.11
Sabaragamuwa	1.06	0.10	1.78	0.29
North Western	0.17	-1.20	0.88	-0.36
Uva	0.32	-2.07	1.21	-0.90
North Central	-0.04	-1.65	0.67	-0.67
Northern	0.10	-0.39	0.75	0.33
Eastern	0.03	-1.50	0.67	-0.57

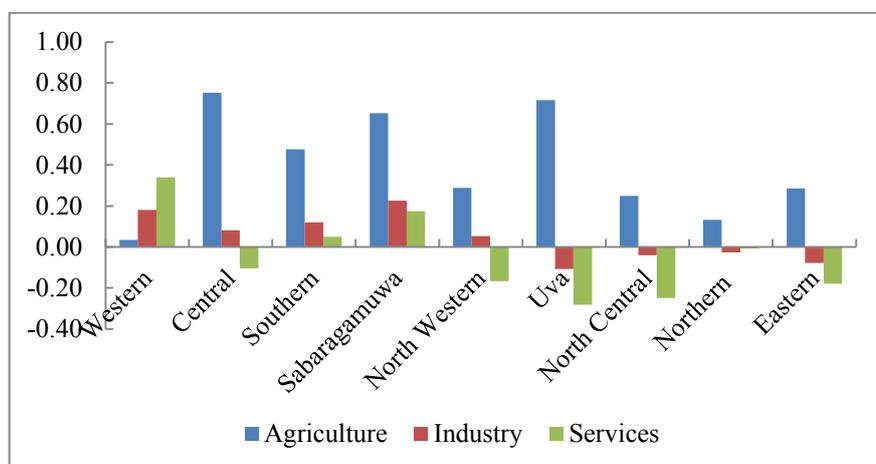
Source: Model simulations

### ***Industry results***

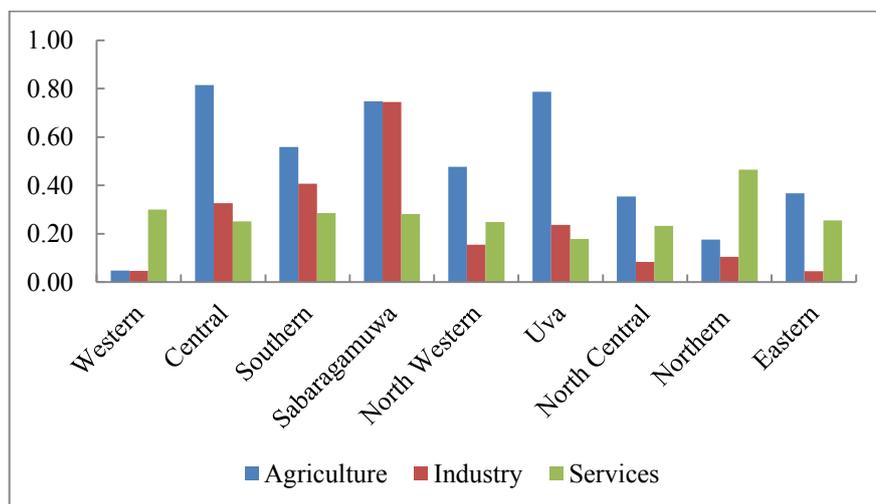
In our model data base, 37 industries have been grouped as national industries and the remaining three industries have been allocated to local industry group. As explained in Chapter 4, national industries are traded extensively across regional borders, while local commodities are consumed in the region in which they are being produced. These two groups are treated differently in the regional extension of the model. The output growth of each national industry in a region is believed to stay in line with that industry's output growth at the national level. In contrast, local industry growth rates are set to equal the rate of growth on demand for local commodities in each region and the rest of the world, which incorporates local multiplier effects.

Figure 6.6 shows the effect of agricultural productivity increase on contributions to regional GDP by different sectors. According to Figure 6.6, agricultural sector has a positive influence on all the regions in the short-run. The industrial sector positively contributes only to the GDP

of five provinces, while four regions receive higher positive contributions from the services sector. All three sectors positively affect all the regions in the long-run.



(a) Short-run



(a) Long-run

**Figure 6.6: Impacts of productivity improvements on output by region and aggregate industry (percentage changes)**

Source: Model simulations

***Determinants of each industry’s growth relative to national growth***

It is important to examine the ‘regional advantage matrix’ in order to determine each region’s growth relative to national growth. A regional advantage matrix decomposes the difference between percentage change in a region’s real value-added and the percentage change in national real GDP into contributions made by each industry. It shows which industries are making a positive contribution to this difference. Columns of the regional advantage matrix

add up to the difference between the regional and national GDP growth. Rows of the matrix explain which industries are attributed to this difference.

A region is said to have a positive (negative) regional advantage if its regional GDP growth surpasses (follows) the national GDP growth. A combination of three factors influences an industry's contribution to the difference between the regional and national GDP growth. An industry contributes positively to a region if its output increases by more than national real GDP growth and that industry's share in the particular region is larger than its share in the national economy; or if its output increases by less than the national real GDP growth and its share in the region is less than its share in the national economy; or in relation to local industries, if its output in the region increases (decreases) by more (by less) than its national output. Accordingly, winning regions have more than their share of faster growing industries and/or less than their share of slower growing or contracting industries, while losing regions will specialise in contracting industries and/or have less than their share of faster growing industries.

By looking at the regional advantage matrix in Table 6.11, we can say four regions gain as a result of agricultural productivity improvement in the short-run. Those are Sabaragamuwa, Central, Southern and Western Provinces with positive regional advantage of 0.54, 0.21, 0.13 and 0.04 percentages, respectively. That is those four provinces have more than their share of the faster growing industries and/or have less than their share of slower growing industries, while the other five provinces have less than their share of the faster growing industries and/or they specialise in the slower growing industries.

Table 6.11 shows that seven provinces (Central, Uva, Sabaragamuwa, Southern, North Western, Eastern and North Central) receive positive contributions from agricultural industries towards their regional advantage in the short-run. Only two (Sabaragamuwa, and Western) provinces receive positive contributions from industrial sectors to their regional advantage. Only Western and Sabaragamuwa Provinces receive positive contributions from industrial sectors to their regional advantage. With regard to national industries, Central, Sabaragamuwa, Uva and Southern Provinces receive positive contributions towards their regional advantage.

Comparing the regional advantage matrix in the Appendix Table B.4 with Table 6.11, we can observe that winning regions are over-represented in terms of fast growing agricultural industries and related export-oriented manufacturing industries.

In the long-run, all industries record positive output growth at the national level apart from two industrial sectors (garments and other manufacturing sectors) that have demonstrated significant output contractions (see Table 6.6). Agricultural industries and related export-oriented manufacturing industries which recorded significant output growth in the short-run exhibit a similar pattern of excessive output growth in the long-run as well (minor export crops, tea growing, vegetables, highland crops and tea processing sectors). Other than those industries, the coconut growing industry and coconut processing industry encounter high output growth. Among manufacturing industries, the textile, footwear and leather industry, wood and wood products industry, and chemicals and fertiliser industry show a sizable expansion. All the other agricultural, manufacturing and services industries experience modest growth relative to the above-mentioned industries.

**Table 6.11: Short-run aggregate regional advantage matrix of productivity improvements**

Sector	Western	Central	Southern	Sabara-gamua	North Western	Uva	North Central	Northern	Eastern
Agriculture	-0.215	0.507	0.231	0.406	0.044	0.473	0.007	-0.114	0.043
Industry	0.062	-0.043	-0.004	0.103	-0.071	-0.23	-0.164	-0.151	-0.203
Services	0.198	-0.247	-0.092	0.032	-0.31	-0.427	-0.393	-0.146	-0.322
<b>Total Contribution</b>	<b>0.045</b>	<b>0.217</b>	<b>0.135</b>	<b>0.541</b>	<b>-0.336</b>	<b>-0.184</b>	<b>-0.55</b>	<b>-0.412</b>	<b>-0.483</b>
National industries	-0.002	0.258	0.119	0.487	-0.28	0.017	-0.427	-0.355	-0.345
Local industries	0.046	-0.041	0.016	0.054	-0.057	-0.202	-0.123	-0.057	-0.138
<b>Total Contribution</b>	<b>0.045</b>	<b>0.217</b>	<b>0.135</b>	<b>0.541</b>	<b>-0.336</b>	<b>-0.184</b>	<b>-0.55</b>	<b>-0.412</b>	<b>-0.483</b>

Source: Model simulations

The aggregate regional advantage matrix (Table 6.12) indicates that five provinces record positive regional advantage in the long-run. Sabaragamuwa, Central, Southern, Uva and North Western Provinces are the regions with positive regional advantage (recording 1.02, 0.64, 0.5, 0.45 and 0.13 per cent, respectively). The other four provinces (Northern, Eastern, North Central and Western Provinces) record negative regional advantage. This suggests that, while the former five provinces have more than their share of the faster growing industries and/or

have less than their share of slow growing industries, the latter four provinces have less than their share of the faster growing industries and/or specialise in slow growing industries.

Table 6.12 further demonstrates that all the provinces except Western and Northern Provinces receive positive contributions from the agricultural industries because of their over-representation of faster growing agricultural industries. Western Province under-represents many of the fast growing agricultural industries. Sabaragamuwa, Southern, Central, Uva and North Western Provinces harvest positive contributions from industrial sectors mainly because those regions have more than their share of the faster growing agriculture-related processing industries. Western, Southern and Northern Provinces gain from the services sectors. Among those, Northern Province receives the highest positive gain because it is over-represented in the public administration and defence sector.

**Table 6.12: Long-run aggregate regional advantage matrix of productivity improvements**

Sector	Western	Central	Southern	Sabara-gamuwa	North Western	Uva	North Central	Northern	Eastern
Agriculture	-0.22	0.48	0.23	0.42	0.14	0.43	0.01	-0.12	0.01
Industry	-0.14	0.18	0.26	0.60	0.01	0.09	-0.06	-0.02	-0.08
Services	0.01	-0.02	0.01	0.00	-0.02	-0.07	-0.03	0.14	-0.01
<b>Total Contribution</b>	<b>-0.36</b>	<b>0.64</b>	<b>0.50</b>	<b>1.02</b>	<b>0.13</b>	<b>0.45</b>	<b>-0.08</b>	<b>0.00</b>	<b>-0.08</b>
National industries	-0.34	0.63	0.45	0.96	0.15	0.45	-0.03	-0.02	-0.04
Local industries	-0.01	0.01	0.06	0.07	-0.02	0.00	-0.04	0.02	-0.04
<b>Total Contribution</b>	<b>-0.36</b>	<b>0.64</b>	<b>0.50</b>	<b>1.02</b>	<b>0.13</b>	<b>0.45</b>	<b>-0.08</b>	<b>0.00</b>	<b>-0.08</b>

Source: Model simulations

### ***Impact on employment***

Like the regional output growth, the assumptions underlying the employment growth of the national industries and local industries are different. The employment growth of a national industry is assumed to be in step with industry's employment growth at the national level. On the other hand, the employment growth of a local industry is estimated by adding the employment growth of that industry at the national level to the growth of its regional output relative to its national output. It is important to focus on employment contributions rather than employment growth rates of all the individual industries as it enables reflection on the differences in aggregate regional employment depicted in Table 6.10.

Table 6.13 displays the contributions to total regional employment by aggregate industries (agriculture, industry and services). The differences in employment at the regional level stem from the economic structure of the nine provinces. Reflecting the reduction in total agricultural employment, employment in the broad agriculture sector in all the provinces shows a decline in both the short-run and long-run. However, long-run reductions are less prominent than that in the short-run. Highest reductions are record in the Uva, North Central and Eastern Provinces. Regarding contributions to employment from the broad industry sector in the long-run, there is a negative 0.02 contribution from the Western Province. This could be due to the contraction of employment in the garment and other manufacturing sectors which are mainly located in the Western Province.

**Table 6.13: The effects on contributions to total regional employment of productivity improvements**

Province	Agriculture		Industry		Services	
	SR	LR	SR	LR	SR	LR
Western	-0.11	-0.06	0.42	-0.02	0.61	0.35
Central	-1.27	-0.82	0.19	0.15	0.04	0.28
Southern	-0.76	-0.43	0.24	0.22	0.21	0.33
Sabaragamuwa	-0.69	-0.37	0.46	0.33	0.33	0.33
North Western	-1.34	-0.70	0.16	0.06	-0.02	0.28
Uva	-1.82	-1.21	-0.09	0.12	-0.16	0.19
North Central	-1.50	-0.96	-0.02	0.02	-0.13	0.28
Northern	-0.43	-0.27	-0.01	0.05	0.05	0.55
Eastern	-1.38	-0.90	-0.07	0.01	-0.05	0.32

Source: Model simulations

### 6.3.2 Scenario II: Agricultural trade reforms

This section describes the effects of tariff cuts in the agricultural sectors as detailed in section 6.1.2.

#### 6.3.2.1 Macroeconomic effects

This section presents the projected macroeconomic implications of the trade policy shock. Table 6.14 presents the projected macroeconomic effects of a tariff cut in the agricultural sectors in Sri Lanka. Similar to Section 6.4.1.1, the results, apart for a few variables, are stated as the percentage changes of respective endogenous variables with respect to their base values.

The results reveal that the liberalisation of agricultural trade in both the short-run and long-run brought in a moderate increase in real GDP. In the short-run it yielded a 0.03 per cent increase in real GDP, while in the long-run it was a 0.04 per cent increase. In the short-run it is apparent that all components of GDP other than aggregate employment have been set fixed. Therefore, we can see a change in employment due to the policy shock. According to Table 6.14, aggregate employment has increased by 0.07 per cent. Industry results show that this increase in employment is due to expanding export-oriented sectors in the economy. The assumption of the fixed use of capital and land cause an increased rate of employment compared to increase in real GDP. With fixed capital and land, increased use of labour instigates the decline of marginal productivity of labour. Therefore, to accomplish a particular output increase, industry must expand the use of labour input by more than the rate of output growth.

By using equations (6.1) and (6.2) from Section 6.4.1.1 and from our data base  $S_L = 0.44$ , a 0.03 per cent increase in real GDP can be obtained, given the increase in aggregate employment (0.07 per cent) from Table 6.14 ( $0.07 * 0.44 = 0.03$ ). Adding the change in indirect taxes (0.002 per cent) from our short-run model simulations to this gives an approximate value of 0.032 ( $0.03 + 0.002 = 0.032$ ) as the percentage change in the real GDP, which is closer to our short-run model simulation result in Table 6.14.

**Table 6.14: Projected macroeconomic effects of agricultural trade liberalisation on selected macro variables (percentage changes)**

Description	SR	LR
Ordinary change to nominal balance of trade to nominal GDP	0.0002	Exogenous
Aggregate employment: wage bill weights	0.07	Exogenous
Ordinary change in the real trade balance*	416.82	Exogenous
Real wage	Exogenous	0.47
Real GDP from expenditure side	0.031	0.041
Real devaluation	0.07	0.04
Terms of trade	-0.01	0.03
Export volume index	0.11	-0.42
Import volume index, C.I.F. weights	0.02	-0.31
GDP price index, expenditure side	-0.07	-0.04
Aggregate investment price index	-0.01	0.12
CPI	-0.07	-0.15
Exports price index	-0.01	0.03
Duty-paid imports price index, local currency	-0.49	-0.50
Aggregate real investment expenditure	Exogenous	0.03
Real household consumption	Exogenous	0.05
Aggregate real government demands	Exogenous	0.05
Real GDP at factor cost (inputs)	0.03	0.04

Source: Model simulations

Notes: \* in Rs Millions

A tariff cut in agricultural goods reduces the prices of imported agricultural goods that are used as inputs as well as final consumer goods. This move brings down the prices of domestic counterparts of these imported goods. Furthermore, now cheaper import and import-competing goods reduce the direct cost of production of non-traded goods. As a result, there will be a declining effect on the CPI. As a result of these three impacts, the CPI declined by 0.07 per cent (Table 6.14). A reduction in CPI represents a cut in production costs. A decline of CPI leads to a decline in nominal wages (0.07 per cent) as the nominal wages are allowed to be fully indexed to the CPI in our model. This reduction in nominal wages can be viewed as a cause of reduction in the cost of production.

Predictions of aggregate exports would follow from the CPI projections. Since selling prices of export industries are decided on world markets, these industries are capable of taking advantage of the reductions in domestic cost as a result of tariff cuts. The export price index declines by 0.01 per cent. This would help export-oriented industries to expand.

Aggregate imports are projected to increase. Producers of import-competing sectors whose commodities were not subjected to a tariff cut benefit from the reduction in costs as a result of the tariff cut similar to the exporters. The increase in demand for now cheaper imported commodities whose tariffs are cut is greater than the reduction in imports of commodities whose tariffs were not cut. Overall, balance of trade moves to a surplus (by Rs. 416.82 million) with the export volume increase by more than the import volume (0.11 and 0.02, respectively). This rise in exports is credited to lower export prices and a real depreciation of the exchange rate.

Using shares of exports ( $S_E = 0.39$ ) and imports ( $S_{M=0.49}$ ) from our data base and the percentage changes in exports ( $e = 0.11$ ) and imports ( $m = 0.02$ ) from Table 6.14, in (6.3) gives us

$$gdp_R = (0.11 * 0.39) - (0.02 * 0.49) = 0.03$$

The real exchange rate depreciates by 0.07 per cent as a result of a reduction in the GDP price index, suggesting an increase in competitiveness in export markets. Furthermore, a deterioration in the terms of trade (-0.01 per cent) is expected arising from reduced export prices in the short-run. Finally, the loss of tariff revenue to the government by tariff removals on agricultural goods comes at a cost of Rs 3,170 million.

An increase in demand for workers by these expanding export-oriented industries can be expected to have a positive impact on aggregate employment in the economy. The projected increase in employment and decline in the CPI due to a tariff cut in agricultural sectors are marginal because import shares of agricultural commodities in the base year are very small compared to those of manufacturing commodities. However, as Naranpanawa (2005) describes, we cannot conclude instantly that agricultural tariff cuts are not significant, since

NTBs such as quantity restrictions are in operation in some agricultural imports that cannot be captured by the data base of this model.

In the long-run, some of the macro variables show similar change of directions, while some other variables take the opposite direction of change compared to short-run. Primary factors, for instance, labour and capital are permitted to be mobile between industries in the long-run. Therefore, productive industries will draw resources from inefficient industries and expand further in the long-run producing a higher GDP compared to the short-run. On the income side we assume that aggregate employment is fixed in the long-run while real wages are allowed to be determined endogenously. However, labour is permitted to be mobile between different labour groups and industries. In this context, tariff cut in the long-run resulted in 0.47 per cent increase in real wages. The rise in nominal wages (0.32 per cent) is lower than that of the real wages because the CPI falls by 0.15 per cent.

The economy's aggregate capital stock increases by 0.09 per cent while keeping average gross rate of return on capital constant. The rise in price of labour (by 0.32 per cent) relative to the rise in price of capital (0.12 per cent) favours the substitution of capital for labour resulting in an increase in capital stock in the long-run. Therefore, we conclude that a tariff cut in agricultural sectors supports the expansion of capital intensive industries in the long-run.

Use of equations (6.1) and (6.4), capital share from our data base and change in aggregate capital stock from Table 6.14 would give us the change in the real GDP as 0.04 per cent ( $0.49 \times 0.09 = 0.04$ ). As in Section 6.4.1.1, by adding the change in indirect tax (0.001) from the long-run model simulations, the change in the real GDP of 0.041 ( $0.04 + 0.001 = 0.041$ ) can be obtained.

On the expenditure side of the economy, the balance of trade is held constant and change in real GDP is matched by the change in domestic absorption. The results show that the real consumption has increased by 0.05 per cent demonstrating an aggregate welfare improvement. By assumption, real government expenditure also rises by the same amount (0.05 per cent). Aggregate real investment expenditure expands by 0.03 per cent.

Use of shares and percentage changes in domestic absorption in equations (6.6) and (6.7) gives,

$$gdp_R = (0.7 * 0.05) + (0.2 * 0.03) + (0.14 * 0.05) + (0.39 * -0.42) - (0.49 * -0.31) = 0.04$$

where  $c$  (0.05),  $i$  (0.03),  $g$  (0.05),  $e$  (-0.42) and  $m$  (-0.31) (Table 6.14)

In response to cheaper imports, the CPI and GDP price index decline by 0.15 and 0.04 per cent, respectively. Real exchange rate depreciation (by 0.04 per cent) is observed in the long-run and it is less than in the short-run. This depreciation of the real exchange rate is a result of a reduction in the GDP price index (which is defined as the ratio of CIF import price index over the GDP price index) owing to cheaper import prices. Export prices increase by 0.03 per cent resulting in an equivalent improvement in terms of trade (0.03 per cent) and decline in export volume of 0.42 per cent. Import volume declines by 0.3 per cent. Finally, the loss of tariff revenue to the government by tariff removals on agricultural goods comes at a cost of Rs 3,221 million.

### 6.3.2.2 Industry results

According to the I-O data base of the model, the Sri Lankan economy consists of 40 industries. Among these industries, tariffs are levied on 17 imports -eight agricultural and nine manufacturing industries. That is, the manufacturing sector has the highest proportion of industries protected by tariffs, while the agricultural sector is the second highest. Furthermore, a closer examination of the data base reveals that a majority of the tariff revenue (Rs. Million 20,520.47) is collected from the manufacturing industry group (CIF value of Rs. Million 501,866). Tariff revenue of Rs. Million 3,163 is collected from agricultural imports (worth of Rs. Million 50,456). A brief overview of the tariff structure of the country suggests that the agricultural sector is still highly protected (Annex Table B.6).

Within this context, this section explains the impact of tariff removal on agricultural commodities on overall industries at the national level. As in the previous section, they are interpreted in line with macroeconomic results. First, the results are summarised and presented in Table 6.15 in order to show the impacts on the three broad sectors, agriculture, industry and

services. Imports of agricultural goods have increased owing to lower prices after removing tariffs on agricultural sectors in both the short-run and long-run. However, industrial imports reduced (by 0.44 per cent) in the long-run reflecting the overall reduction of imports in the economy. Output of the broad agricultural sector is affected slightly negatively, while the other two sectors show an increase in output in the short-run. In the long-run a contraction of industrial output (by 0.24 per cent) is experienced. Overall employment in all three sectors shows an increase in the short-run while that of agricultural and industrial sectors experience a reduction in the long-run. There is a growth in export in all three sectors in the short-run. Similar to imports, industrial exports show a decline in the short-run signalling the drop in aggregate exports in the economy.

The sectoral projections of a 100 per cent reduction in the level of protection from import competition offered to the agricultural sector are presented in Table 6.16. Imports of agricultural sectors either have increased or remained unaffected in both the short- and long-run. Minor export crops (3.55 and 4.39 per cent, respectively, in the short-run and long-run) and tobacco sectors (1.06 and 2.1 per cent, respectively, in the short-run and long-run) show the highest expansion. This could be largely due to the fact that those commodities have higher import shares and initial tariff levels (Annex Table B.6) and sales of their products to the food processing sector (food, beverages and tobacco sector) (Annex Table B.7). Fruit, forestry and paddy sectors show a mild expansion of imports due to the shock. The rice milling, food, beverages and tobacco and garments sectors show a slight decline in imports as a result of contracting demand from the households.

**Table 6.15: Summarised sectoral impacts of tariff cut on imports, output, employment and exports (percentage changes)**

Sector	SR				LR			
	Imports	Output	Employment	Exports	Imports	Output	Employment	Exports
Agriculture	0.36	-0.001	0.05	0.85	0.65	0.02	-0.01	1.51
Industry	0.00	0.04	0.16	0.05	-0.44	-0.24	-0.23	-0.83
Services	-0.01	0.02	0.05	0.24	0.02	0.11	0.09	1.22

Source: Model simulations

Forestry, paddy, fruit and miscellaneous agricultural sectors show a slight expansion of imports in the long-run mainly as a result of increased intermediate demand. Among industrial sectors, imports of the coconut processing sector, and textile, footwear and leather sectors contract as a result of a decline in demand as intermediate inputs, while imports of the food, beverages and tobacco sector contracts as a result of a decline in demand from households.

Industry output results reveal that apart from the tobacco sector, all the other sectors in the economy show a slight increase in industrial activity or are unaffected by the shock of the agricultural tariff cut in the short-run. The tobacco sector exhibits a 7.78 per cent decline in its output due to the shock. According to Fan decomposition results, a higher negative domestic share effect, that is replacement of domestic goods by imports, directs to this output contraction. Interestingly, the minor export crop sector shows a small increase in its output (0.07 per cent) even with significant increase in imports recorded (3.55 per cent). Expansion of exports leads to the increase in the output of that sector as the minor export crop sector is an export-oriented sector. A reduction in domestic price level due to the tariff cut improves the competitiveness of export-oriented agricultural sectors in the short-run. Output expansion of sectors where the tariff cut applied is because of the increase in the domestic share effect.

Projected output increases in other agricultural sectors mainly lies with the responses of the food processing sectors. The tea processing and rubber processing sectors, which are endogenous export industries in our model, are projected to experience slight increases in output due to the tariff cuts. These sectors purchase mainly from tea growing and rubber growing sectors leading to an expansion of output in both industries in the short-run. Other agricultural and agriculture-related processing sectors such as paddy, fruit, vegetables, highland crops, miscellaneous agricultural products, livestock and fish products, rice milling and flour milling sectors experience expansions in output largely due to the increase in sales of their products to the food, beverages and tobacco sector.

In the long-run, output of the tobacco sector declines sharply because of the contraction in its domestic share. The minor export crop sector also reports a slight reduction in output as a result of a decline in its domestic share despite an increase in export effect (Annex Table B.8). A striking result in the long-run is that there is a contraction experienced in the agricultural-related export-oriented processing industries (tea processing, rubber processing and coconut

processing industries). This reduction results from the marginal drop in the output of major intermediate input-supplying industries such as tea growing, rubber growing and coconut growing which are all perennial crops. Farmers may reallocate their resources from these industries to more profitable industries in the long-run causing a reduction in replanting activities and/or application of fertiliser due to any competition coming from the cheaper imports. In addition, a drop in output by the garments industry can also be observed.

The impact of an agricultural tariff cut on industry employment is positive except for the tobacco industry in the short-run. The tobacco industry experiences a substantial employment loss as a result of contraction of the activity level of the industry in both the short-run and long-run (15.78 per cent and 14.62 per cent, respectively). The food, beverages and tobacco sector shows a 1.66 per cent increase in employment, while all the other agricultural, industrial and services sectors show small increases in employment. All the agricultural industries with negative output growth recorded a negative employment change reflecting the reduction in the overall employment in the agricultural sector (tea, rubber, coconut, minor export crops and tobacco sectors). Contraction of tea processing, rubber processing, coconut processing, garments and other manufacturing sectors causes a drop in their demand for labour resulting in an overall reduction in employment in the broad industrial sector.

Prices of the majority of goods in all three sectors, agricultural, industrial and services, decline as a result of the tariff cut in in the short-run. The largest price decline was observed in the tobacco sector in both the short-run and long-run despite the reduction of output (19 per cent and 17 per cent, respectively). The food, beverages and tobacco sector recorded a 0.35 per cent decline in price, while the minor export crop sector experienced a 0.12 per cent decline in price in the short-run. Prices of all agricultural sectors except for the rubber growing, minor export crops and tobacco sectors rise in the long-run. Prices of the flour milling; food, beverages and tobacco; wood and wood products; and chemicals and fertiliser sectors increase among the industrial sectors in the long-run.

Price projections for the endogenous agricultural and agriculture-related export commodities can be explained by the movement in the export volumes. According to Higgs (1986), basic value price for an endogenous export commodity can be expressed as

$$p_e^i = -\gamma_i x_i^E + f_i^e \quad (6.8)$$

where,  $p_e^i$  is the percentage change in the at-port export price of commodity  $I$ ,  $x_i^E$  is the percentage change in the level of exports of commodity,  $\gamma_i$  is the reciprocal of the foreign elasticity of demand for commodity  $i$ , and  $f_i^e$  is the exogenous percentage shift in the foreign demand curve for commodity  $i$ . For example, our short-run tariff cut simulation results reveal that exports of minor export crops are expected to increase by 2.49 per cent. This would lead to a 0.12 per cent fall ( $-2.49*0.05=-0.12$ ) in the export price of minor export crops with the value of  $\gamma_i = 0.05$ . Since our model follows the non-margin version of ORANI-G, we can say the tariff cut leads to a 0.12 per cent decline in farm-gate price.

The tariff cut has increased competition for the domestic industries by lowering the prices of competing imports in the domestic market. The tariff cut has also directly reduced the material input cost of the domestic industries and hence the CPI in the short-run. Since nominal wages are fully indexed to the CPI, nominal wages in all industries fall in line with the CPI. Reduced nominal wages bring down input costs and output prices for all industries. The short-run variable cost of industries is used as the index to measure the impact on cost of production in the short-run, which is summarised in Annex Table B.9. The short-run variable industry cost (excluding land and capital which are fixed factors in the short-run) for all industries show a decline, with the tobacco, and food, beverages and tobacco sectors reporting the highest reductions. Decomposition of variable industry cost shows that for many industries reduction of material cost brings about a greater decline in the variable cost than the decline in labour cost due to indexation of nominal wages to the CPI.

The impact on cost is different in the long-run. Unlike in the short-run, nominal wages are not indexed to the CPI. Real wages adjust in response to the changes in demand for labour, the supply of which is assumed to be determined exogenously in the long-run. Furthermore, capital is not fixed in the long-run. The index of production cost can be used to examine impacts on long-run production cost (Annex Table B.10).

**Table 6.16: Projected effects of tariff cuts on imports, output and employment (percentage changes)**

Sector	Industry category <sup>a</sup>	SR				LR			
		Imports	Output	Employment	price	Imports	Output	Employment	price
Tea growing	A	0	0.03	0.06	-0.020	0	-0.23	-0.35	0.068
Rubber growing	A	0	0.01	0.05	0.004	0	-0.18	-0.48	-0.2
Coconut growing	A	0.07	0.02	0.03	-0.041	0.32	-0.19	-0.30	0.11
Paddy	A	0.16	0.01	0.01	-0.052	0.92	0.04	0.03	0.263
Vegetables	A	0.01	0.01	0.02	-0.038	0.04	0.05	0.06	0.283
Fruit	A	0.41	0.25	0.55	0.477	0.61	0.55	0.88	0.88
Highland crops	A	0.03	0.04	0.10	0.033	0.22	0.19	0.29	0.499
Potatoes	A	0.00	0.00	0.00	-0.059	0.02	0.02	0.01	0.233
Minor export crops	A	3.55	0.07	0.15	-0.123	4.29	-0.13	-0.24	-0.112
Tobacco	A	1.06	-7.78	-15.78	-19.158	2.10	-9.44	-14.62	-17.341
Betel	A	0	0.02	0.04	-0.025	0	0.09	0.13	0.372
Miscellaneous agricultural crops	A	0.12	0.07	0.15	-0.053	0.65	0.32	0.51	0.471
Plantation development	A	0	0.00	0.01	-0.049	0	0.00	-0.02	0.232
Firewood	A	0	0.05	0.11	0.043	0	0.31	0.28	0.264
Forestry	A	0.23	0.03	0.06	-0.006	1.25	0.15	0.11	0.24
Livestock and fisheries	A	0.05	0.08	0.25	0.147	0.14	0.25	0.28	0.14
Tea processing	ARM	0	0.03	0.08	-0.015	0	-0.23	-0.29	0.107
Rubber processing	ARM	0	0.01	0.09	0.002	0	-0.43	-0.52	0.035
Coconut processing	ARM	0.00	0.00	0.05	0.000	-2.51	-2.51	-2.60	0.135
Rice milling	ARM	-0.16	0.01	0.11	-0.032	1.20	0.05	-0.04	0.242
Flour milling	ARM	0.09	0.06	0.69	0.021	-0.88	0.43	0.34	-0.197
Food, beverages and tobacco	ARM	-0.34	0.16	1.66	-0.351	-1.83	0.92	0.83	-1.965
Textile, footwear and	M	0.04	0.10	0.34	0.197	-1.32	0.79	0.72	0.122

leather									
Garments	M	-0.01	0.01	0.03	0.000	0.21	-1.66	-1.73	0.075
Wood and wood products	M	0.17	0.23	0.57	0.071	0.68	1.25	1.19	-0.063
Paper and paper products	M	0.00	0.01	0.01	-0.016	0.07	0.04	0.00	0.074
Chemicals and fertiliser	M	0.00	0.04	0.20	-0.007	0.06	0.21	0.12	-0.014
Petroleum	M	0.05	0.02	0.25	0.030	0.17	0.15	0.06	0.05
Plastic and rubber products	M	0.01	0.01	0.07	-0.001	-0.09	0.64	0.56	0.069
Other manufacturing	M	0.01	0.02	0.05	-0.001	-0.10	-0.64	-0.71	0.077
Electricity, gas and water	S	-0.01	0.02	0.09	0.062	0.00	-0.07	-0.15	0.153
Construction	S	0	0.01	0.01	-0.045	0	0.02	-0.02	0.202
Hotels and restaurants	S	0	0.01	0.02	-0.105	0	0.06	0.02	-0.03
Tourist and travel	S	-0.01	0.01	0.03	-0.020	0.04	0.13	0.08	0.126
Trade and transport	S	-0.01	0.03	0.08	0.018	0.01	0.10	0.03	0.18
Post and communications	S	-0.05	0	0.42	0.235	0.01	0.17	0.07	0.166
Banking	S	0.00	0.05	0.07	-0.031	-0.01	0.27	0.24	0.256
Owner dwelling	S	0	0.01	0.01	-0.068	0	-0.03	-0.03	0.304
Public administration and defence	S	0.00	0.00	0.00	-0.065	0.02	0.06	0.06	0.171
Other personal services	S	0	0.01	0.01	-0.050	0	0.00	-0.02	0.242

Source: Model simulations

Note:

<sup>a</sup> Key A= Agricultural, AMR=Agriculture-related manufacturing, M=Manufacturing, S=Services

The reduction of average production costs is largely attributable to the reduction in the material cost. The rubber growing, minor export crops, tobacco, flour milling, food, beverages and tobacco, wood and wood products, and chemicals and fertiliser sectors record overall reduction of cost of production in the long-run. Reduction of cost of land is also attributed to the fall in cost of production in some agricultural industries (for example, tea growing, rubber growing, coconut growing, minor export crops and tobacco sectors).

### 6.3.2.3 Impact on employment by occupation

Table 6.17 presents the changes in aggregate employment among different occupational groups due to the tariff shock. The results revealed that tariff cuts on agricultural imports yielded marginal increases in all the occupational groups in the short-run. The highest gain was experienced in the production and related transport equipment operators and workers category (0.12 per cent). This is due to the expansion of industrial and services-related activities.

**Table 6.17: The impact of elimination of tariff in agricultural sectors on employment by different occupations (percentage changes)**

Occupational category	SR	LR
Professional, technical and related workers	0.02	0.03
Administrative and managerial workers	0.07	0.12
Clerical and related workers	0.04	0.1
Sales and service-related workers	0.07	0.03
Agricultural, animal husbandry, fisheries and forestry workers	0.05	-0.04
Production and related transport equipment operators and workers	0.12	-0.07
Other workers	0.08	-0.01

Source: Model simulations

The long-run results projected a contraction of demand for skilled agricultural workers, and unskilled production and related transport equipment operators and workers as a result of some of the major agricultural and industrial sectors. For example, tea growing, rubber growing, coconut growing, minor export crops and the tobacco sectors employ around 30 per cent of the

total agricultural workforce. Thus, we would expect their employment to reduce when production in those industries contracts.

#### 6.3.2.4 Impact on real income and real consumption

The industry expansions and contractions affect the demand for primary factors and, therefore, the factor income of households. Table 6.18 reports the percentage changes in the real income and real consumption of different household groups. According to the results, it is apparent that the elimination of agricultural tariffs generates only marginal positive changes in both real income and real consumption. This implies that tariff reduction has a welfare enhancing effect on households. When the impact in real income is considered, an increase in real household income by similar percentage points across households can be observed in both the short-run and long-run.

**Table 6.18: The effects on real income and real consumption of agricultural tariff reductions (percentage changes)**

Household group	After tax real income		Real consumption
	Short-run	Long-run	Long-run
Western	0.35	0.42	0.02
Central	0.28	0.43	0.06
Southern	0.28	0.42	0.06
Sabaragamuwa	0.27	0.42	0.03
North Western	0.3	0.42	0.06
Uva	0.29	0.42	0.06
North Central	0.29	0.42	0.05
Northern	0.26	0.43	0.06
Eastern	0.28	0.43	0.11

Source: Model simulations

### 6.3.2.5 Regional results

#### *Macro results*

The effects of tariff cuts on regional output and employment are presented in Table 6.19. The regional output is unaffected in the Northern Province while it increases in all the provinces in the short-run. Among the regions recording positive output growth, only Western and Southern Provinces recorded higher GDP growth than the national GDP growth at factor cost (0.032 per cent). Sabaragamuwa Province reports an output growth equal to national output growth. All the provinces record positive growth in their regional output in the long-run, but the relative positions of the regions in terms of the output growth become considerably different compared to the short-run. However, only five provinces are able to exceed the national GDP growth (0.04 per cent). Western and Sabaragamuwa are the only regions whose output growth stays below the national GDP growth. North Central Province records the highest growth (0.15 per cent) followed by Eastern and Southern provinces, respectively. The Western Province experiences the lowest growth in output.

**Table 6.19: The effects of agricultural tariff reductions on regional output and employment (percentage changes)**

Region	Short-run		Long-run	
	Growth in real gross regional product	Growth in aggregate regional employment	Growth in real gross regional product	Growth in aggregate regional employment
Western	0.04	0.1	0.01	-0.04
Central	0.02	0.04	0.06	0
Southern	0.04	0.08	0.11	0.06
Sabaragamuwa	0.03	0.07	0.02	-0.01
North Western	0.03	0.06	0.07	0.03
Uva	0.01	0.03	0.07	0.02
North Central	0.02	0.04	0.15	0.07
Northern	0	0	0.07	0.05
Eastern	0.02	0.03	0.12	0.08

Source: Model simulations

Regional employment growth follows the regional output growth in the short-run keeping the relative position of each province alike in terms of both output and employment. Western Province records the highest employment growth (0.1 per cent) followed by Southern (0.08 per cent), Sabaragamuwa (0.07 per cent) and North Western Provinces (0.06 per cent). Only Western, Southern and Sabaragamuwa Provinces exceed the national employment (which is equal to 0.07 per cent). In the long-run, output increase does not reflect the increase in employment. Eastern province experiences the highest employment growth followed by North Central and Southern Provinces.

### ***Industry results***

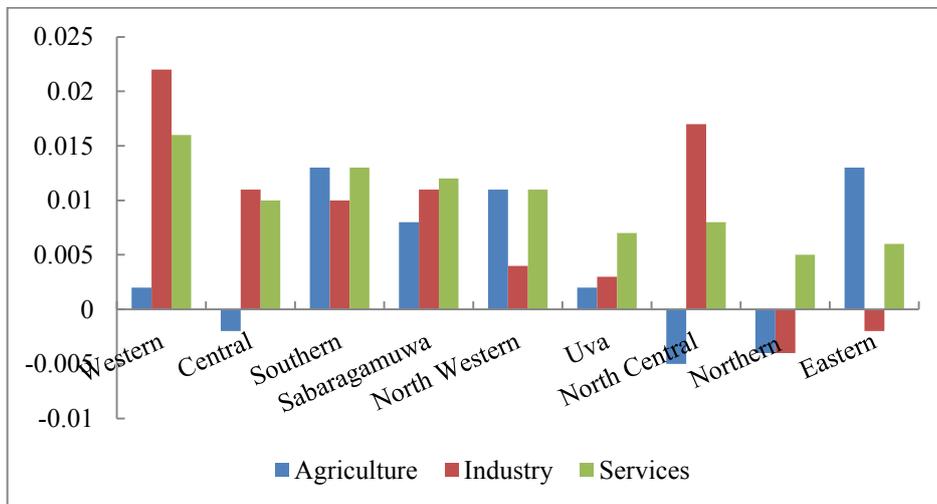
Figure 6.7 illustrates the contributions to regional GDP by three aggregate sectors, agriculture, manufacturing and services in both the short-run and long-run. Accordingly, Southern, North Western, Sabaragamuwa, Eastern, Uva and Western Provinces receive positive contributions to their regional GDP from agricultural industries in the short-run. All the provinces except for Northern and Eastern Provinces receive positive contributions from the industrial sectors with the Western Province recording the highest growth. The services sector contributes positively to all the regions.

### ***Determinants of each region's growth relative to national growth***

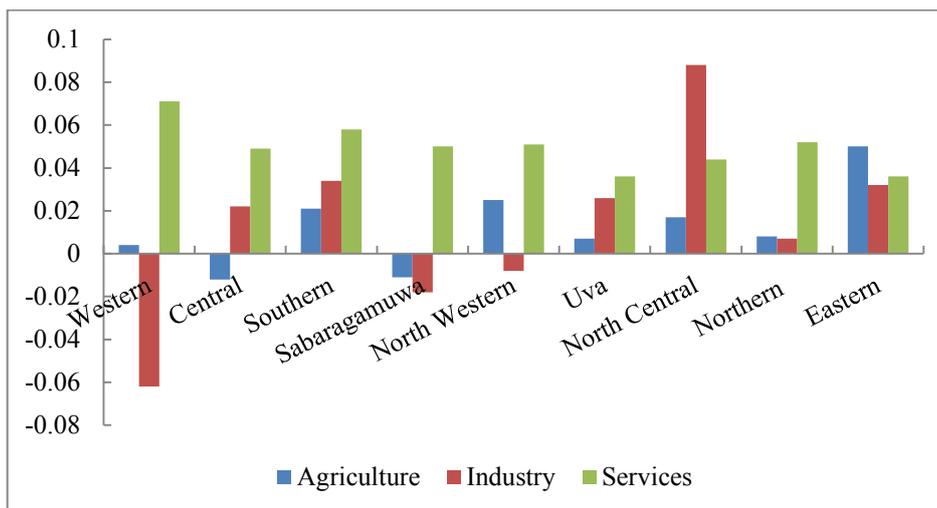
Table 6.20 depicts the aggregate regional advantage matrix in the short-run. It is a summary of Appendix Table B.11. By looking at the regional advantage matrix we can say two regions gain as a result of agricultural tariff cut in the short-run. Those are Western and Southern Provinces with positive regional advantage of 0.008 and 0.0036 percentages, respectively. Only these two provinces receive positive contributions towards the regional advantage from the group of national industries (0.0057 per cent and 0.0044 per cent, respectively). Local industries provide positive contributions to Western and North Central regional advantage. All local industries which have multiplier effects contribute positively to the Western Province.

As mentioned in Table 6.16, major export industries and import-competing industries whose commodities were not subjected to a tariff cut, and other related industries to the above two groups are the main industries benefitting from this policy shock. Therefore, we can expect winning regions to have more than their share of the faster growing industries and/or less of its

share of slower growing industries, while the other seven provinces have less than their share of the faster growing industries and/or are specialised in the slower growing industries.



(a) Short-run



(b) Long-run

**Figure 6.7: The effects on contributions to regional GDP by aggregate sectors of agricultural tariff reductions (percentage changes)**

Source: Model simulations

Western Province receives positive contributions primarily because of its over-representation of some manufacturing export industries (particularly, the food, beverages and tobacco sector, and textile, footwear and clothing sector). On the other hand, negative contributions are made by under-representing agricultural and manufacturing export industries (especially, tea processing and minor export crops). Regional growth of Southern Province exceeds the

national GDP growth mostly owing to its over-representation of protected agricultural industries such as highland crops, minor export crops and the livestock and fish sectors and export-oriented manufacturing industries, mainly the other manufacturing sector. In contrast, Southern Province is deprived mainly by its under-representation of fast growing import-competing manufacturing industries (such as the food, beverages and tobacco sector, the textile, footwear and clothing sector and the wood and wood products sector). Sabaragamuwa Province only slightly gains from agricultural sectors, but these gains are cancelled out by over-representation of the tobacco industry which has negative output growth and under-representation of the import-competing manufacturing industries (food, beverages and tobacco sector and textile, footwear and clothing sector). An examination of the composition of national industries in North Western Province suggests that the province benefits by positive contributions from agricultural industries and under-representation of the tobacco sector, thus resulting in a positive contribution from the agricultural sector. However, there is no contribution from agricultural processing industries. Furthermore, it suffers from over-representing the garment industry while under-representing the fast growing, import-competing food, beverages and tobacco industry. Even though the Uva and Central Provinces are predominantly agricultural regions, their benefits from the faster growing agricultural-related industries are reversed by slower growing agricultural-related industries resulting in a negative contribution from agricultural sectors.

**Table 6.20: Short-run aggregate regional advantage matrix of agricultural tariff reductions**

Sector	Western	Central	Southern	Sabara-gamuwa	North Western	Uva	North Central	Northern	Eastern
Agriculture	0.0027	-0.0106	0.0054	0.0009	0.0025	-0.0096	-0.0155	-0.0081	0.0008
Industry	0.0037	-0.0009	-0.0016	-0.0012	-0.0079	-0.0091	0.0062	-0.0132	-0.0114
Services	0.0018	-0.0013	-0.0002	-0.0011	-0.0006	-0.0009	-0.0025	-0.0142	-0.0051
<b>Total Contribution</b>	<b>0.0082</b>	<b>-0.0128</b>	<b>0.0036</b>	<b>-0.0014</b>	<b>-0.006</b>	<b>-0.0196</b>	<b>-0.0118</b>	<b>-0.0355</b>	<b>-0.0157</b>
National industries	0.0057	-0.0114	0.0044	-0.0013	-0.0025	-0.0119	-0.0143	-0.0271	-0.008
Local industries	0.0025	-0.0014	-0.0008	-0.0001	-0.0035	-0.0077	0.0025	-0.0084	-0.0077
<b>Total Contribution</b>	<b>0.0082</b>	<b>-0.0128</b>	<b>0.0036</b>	<b>-0.0014</b>	<b>-0.006</b>	<b>-0.0196</b>	<b>-0.0118</b>	<b>-0.0355</b>	<b>-0.0157</b>

Source: Model simulations

Table 6.19 shows that Western and Sabaragamuwa Provinces are the losing regions due to the agricultural tariff elimination in the long-run. Table 6.21 further explains the contributions of

different aggregate sectors towards regional advantage in the long-run. It is a summary of detailed regional advantage matrix in the Appendix Table B.12. Western Province and Sabaragamuwa Province receive negative contributions from both national and local industry categories. The agricultural sector contributes positively to the Western, Southern, North Western, Northern and Eastern Provinces, while contributing negatively to Central, Sabaragamuwa and Uva provinces. Central, Sabaragamuwa and Uva provinces over-represent most of the contracting agricultural industries such as the tea growing, rubber growing, minor export crops and tobacco sectors and thus receive negative contributions from agricultural sectors. The industry sector plays a positive role in all the regions except Western Province, where as the services sector contributes negatively in all the provinces except Western Province.

Western Province receives the advantage of over-representation of import-competing manufacturing industries, while suffering from negative impacts from under-representation of faster growing agricultural industries and over-representation of slower growing export-related industries, such as tea processing and garment industries, resulting in a negative total contribution. North Central Province over-represented by most of the fast growing agricultural industries (particularly, vegetables, fruit, highland crops, the livestock and fisheries and firewood sectors) and manufacturing sectors (flour milling and food, beverages and tobacco sectors), while it is under-represented by the tobacco industry. This generates overall positive contributions towards the region's GDP. On the other hand, it receives negative contributions as a result of specialising in agriculture-related processing industries and garments sectors, while being under-represented in the textile, footwear and leather sector. Southern Province benefits from the agriculture sector as a result of positive contributions from its over-representation of faster growing agricultural industries, such as highland crops, livestock and fisheries, and miscellaneous agricultural products, and under-representation of slow growing agricultural industries (especially the tea growing, coconut growing and minor export crops sectors) exceeding the negative contributions from over-representation of the tobacco industry and under-representation of the fast growing fruit sector.

**Table 6.21: Long-run aggregate regional advantage matrix of agricultural tariff reductions**

Sector	Western	Central	Southern	Sabara-gamuwa	North Western	Uva	North Central	Northern	Eastern
Agriculture	0.003	-0.027	0.008	-0.024	0.011	-0.012	0	0.001	0.031
Industry	-0.043	0.051	0.062	0.01	0.02	0.054	0.117	0.039	0.064
Services	0.009	-0.009	-0.001	-0.01	-0.007	-0.017	-0.013	-0.017	-0.021
<b>Total Contribution</b>	<b>-0.031</b>	<b>0.015</b>	<b>0.069</b>	<b>-0.024</b>	<b>0.024</b>	<b>0.025</b>	<b>0.104</b>	<b>0.023</b>	<b>0.074</b>
National industries	-0.029	0.015	0.067	-0.018	0.022	0.023	0.092	0.019	0.065
Local industries	-0.002	0	0.002	-0.006	0.002	0.002	0.012	0.004	0.009
<b>Total Contribution</b>	<b>-0.031</b>	<b>0.015</b>	<b>0.069</b>	<b>-0.024</b>	<b>0.024</b>	<b>0.025</b>	<b>0.104</b>	<b>0.023</b>	<b>0.074</b>

Source: Model simulations

### 6.3.3 Scenario III: Increase in cultivated land area

This section describes the effects of land expansion in the agricultural sectors as detailed in Section 6.1.3.

#### 6.3.3.1 Macroeconomic effects

This section presents the macroeconomic implications of the land expansion shock. All projections, with the exception of the balance of trade, are percentage deviations from the value which the variable in question would have taken if there had been no change in the extent of area cultivated. The short-run and long-run macro impacts of land expansion in agricultural sectors are given in Table 6.22.

The results in Table 6.22 show that expansion of agricultural land resulted in a positive GDP in both the short-run and long-run with higher GDP in the long-run. The real GDP increased by 0.05 per cent in the short-run, while it increased by 0.09 per cent in the long-run. Furthermore, expansion of agricultural land stimulated an increase in aggregate employment in the economy in the short-run. Accordingly, there is a 0.02 per cent increase in aggregate employment.

From Table 6.22, it can be seen that land expansion in the agricultural sector generates a decline in the CPI (by 0.18 per cent) suggesting a reduction in cost of living. This means that

after about two years we would expect the CPI to be about 0.18 percentage points lower as a result of the increase in land extent than it would have been in the absence of the increase in land extent. In terms of the rate of inflation, we can say that if prices were to go up by, say, 7 per cent over two-year period in the absence of increase in land cultivated, then they would only go up by 6.82 per cent with the increase in land. As wages of all sectors are indexed to the CPI to keep real wages unchanged in the short-run, the reduction in CPI causes a fall in nominal wages (by 0.18 per cent). Furthermore, the average gross rate of return on capital increases by 0.14 per cent as a result of the policy shock.

**Table 6.22: Projected macroeconomic effects of land expansion (percentage changes)**

Description	Short-Run	Long-Run
Ordinary change to nominal balance of trade to		
nominal GDP	0.0003	Exogenous
Aggregate employment: wage bill weights	0.016	Exogenous
Ordinary change in the real trade balance*	662.97	Exogenous
Real wage	Exogenous	0.18
Real GDP	0.05	0.09
Real devaluation	0.17	0.02
Terms of trade	-0.01	0.005
Export volume index	0.16	-0.06
Import volume index, C.I.F. weights	0.02	-0.03
GDP price index, expenditure side	-0.17	-0.02
Aggregate investment price index	-0.05	0.05
CPI	-0.18	-0.07
Exports price index	-0.01	0.005
Aggregate real investment expenditure	Exogenous	0.14
Real household consumption	Exogenous	0.07
Aggregate real government demands	Exogenous	0.07
Real GDP at factor cost (inputs)	0.06	0.09

Source: Model simulations

Notes: \* in Rs Millions

Equation (6.1) can be applied to calculate the quantum index of GDP. Since the policy shock causes changes in land use, we cannot apply (6.2). Therefore,

$$k = 0 \quad (6.9)$$

From our data base,  $S_L = 0.44$  and  $S_N = 0.06$ . Equations (6.1) and (6.9) suggest a value of 0.05 for the real GDP, given the value of aggregate employment as 0.02 and value of aggregate land as 0.8 from our short-run simulation  $[(0.44 * 0.02) + (0.006 * 0.8)]$ . A small contribution from indirect tax (0.001) can be added to this to get the value to real GDP approximating to our model result of 0.052.

In the short-run, domestic absorption has been set fixed, while balance of trade is allowed to be adjusted. With the domestic absorption held constant, increase of agricultural land stimulates both exports and imports. Exports expand at a faster rate than imports (0.16 per cent and 0.02 per cent, respectively) causing a small improvement in the balance of trade. The ratio of the ordinary change in nominal trade balance to the ordinary change in nominal GDP becomes slightly positive (0.0003) and the real trade balance improves by Rs. 662.97 million. Since exports and imports are the only expenditure aggregates contributing to real GDP from the expenditure side in the short-run, use of (6.3) leads to an increase of 0.052 per cent in real the GDP  $[(0.39 * 0.16) - (0.49 * 0.02) = 0.052]$ .

The expansion of exports is credited to lower export prices and a depreciation of the exchange rate (by 0.17 per cent). The export price index falls by 0.01 per cent. The real exchange rate depreciates largely as a result of a decline in the GDP price index, which is the outcome of a decline in overall prices.

In the long-run, higher real GDP (0.09 per cent) is accompanied by a decline in the CPI (0.07 per cent) and the GDP price index (0.02 per cent). The corresponding reduction in the CPI and GDP price index is much higher in the short-run.

Aggregate employment is fixed on the income side reflecting the assumption that the economy is in full employment. Given that aggregate employment, technical change and gross rate of return on capital are fixed, an increase in agricultural land would affect that aggregate output

through changes in real wages and capital stock. Real wages increase by 0.18 per cent as a result of agricultural land expansion. The increase in nominal wages is lower than that of real wages due to a fall in CPI. The aggregate capital stock, which is free to adjust in the long-run in order to keep the average gross rate of return on capital constant, expands by 0.08 per cent. Therefore, by applying (6.1) and  $l = 0$ , we can get a value of  $GDP = 0.09$ , given that  $k = 0.08$  and  $n = 0.84$  from our long-run simulations and  $S_K = 0.49$  and  $S_N = 0.06$  from our data base.

All the components of domestic absorption are determined endogenously in the long-run except for the demand for inventories. The results reveal that expansion of agricultural land led to a higher level of aggregate real consumption (0.07 per cent) reflecting a welfare improvement. The aggregate real government consumption also increases by the same percentage as it is assumed to move with aggregate real consumption. Further, aggregate real investment expenditure rises by 0.14 per cent. Therefore, application of (6.6) and (6.7) again gives the value of the real  $GDP = 0.086$  approximating to our long-run GDP from the model results.

$$GDP_R = (0.7 * 0.07) + (0.25 * 0.14) + (0.14 * 0.07) + (0.39 * -0.06) - (0.49 * -0.03) = 0.086$$

It is observed that real devaluation of 0.02 per cent occurs as a result of land expansion. However, in contrast to the short-run, both aggregate imports and exports are expected to decline in the long-run. Implications on different industries in the economy show that decline in industrial exports and imports leads to the overall decline in both imports and exports despite the increase in agricultural imports and exports due to the shock. The export price index increases by 0.05 per cent reflecting positive terms of trade.

### 6.3.3.2 Sectoral effects

In this section we present the sectoral impacts of the agricultural land expansion on variables such as output and employment of industries. Table 6.23 describes the summarised sectoral impacts on output, employment, imports and exports. Agricultural land expansion leads to output expansion in all three broadly defined industry groups -agriculture, industry and services in both the short-run and long-run with the highest output growth in the agricultural sector. In spite of this output expansion, there is a decline in overall employment in the

agricultural sector. This decline is lower in the long-run (0.06 per cent reduction) compared to the short-run (0.28 per cent reduction). However, expansion of land in the agricultural sector is projected to cause considerable growth in employment in the industrial and services sectors, highlighting the increase in aggregate employment at national level.

Furthermore, land expansion stimulated all three aggregate sectors to expand exports in the short-run with the highest export growth recorded in the agricultural sector (0.82 per cent). However, exports of industrial and services sectors tend to decline in the long-run. Expansion of agricultural exports could not outweigh this decline causing a decline in aggregate exports at the national level.

The short-run and long-run sectoral effects of the agricultural land expansion are given in Table 6.23. All industries have shown an expansion or remained neutral under this policy. Minor export crops, rubber growing, coconut growing, vegetables, tea growing and the highland crops sectors are the major expanding agricultural sectors in the short-run. Tea processing, rubber processing, wood and wood products, textile, footwear and leather products, plastic and rubber products, and the coconut processing sectors show the largest gainers in output growth in the industry sector.

**Table 6.23: Summarised impacts of land expansion on output employment imports and exports (percentage changes)**

Sector	SR				LR			
	Output	Employment	Exports	Imports	Output	Employment	Exports	Imports
Agriculture	0.15	-0.28	0.82	0.03	0.23	-0.06	0.58	0.04
Industry	0.05	0.14	0.11	0.03	0.04	0.03	-0.05	-0.06
Services	0.03	0.06	0.25	-0.02	0.01	0.01	-0.34	0.06

Source: Model simulations

A sales decomposition analysis of the changes in output results presented in Table 6.24 is reported in the Appendix Table B.13 for both the short-run and long-run. Decomposition in the short-run reveals output growth in agricultural sectors stimulated agriculture-related export-oriented and import-competing manufacturing industries. For example, manufacturing industries, such as the tea processing, rubber processing, coconut processing, and food, beverages and tobacco sectors, show as expansion as a result of increased sales of these raw

products (tea growing, rubber growing, coconut growing, vegetables and highland crops sectors) to those manufacturing industries. Other export-oriented industries, such as textile, footwear and leather products, garments, wood and wood products, and plastic and rubber products show output growth as a result of an increase in sales for exporting.

In the long-run, some industries have shown an expansion while other industries have either displayed a contraction or stayed neutral. Minor export crops, rubber growing, coconut growing, plantation development and the vegetable sectors are expected to expand in terms of output in the long-run. However, the tea growing sector has displayed a slight contraction despite its expansion of land. The rubber processing and coconut processing sectors have expanded substantially owing to subsequent expansion in the rubber growing and coconut growing sectors. On the other hand, the tea processing sector shrunk slightly corresponding to contraction of the tea growing sector. The expansion of land in the agricultural sector is projected to cause detrimental effects on the output of other export-oriented manufacturing sectors. The trade and transport sector also showed a marginal contraction.

It is evident from Table 6.24 that many of the agricultural industries demonstrate a reduction in employment in both the short-run and long-run. In the short-run, the rubber growing, coconut growing, paddy, vegetables, fruit, and highland crops sectors experience employment contraction despite the land expansion in those sectors. The minor export crops and tea growing sectors experience an employment expansion in line with the land expansion. All the manufacturing and services industries demonstrate employment growth. Manufacturing industries which primarily dependent on agricultural outputs as intermediate inputs show a clear expansion of employment. For example, overall employment in the tea processing, rubber processing and coconut processing sectors has expanded.

In the long-run, employment in the tea growing sector is projected to contract in line with its output contraction and this to lead to employment contraction in the tea processing sector as well. Employment in the minor export crops, rubber growing and plantation development sectors are expected to increase due to policy shock. Export-oriented manufacturing industries, such as textile, footwear and leather, garments, wood and wood products, plastic and rubber products, and other manufacturing sectors which experience negative output growth, display a drop in employment.

Furthermore, Table 6.24 shows that output prices of agricultural as well as manufacturing and services sectors decline in both scenarios reflecting reduced inflationary impacts as shown by a decline in the CPI. A decomposition of output price ( $p_{1tot}$ ) shows that the reduction of primary factor input prices as a result of lower land and labour prices and intermediate input prices is the main cause of the decline in agricultural output prices. However, price decline is more prominent in the short-run compared to the long-run. It is important to note that output prices of most export-oriented manufacturing industries (especially tea processing, textile, footwear and leather, garments, and other manufacturing sectors) increase as a result of a decline in export volumes in those sectors. For example, application of (6.8) into the garments sector would result in a 0.02 per cent increase in price of output given the values of  $x_i^E = 0.4$  and  $\gamma_i^E = 0.05$ , which is equal to the output price of garments sector in our long-run simulation results (Table 6.24).

### **6.3.3.3 Impacts on employment by occupation**

Table 6.25 presents the projections of changes in employment among different occupational labour categories. These projections reveal a contraction in the agricultural labour category in both the short-run and long-run (by 0.27 and 0.07 per cent, respectively) similar to the situation in scenario I. Furthermore, industry results showed a reduction of employment in some agricultural sectors. We may observe that this reduction is caused by the drop in the agricultural-related workers category. All the other occupational categories show positive outcomes with unskilled labour, particularly production and related transport equipment operators and workers, who are predominantly employed in expanding manufacturing sectors, benefitting the most (demand increased by 0.11 per cent). We can observe a decline in demand for both production and related transport equipment operators and workers, and administrative and managerial workers in the long-run apart from the decline in agriculture-related workers. Decline in performance of manufacturing industries in the long-run may have created such contractions.

**Table 6.24: Projected effects of agricultural land expansion on sectoral output and employment (percentage changes)**

Sector	Industry category <sup>a</sup>	SR			LR		
		Output	Employment	Price	Output	Employment	Price
Tea growing	A	0.11	0.15	-0.10	-0.02	-0.09	-0.01
Rubber growing	A	0.74	-2.26	-4.56	1.41	0.58	-1.14
Coconut growing	A	0.37	-1.95	-3.87	1.47	-0.06	-2.33
Paddy	A	0.01	-0.03	-0.23	0.04	0.00	0.04
Vegetables	A	0.12	-0.58	-1.21	0.12	-0.41	-0.72
Fruit	A	0.05	-0.56	-1.26	0.00	-0.51	-0.80
Highland crops	A	0.09	-0.49	-1.28	0.05	-0.44	-0.82
Potatoes	A	0.00	-0.01	-0.14	0.05	0.07	0.12
Minor export crops	A	2.13	2.16	-0.12	2.79	2.64	-0.15
Tobacco	A	0.07	0.16	0.00	-0.08	-0.14	0.00
Betel	A	0.02	0.05	-0.12	0.00	0.00	0.10
Miscellaneous agricultural crops	A	0.03	0.06	-0.10	0.04	0.06	0.13
Plantation development	A	0.06	0.12	-0.05	0.34	0.53	0.35
Firewood	A	0.01	0.02	-0.17	0.02	0.00	0.07
Forestry	A	0.04	0.09	-0.08	0.07	0.06	0.09
Livestock and fisheries	A	0.04	0.13	0.00	-0.05	-0.08	0.03
Tea processing	ARM	0.11	0.28	-0.05	-0.02	-0.04	0.01
Rubber processing	ARM	0.94	14.95	-0.17	1.89	1.86	-0.41
Coconut processing	ARM	0.09	0.92	0.00	10.50	10.47	-0.52
Rice milling	ARM	0.01	0.17	-0.18	0.04	0.01	0.04
Flour milling	ARM	0.00	0.04	-0.03	0.03	0.00	0.02
Food, beverages and tobacco	ARM	0.02	0.18	0.00	0.00	-0.03	-0.01
Textile, footwear and leather	M	0.11	0.41	0.17	-0.29	-0.31	0.03
Garments	M	0.04	0.13	0.00	-0.44	-0.46	0.02
Wood and wood products	M	0.22	0.55	0.17	-0.33	-0.35	0.03
Paper and paper products	M	0.01	0.02	-0.04	0.07	0.05	0.03

Chemicals and fertiliser	M	0.04	0.22	0.04	0.12	0.09	0.02
Petroleum	M	0.03	0.31	0.01	-0.03	-0.06	0.02
Plastic and rubber products	M	0.11	0.55	0.18	-0.14	-0.16	-0.04
Other manufacturing	M	0.05	0.13	0.00	-0.17	-0.19	0.03
Electricity, gas and water	S	0.07	0.36	0.34	0.37	0.35	0.06
Construction	S	0.03	0.04	-0.10	0.15	0.14	0.06
Hotels and restaurants	S	0.03	0.05	-0.27	0.07	0.06	-0.08
Tourist and travel	S	0.00	0.00	-0.08	0.03	0.01	0.05
Trade and transport	S	0.03	0.09	-0.05	-0.01	-0.03	0.06
Post and communications	S	0.00	0.42	0.17	0.01	-0.03	0.06
Banking	S	0.06	0.07	-0.13	0.00	-0.01	0.09
Owner dwellings	S	0.01	0.01	-0.17	0.03	0.03	0.11
Public administration and defence	S	0.00	0.00	-0.14	0.07	0.07	0.09
Other personal services	S	0.03	0.03	-0.13	0.12	0.11	0.08

Source: Model simulations

Note:

<sup>a</sup> Key A= Agricultural, AMR=Agriculture-related manufacturing, M=Manufacturing, S=Services

**Table 6.25: The impact of elimination of agricultural land expansion on employment by different occupations (percentage changes)**

Occupational group	SR	LR
Professional, technical and related workers	0.03	0.05
Administrative and managerial workers	0.08	-0.01
Clerical and related workers	0.05	0.03
Sales and service-related workers	0.06	0.04
Agricultural, animal husbandry, fisheries and forestry workers	-0.27	-0.07
Production and related transport equipment operators and workers	0.11	-0.02
Other workers	0.04	0.02

Source: Model simulations

#### **6.3.3.4 Household level effects**

The industry expansion and contraction due to the expansion of agricultural land affects the derived demand for primary factor inputs and the factor incomes influencing the household income as household income flows are determined by their ownership of factors. The short-run and long-run effects on the real household income and long-run effects on the real household consumption from the expansion of land in the agricultural sector are presented in Table 6.26. Accordingly, after-tax income of all household groups increases in both the short-run and long-run. The highest increase is recorded by the Western Province (0.07 per cent) in the short-run. This can be credited to the increase in demand for skilled and unskilled occupational categories as a result of expansion of the manufacturing and services industries. Households of agricultural provinces show only marginal increases in their incomes particularly Uva, Sabaragamuwa, North Central and Central Provinces. This can be attributed to the contraction of the agriculture-related labour force and reduction of land prices. Northern, North Western, Southern and Eastern Provinces record slight increases in real household income. Long-run effects show that all the household groups benefitted at a higher level. Northern Province records the highest income (0.14 per cent) followed by Southern and Eastern Provinces.

**Table 6.26: The effects on real income and real consumption of agricultural land expansion (percentage changes)**

Household group	Real income		Real Consumption
	SR	LR	
Western	0.07	0.12	0.03
Central	0.03	0.12	0.07
Southern	0.04	0.13	0.07
Sabaragamuwa	0.02	0.12	0.09
North Western	0.05	0.12	0.07
Uva	0.01	0.12	0.08
North Central	0.02	0.12	0.09
Northern	0.05	0.14	0.11
Eastern	0.04	0.13	0.07

Source: Model simulations

Increased cultivated land area stimulated the decline in the aggregate CPI by 0.18 per cent in the short-run and 0.07 per cent in the long-run through reduction of commodity prices. We could observe a variation in the change in consumer prices across households. Similar to the aggregate CPI, a decline in the CPI was observed in both the short-run and long-run in all households. The highest consumer price deflation is recorded by the Northern Province households (-0.22 per cent) followed by Sabaragamuwa, North Central and Uva Province households (-0.21 per cent), while the lowest was for Western Province households (-0.12 per cent) in the short-run. Uva, North Central and Northern provinces (-0.09 per cent) showed the highest declines in the CPI, while Western Province showed the lowest decline (-0.03 per cent) in the long-run.

Overall, real consumption of all household groups is increased as a result of increased cultivated land area implying welfare enhancement of all households. Northern Province households are the largest beneficiary in real household consumption (0.11 per cent). This is followed by the households of North Central Province (0.09 per cent), Sabaragamuwa (0.09 per cent) and Uva (0.08 per cent) Provinces. Western Province households benefitted the least. The simulation results in the earlier section projected price reductions in the agricultural/food-

related industries in the long-run. Increase in household consumption in all the household groups can be attributed to lower food prices and increased household income.

### **6.3.3.5 Regional results**

#### ***Macro results***

The short-run and long-run effects of land expansion on the regional GDP and employment are presented in Table 6.27. Regional GDP increases in all the provinces in the short-run as a result of expansion of land in the agricultural sector. Sabaragamuwa Province experiences the highest growth (by 0.12 per cent) followed by the Central Province (by 0.09 per cent), Southern and North Western Provinces (by 0.08 per cent) and Uva Province (by 0.07 per cent). Although all the regions record positive GDP growth, only these five provinces exceed national real GDP (GDP at factor cost) growth of 0.057 per cent. The regional GDP growth rates of Western, North Central, Northern and Eastern Provinces are below the national real GDP growth rate.

In the long-run, of all the provinces, only Western Province fails to record positive growth in its regional GDP. Sabaragamuwa Province records the highest growth (by 0.46 per cent). Among the regions recording positive output growth, Sabaragamuwa, Southern, Central, North Western, Uva and Northern Provinces are the regions where output growth exceeds national GDP growth. North Central, Eastern and Western Provinces are the regions where GDP growth stays below the national GDP growth.

Western Province records the highest growth in regional employment (0.08 per cent), while Sabaragamuwa and Southern Provinces also exhibit a slight positive growth in employment in the short-run. All these three regions surpass the national aggregate employment growth of 0.016 per cent. Employment contractions can be observed in six regions. The highest employment contraction is in the North Western Province (-0.16 per cent) followed by Uva and North Central Provinces (-0.07 per cent).

In the long-run, Sabaragamuwa Province experiences the highest employment growth of 0.13 per cent, while Southern and Northern Provinces come next. Employment falls in Western, North Central and Eastern Provinces by 0.04 per cent, 0.02 per cent and 0.01 per cent,

respectively. This indicates that while expansion of agricultural land increases employment in Sabaragamuwa, Southern, Central, Northern and Uva Provinces in the long-run, it creates unemployment in the Western Province and causes sustained unemployment in North Western, North Central and Eastern Provinces.

**Table 6.27: The effects of agricultural land expansion on regional output and employment (percentage changes)**

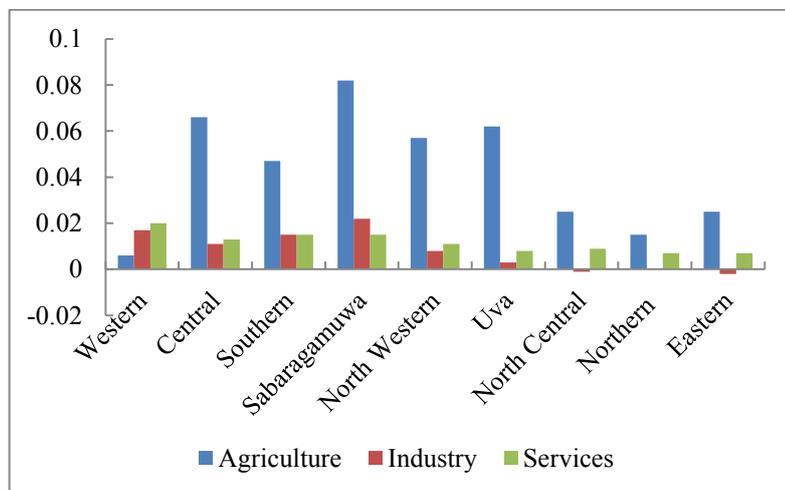
Region	SR		LR	
	Growth in real gross regional product	Growth in aggregate regional employment	Growth in real gross regional product	Growth in aggregate regional employment
Western	0.04	0.08	-0.01	-0.04
Central	0.09	0.00	0.21	0.02
Southern	0.08	0.02	0.23	0.07
Sabaragamuwa	0.12	0.03	0.46	0.13
North Western	0.08	-0.16	0.19	0.00
Uva	0.07	-0.07	0.19	0.01
North Central	0.03	-0.07	0.06	-0.02
Northern	0.02	-0.02	0.1	0.05
Eastern	0.03	-0.05	0.06	-0.01

Source: Model simulations

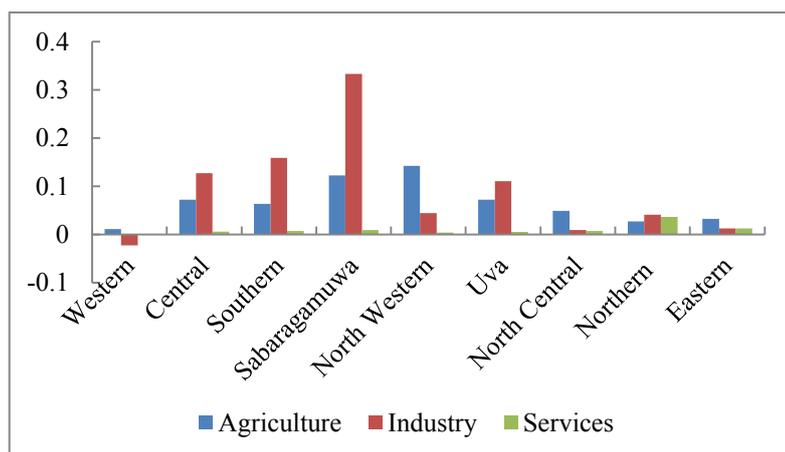
### ***Industry results***

Short-run and long-run effects on the contributions to regional GDP by three broadly defined aggregate sectors, agriculture, manufacturing and services, are illustrated in Figure 6.8. All the regions receive positive contributions from agricultural industries in the short-run towards their regional GDP. The highest contribution is received by the Sabaragamuwa Province followed by Central and Uva Provinces. All the provinces except for North Central and Eastern Provinces receive positive contributions from the industrial sectors with Sabaragamuwa Province recording the highest growth. The services sector contributes positively to the GDP of all the regions and the Western Province receives the highest. Similar to the short-run effects, all the regions sustain positive impacts from agriculture in the long-run. This time, North Western Province receives the highest contribution. The industry sector

has a negative effect on Western Province regional GDP while all the other provinces have a positive effect.



(a) Short-run



(b) Long-run

**Figure 6.8: The effects on contributions to regional GDP by aggregate sectors of agricultural land expansion (percentage changes)**

Source: Model simulations

***Determinants of each regions growth relative to national growth***

The short-run aggregate regional advantage matrix is presented in Table 6.28. By looking at the regional advantage matrix we can distinguish five regions that gain as a result of agricultural land expansion in the short-run. These are Sabaragamuwa, Central, Southern, North Western and Uva Provinces which can mainly be considered as agricultural provinces. According to Table 6.28, five regions (Sabaragamuwa, Central, Uva, Southern and North

Western) receive positive contributions from agricultural industries towards their regional advantage in the short-run. Only four (Sabaragamuwa, Southern, Central and North Western) provinces receive positive contributions from industrial sectors for their regional advantage. Western, Southern and Uva provinces gain positive advantages from service sectors. Furthermore, Table 6.29 shows that Central, Southern, Sabaragamuwa, North Western and Uva Provinces receive positive contributions towards their regional advantage from the group of national industries. Local industries provide positive contributions only to Central's, Southern's and Sabaragamuwa's regional advantage.

**Table 6.28: Short-run aggregate regional advantage matrix of agricultural land expansion**

Sector	Western	Central	Southern	Sabara-gamuwa	North Western	Uva	North Central	Northern	Eastern
Agriculture	-0.014	0.028	0.012	0.048	0.02	0.019	-0.015	-0.013	-0.018
Industry	-0.002	0.004	0.008	0.014	0.001	-0.005	-0.007	-0.002	-0.005
Services	0.001	0	0.001	0	-0.002	0.002	-0.002	-0.02	-0.005
<b>Total Contribution</b>	<b>-0.015</b>	<b>0.032</b>	<b>0.021</b>	<b>0.062</b>	<b>0.019</b>	<b>0.016</b>	<b>-0.024</b>	<b>-0.035</b>	<b>-0.028</b>
National industries	-0.015	0.03	0.016	0.053	0.024	0.025	-0.017	-0.029	-0.021
Local industries	0	0.002	0.005	0.009	-0.005	-0.009	-0.007	-0.006	-0.007
<b>Total Contribution</b>	<b>-0.015</b>	<b>0.032</b>	<b>0.021</b>	<b>0.062</b>	<b>0.019</b>	<b>0.016</b>	<b>-0.024</b>	<b>-0.035</b>	<b>-0.028</b>

Source: Model simulations

An examination of the detailed regional advantage matrix in Appendix Table B.14 reveals that the regions in which GDP exceeds the national GDP, are over-represented in some fast growing agricultural and manufacturing industries. For instance, Sabaragamuwa Province benefits from the land expansion in the short-run because it is over-represented in the fast growing agricultural industries (particularly tea growing, rubber growing, coconut growing and minor export crops), agriculture-related manufacturing industries (tea processing, rubber processing, and coconut processing) and other fast growing manufacturing industries like wood and wood products, and plastic and rubber products. It is disadvantaged by under-representation in the textile, footwear and leather sector and having zero contributions from the fruit, tobacco and plantation development sectors. North Western Province benefits from the shock because it is over-represented in minor export crops and highland crops, coconut growing sector, the textile, footwear and leather products, and wood and wood products

sectors. These benefits exceed the losses from the region's under-representation of other faster growing industries such as tea growing, rubber growing, tea processing, rubber processing, and the plastic and rubber products industries.

Regional growth of Western Province becomes lower than the national GDP in the short-run despite its higher shares in manufacturing industries, such as textile, footwear and leather products, and wood and wood products and because of its lower proportion of faster growing agricultural and agriculture-related manufacturing industries. Northern Province does not gain from the policy in the short-run because it lacks the support from major agricultural and manufacturing industries.

Table 6.27 has revealed that Western, North Central and Eastern Provinces are the losing regions in the long-run with the Western Province having negative regional GDP. Table 6.29 further illustrates the contributions of different aggregate sectors towards the regional advantage in the long-run. It is a summary of the detailed regional advantage matrix in the Appendix Table B.15. According to Table 2.29, Sabaragamuwa, Central, Southern, North Western and Uva Provinces benefit from all three aggregate sectors, while Western Province lacks support from them.

**Table 6.29: Long-run aggregate regional advantage matrix of agricultural land expansion**

Sector	Western	Central	Southern	Sabara-gamuwa	North Western	Uva	North Central	Northern	Eastern
Agriculture	-0.020	0.013	0.007	0.067	0.083	0.004	-0.014	-0.017	-0.036
Industry	-0.076	0.094	0.125	0.298	0.010	0.074	-0.023	0.015	-0.015
Services	-0.008	0.008	0.005	0.007	0.005	0.017	0.011	0.015	0.016
<b>Total Contribution</b>	<b>-0.104</b>	<b>0.114</b>	<b>0.137</b>	<b>0.372</b>	<b>0.099</b>	<b>0.096</b>	<b>-0.027</b>	<b>0.013</b>	<b>-0.035</b>
National industries	-0.095	0.104	0.117	0.347	0.101	0.075	-0.019	0.010	-0.028
Local industries	-0.009	0.010	0.020	0.025	-0.002	0.021	-0.007	0.003	-0.007
<b>Total Contribution</b>	<b>-0.104</b>	<b>0.114</b>	<b>0.137</b>	<b>0.372</b>	<b>0.099</b>	<b>0.096</b>	<b>-0.027</b>	<b>0.013</b>	<b>-0.035</b>

Source: Model simulations

The detailed regional advantage matrix demonstrates that gains from having a higher proportion of faster growing industries (particularly, minor export crops, coconut growing, rubber growing, plantation development, coconut processing, rubber processing and

construction industries) and a lower proportion of slow growing industries (tea growing and tea processing industries) helped Sabaragamuwa Province to counteract the losses from over-representation in some slow growing manufacturing industries (such as the food, beverage and tobacco, textile, footwear and leather, garments, and paper and paper products sectors). Similarly, returns from faster growing industries in the Central, Southern and Uva Provinces surpass the losses of slower growing industries resulting in positive regional GDP. North Western Province benefits as a result of positive contributions mainly from coconut growing, minor export crops and plantation industries, and under-representation in slow growing industries in the long-run.

Advantages received by the Western Province from having lower proportions of slow growing manufacturing and services industries could not surpass the disadvantages stemming from under-representation in fast growing agricultural industries. Even though Northern Province is at a disadvantage due to the policy shock in the short-run, it gains in the long-run.

#### **6.4 Results of the SSA**

In this section we carried out the SSA procedure for simulation I (for both short-run and long-run scenarios) by systematically varying the values of three Armington elasticities (namely, intermediate, investment and household Armington), substitution elasticities between primary factors, and substitution elasticities between different occupational categories of labour. All these parameters were allowed to vary by 50 per cent from their original values based on a triangular distribution and Stroud's quadrature. Under both scenarios, the confidence intervals at the 95 per cent level of significance for the important macroeconomic variables were constructed around their estimated mean using the estimated standard deviations and Chebyshev's inequality<sup>15</sup>. The results shown in Table 6.30 reveal that, with one exception, the SSA mean values are not significantly different from the original simulation results. The exception is the aggregate employment in the short-run. In our simulation, aggregate

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<sup>15</sup> Assume an endogenous variable Y with mean M and standard deviation D. Chebyshev's inequality declares that, regardless of the distribution of the variable in question, for each positive real number k, the probability that the value of Y does not lie within k standard deviations of the mean M is no more than  $1/(k^2)$ . For example, if (k=4) the probability that its value does not lie within 4 standard deviations of the mean is no more than 0.0625 [=1/(4<sup>2</sup>)]. That is, you can be 93.75 per cent sure that the value does lie between M-4D and M+4D (Based on RunGEM SSA help menu).

employment growth showed a 0.49 per cent decline in the short-run. The confidence interval developed using Chebyshev's inequality ranges between -0.324 per cent and 0.226 per cent, indicating that there is a possibility of positive aggregate employment growth in the short-run as a result of productivity improvement.

**Table 6.30: SSA projections of some key macro variables under simulation I (percentage changes)**

Variable	Confidence intervals at the 95 per cent level of significance <sup>a</sup> (Short-run)				Confidence intervals at the 95 per cent level of significance (Long-run)			
	Simulation result	Mean	Lower Limit	Upper Limit	Simulation result	Mean	Lower Limit	Upper Limit
Aggregate employment	-0.049	-0.049	-0.324	0.226	0	n/a	n/a	n/a
Real devaluation	1.504	1.521	1.053	1.989	0.474	0.480	0.363	0.596
CPI	-1.559	-1.580	-2.021	-1.139	-0.693	-0.702	-0.874	-0.531
Real GDP	0.465	0.464	0.354	0.574	0.730	0.729	0.702	0.756
Aggregate imports	0.220	0.220	0.126	0.313	0.179	0.174	0.079	0.269
Aggregate exports	1.458	1.456	1.079	1.833	0.363	0.357	0.245	0.469
Terms of trade	-0.261	-0.260	-0.315	-0.204	-0.212	-0.212	-0.222	-0.202
Real consumption	0	n/a	n/a	n/a	0.737	0.736	0.701	0.772

Note: <sup>a</sup> The lower and upper limits of the confidence intervals at the 95 per cent level significance= estimated mean  $\pm$  (4.47  $\times$  estimated standard deviation)

## 6.5 Chapter summary

This chapter discussed the possible impacts of three domestic agricultural policies on the Sri Lankan economy at the national level, sectoral level, household level and the regional level. Simulation experiments were conducted in relation to agricultural productivity improvement, a 100 per cent cut of prevailing tariffs in agricultural industries and land expansion in the agricultural sectors.

The simulation results demonstrated that the agriculture sector contributes significantly to the Sri Lankan economy confirming that it still has to play an important role in economic development of the country despite its shrinking size in the economy. The results of SSA indicate that the model produces rather robust results that are largely not sensitive to elasticity parameter values.

## Chapter 7

### Summary and Conclusions

This study set out to understand the economy-wide effects of domestic agricultural policies in Sri Lanka. A multi-household CGE model for Sri Lanka and a highly disaggregated data base were developed in order to examine the linkage between the agricultural sector and the other sectors of the economy. As a methodological enhancement, the base model was extended to incorporate regional disaggregation of the national results so that impacts on different regions can be understood distinctly. Then we used this model to analyse possible consequences, at both the national as well as the regional level, of the issues we have expressed interest in. The issues considered in this study are productivity improvement in the agricultural sectors, 100 per cent reduction in existing tariffs in the agricultural sectors and expansion of arable land in agricultural sectors.

This thesis has seven chapters. We began this study by examining the relationship between the agricultural sector's growth and economic development. The specific features of the Sri Lankan economy were then highlighted to demonstrate the importance of the agricultural sector in the economy in Chapter 2. In Chapter 3, we reviewed the application of CGE models in agricultural policy analysis in developing countries. Chapter 4 and 5 were devoted to explaining the theoretical structure of the CGE model developed in this study and the process of constructing the data base necessary to calibrate the model. The policy simulations were described and the results evaluated in Chapter 6.

This final chapter summarises the main findings, suggests appropriate policy responses, highlights the limitations of the study, and sheds some light on future directions of research. The remainder of this chapter is organised as follows. Section 7.1 presents a summary of the main research findings. Policy implications drawn from the findings are described in Section 7.2. Section 7.3 lists the limitations of the present study first and then highlights the suggestions for further research.

## 7.1 A summary of major findings

This section expects to summarise major findings of the study starting from the descriptive analysis of the role of agriculture in the Sri Lankan economy and the evolution of agricultural policies in Sri Lanka, and CGE literature on agricultural policy analysis in developing countries. We then summarise the key results of this study based on the macroeconomic, sectoral, household level and regional effects analysed in Chapter 6.

Chapter 2 presented an overview of the Sri Lankan economy focusing on its structure and development. In doing so, it was understood that the most noteworthy structural change in the Sri Lankan economy since independence has been the diminished prominence of agriculture in the economy. Historically, agriculture was the predominant sector in the economy in terms of value addition, exports and employment generation. Even though its relative position has been declining over the past three decades, it continues to play a vital role in the Sri Lankan economy. It was further revealed that public policy towards agriculture has not been consistent in Sri Lanka. The agricultural sector has been subjected to a mixture of policy reforms since independence. However, the agricultural sector has been seen as a priority area in governments' development agendas and resources have been directed towards agricultural development with the aim of economic development and poverty reduction.

The review of CGE literature on agriculture in developing countries revealed that CGE modelling is the appropriate method to identify overall impacts of agricultural policies on an economy. Furthermore, it suggests that there is a growing interest among researchers in using CGE models for the simulation of domestic markets in developing countries to identify the impacts of the external economic environment.

Each domestic policy considered in this study was expected to cause positive impacts on real GDP. Productivity improvement in the agricultural sector seems to yield the highest GDP growth in both the short-run and long-run. However, results suggest that productivity improvement is likely to have a negative impact on aggregate employment in the short-run, while tariff reduction and land expansion positively affect aggregate employment. Furthermore, all the simulations indicate a reduction of inflation in the economy and cost of living as illustrated by reduction in the CPI.

The short-run macroeconomic results in all three simulations show that Sri Lanka's export competitiveness improves as a result of real devaluation of the exchange rate. It is also observed that all three scenarios lead to an improvement in the balance of trade situation in the country. Long-run macroeconomic results suggest a positive impact on real wages in all three scenarios. Furthermore, aggregate real private consumption is expected to increase in all three policy options implying aggregate welfare improvement in the long-run.

The implications at industry level show that all three simulations stimulate not only the agricultural output, but also outputs of industry and services sectors. Under simulation I, in the short-run, agricultural industries such as minor export crops, tea growing, vegetables, highland crops, rubber growing and coconut growing showed an expansion in terms of output. Similarly, agriculture-related manufacturing industries, which rely on agricultural inputs particularly tea processing and rubber processing, also showed a tendency towards expansion. In addition, other export-related manufacturing industries also indicated a growth in output.

It can be observed under simulation II, in the short-run, the tobacco sector showed a substantial contraction of its output as a result of competition from cheaper imports. The simulation indicated a slight increase in the output of other agricultural sectors mainly as a result of the expansion of food processing industries such as tea processing, rubber processing, flour milling, and the food, beverages and tobacco industries, which are primarily dependent on agricultural products for their intermediate inputs.

The majority of the industries recorded positive output growth under Simulation III in the short-run. The minor export crops, rubber growing, coconut growing, vegetables, tea growing and highland crops sectors were the major expanding agricultural industries. This output growth in agricultural sectors stimulates agriculture-related export-oriented and import-competing food processing industries.

The long-run results of simulation I indicated that the agricultural, and food processing industries' outputs expanded substantially as a result of productivity improvement. However, export-oriented manufacturing industries such as the garment and other manufacturing industries were negatively affected. Relocation of resources into more profitable agriculture-related industries can be considered as one of the possible reasons for the contraction of output

in those industries. In the long-run, under simulation II, the tobacco sector showed a substantial contraction similar to short-run results due to cheaper imports. Furthermore, agriculture-related export-oriented processing industries such as tea processing, rubber processing and coconut processing industries showed a contraction. This contraction results from the marginal drop in output of major raw material supplying industries such as tea growing, rubber growing and coconut growing industries. The expansion of agricultural land under simulation III causes negative effects in the long-run on the output of other export-oriented manufacturing industries.

Productivity improvement in agricultural sectors is likely to cause substantial employment contraction in those sectors, particularly in rubber growing, coconut growing, paddy, vegetables, fruit, highland crops and the livestock and fisheries sectors in both the short-run and long-run. The reason for this could be an increase in labour productivity in the above-mentioned agricultural sectors as a result of the shock leading to a decline in employment. However, agriculture-related food processing industries, which primarily depend on agricultural products for intermediate inputs, showed an expansion of employment. In addition, export-oriented manufacturing industries, garments and other manufacturing industries experienced a contraction in employment following the contraction of output in those sectors. Services sectors experienced employment expansion followed by output expansion.

The tariff cut in agricultural sectors under simulation II seemed to increase industry employment except for the tobacco industry in the short-run. Contraction of tobacco industry employment was associated with the output contraction in both the short-run and long-run. Agricultural industries which record negative outputs in the long run, for example, tea growing, rubber growing, coconut growing, minor export crops and the tobacco sectors recorded negative employment growth. Export-oriented agricultural industries such as tea processing, rubber processing and coconut processing industries also showed a contraction in employment.

Expansion in agricultural land caused reduction in employment in agricultural sectors in both the short-run and long-run. However, this appeared to expand employment in manufacturing

and services industries in the short-run. Reduction of employment in the export-oriented manufacturing industries was associated with the reduction of output in the long-run.

In the short-run, under simulation I, the after-tax real income of all the household groups except for households in Uva Province was expected to increase. Possible reasons for this decline in real income were the decline in agricultural employment and reduced agricultural output prices, as the Uva Province is primary an agricultural province. In the long-run, all the household groups showed a possible increase in real household income. Elimination of agricultural tariffs under simulation II appeared to have similar increases in real income across all household groups in both the short-run and long-run. After-tax real income of all household groups increased under simulation III in both the short-run and long-run. In the short-run, Western province households received the highest benefits as a result of expanding manufacturing and services industries. Households of agricultural provinces received marginal benefits due to contraction of the agricultural labour force and reduced land prices.

Improvement in agricultural productivity under simulation I led to increased GDP in all the regions except for North Central Province in the short-run. Sabaragamuwa, Central, Southern and Western Provinces were the only regions with positive regional advantages. All the regions recorded positive GDP in the long-run. However, Western and North Central provinces recorded negative regional advantages as their GDPs were below the national real GDP.

Regional GDPs of all the regions were either positive or unaffected as a result of the elimination of the agricultural tariff. Only Western and Southern Provinces' regional GDPs surpassed the national real GDP, while Sabaragamuwa Province's GDP was equal to the national real GDP. All the regions recorded positive regional growth in the long-run. However, only seven provinces were able to exceed the national real GDP growth. Western and Sabaragamuwa Provinces' GDP growth stayed below the national GDP.

Increases in agricultural land seemed to produce positive regional GDP in all the regions in the short-run. However, only five provinces received positive regional advantages exceeding the national real GDP. Those were Sabaragamuwa, Central, Southern, North Western and Uva Provinces with Sabaragamuwa receiving the highest regional advantage. Other remaining

regions recorded negative regional advantages. In the long-run all the regions recorded significantly positive regional GDP except for the Western Province.

There was an employment contraction in many regions as a result of productivity improvement in the short-run, reflecting reduction in the demand for agricultural labour. Only Western and Sabaragamuwa Provinces recorded positive employment growth mainly as a result of expanding manufacturing industries. Only Western, Southern, Sabaragamuwa and Northern Provinces recorded positive employment in the long-run. This indicates that productivity improvement in agricultural sectors may cause sustained unemployment in other regions.

Under simulation II, regional employment growth followed regional output growth in the short-run, keeping the relative position of each region alike in terms of both output growth and employment growth. Western Province experienced the highest employment growth. Regional employment in the long-run did not reflect the changes in regional GDP in the long-run. Western and Sabaragamuwa Provinces recorded negative employment, reflecting a creation of unemployment in those provinces.

Employment contractions were observed in six regions (North Western, Uva, North Central, Eastern, Northern and Central Provinces) in the short-run under simulation III, revealing the employment contraction in agricultural industries. Western Province recorded the highest employment growth followed by Sabaragamuwa and Southern Provinces. Land expansion in agricultural sectors seemed to create unemployment in the Western Province in the long-run, while sustaining the unemployment in North Central and Eastern Provinces.

## **7.2 Policy implications**

The above findings of this study have important policy implications. It was found that simulations I and III may lead to reduction in the agricultural labour force in both the short-run and long-run. Although this is consistent with the consequences of the development process, agricultural employment contraction under simulation I is likely to be an issue of serious concern as non-agricultural sectors in the economy would not be able to create enough employment opportunities to absorb the unemployed agricultural labour. Aggregate

employment contraction at the national level was observed as a result of this. This could be a challenge to address given that the prevailing unemployment rate of the country was also around 5 per cent in 2010. This in turn affects employment in many agricultural regions and the real income of the households in agricultural regions.

One policy option to address this issue would be to provide short-term assistance to the people who are affected in agricultural regions through a targeted programme like a social security system and/or unemployment benefit programme. Implementation of employment training/retraining programmes sponsored by the government, such as vocational training programmes in order to gain skills necessary to engage in another employment for the people who lose their jobs, would be another option to deal with the unemployment problem. An alternative policy option for reducing agricultural unemployment would be to foster processing of agricultural products in the same agricultural regions. Such industries would absorb labour shed by primary agricultural sectors by providing off-farm employment opportunities and would become profitable and expand in the long-run by accruing the benefits of abundant cheaper inputs and lower intermediate costs. These industries could not only be large scale enterprises but small and medium enterprises (SME) or micro industries based on local raw materials. Such industries would also promote regional growth and social development in those under-developed regions. However, rural infrastructure expansion and financial assistance for SMEs are among the prerequisites for success of establishment and expansion of such industries.

Reduction of food prices benefits the consumers by lowering the cost of living. However, it affects the income of agricultural producers negatively. The findings of the study suggest that increasing agricultural productivity is more likely to benefit the rural agricultural households less than non-agricultural households in the short-run, as a result of possible agricultural terms of trade deterioration. It was observed that real income of households of Uva province experienced a negative impact as a result of productivity improvement in agricultural sectors in the short-run. Further, other agricultural provinces (Sabaragamuwa, Central and North Central) benefitted only marginally. Reduction of the demand for agricultural labour and lower food prices can both cause lower incomes for agricultural households. Although Uva Province household's real income increased in the long-run, a large number of people would be likely to

suffer in the short-run. This could affect food security in the long-term as this could reduce the number of people involved in agricultural activities and the amount they invest in agriculture.

Market intervention practices such as agricultural price support and a buffer stock programme by a government agency to buy agricultural produce during producing seasons have been considered by several Sri Lankan governments in the past to solve the problem of lower prices. This price intervention practice is operating in Sri Lanka at the moment for some crops such as paddy, but with many setbacks. However, the best policy option in the short-term to promote the well-being of the people engaged in agriculture and to ensure agricultural producers receive a greater share of gains from increased productivity would be to implement a targeted welfare system which includes a welfare grant and additional government support services which can also integrate the unemployment benefit support suggested above. There should at least be an increase in the share of existing targeted assistance to the poor through the Samurdhi programme, which is the national system of social assistance for poverty alleviation, to include the agricultural producers who lose due to the productivity improvement in the short-run.

Such a social assistance programme could be supplemented by a market intervention programme buying agricultural produce from farmers at a guaranteed price, creating a buffer stock. It could then be released back to the market when prices rise to a prescribed level, for example it could be released when the product is out of season, or it could be used for processing. There should be a way of covering the cost of operating the buffer stock programme, for example, the markup between procurement and release price. A common problem occurring in such programmes is government inventories rise without limit until the agency drains its allocated budget for buying the produce. In such instances, improving storage facilities to store more stock, exploring avenues to export excess stocks of products such as excess stocks of rice, vegetables and fruits and/or use of excess stocks in preserving and processing industries would be helpful to make the buffer stock programmes viable. A hybrid approach, such as non-recourse loans keeping the agricultural produce as collateral, as operate in other countries instead of direct market intervention would also be desirable.

Investing in farmer education could be a plausible policy option towards gaining knowledge on identifying and strategically responding to market signals by the agricultural producers.

This would help the farmers in identifying and capitalising on profitable farming options, diversifying production and receiving higher levels of income.

The long-run implications show the possibility that tariff reduction and land expansion in agricultural sectors can lead to a contraction in the country's main exporting industries, both agricultural and non-agricultural, in terms of both output and employment. It was observed that, particularly, tea processing, rubber processing and coconut processing, garments and other manufacturing industries experience a slowdown in the long-run with agricultural tariff reductions. The main manufacturing export industries, textile, footwear and leather, garments, plastic and rubber products, and other manufacturing industries indicated a decline in their output and employment under simulation III. In respect of policy responses to this issue, the government needs to take action in order to make those exporting industries more competitive.

The policy response for making export-oriented manufacturing industries more competitive would be to remove key supply constraints faced by these industries. These constraints include the high cost of capital and lack of capital, weak infrastructure, lack of backward linkages, and bad governance and corruption. Removal of such constraints would reduce the cost of production of those industries. Strengthening financial, technical and managerial infrastructure would provide additional support to enhance their competitiveness. Creating an investment climate that is conducive to the formation of backward linkages and maintaining sources of comparative advantage among local suppliers would increase the efficient and productive growth of export-oriented manufacturing industries.

### **7.3 Limitations and further research**

Despite the effort put into developing a model to represent the socio-economic structure of Sri Lanka and a reliable data base, this study is still constrained by many factors. Therefore, it is important to interpret the findings of the study in the light of those limitations and to draw the reader's attention to these limitations. These limitations are mainly related to the data base and theoretical structure of the model. The areas of further research can be identified mainly based on the limitations of the study.

Firstly, this study uses as its primary source of data the I-O tables of Sri Lanka for 2000, which is the most recent I-O table published for Sri Lanka. The data base should be updated whenever the next I-O table is compiled. As discussed in Chapter 5, the development of the data base was subjected to several constraints. Some detailed data required by the study is not available for Sri Lanka. Therefore, depending on data limitations, development of some data matrices had to be based on some assumptions or best judgements. For example, allocation of land to land-using industries, the derivation of the capital formation matrix and tax matrix and total wage bill matrix for several occupational categories had to be based on various assumptions. Therefore, the impacts of any policy scenario run in the present model will be dependent on these assumptions. Development of a SAM for a recent year would be helpful in capturing more details of the Sri Lankan economy.

In addition, this study uses the non-margin version of ORANI-G model as there are no fine details to develop a margin matrix for Sri Lanka. Therefore, construction of a comprehensive data base for a recent base year with more disaggregated data would help in analysing deeper issues. Furthermore, Chapter 5 described various approximations we had to use in order to extract regional shares from different sources. Improvement of regional shares could help in identifying clearer regional impacts.

This model disaggregates households into nine groups based on their geographical location. Further disaggregation of households in each province based on their income would have been desirable to capture the effects of the shocks analysed. Moreover, in analysing the effects of agricultural trade liberalisation, the present model considered only the elimination of tariffs. This model could not estimate the impacts of NTBs prevailing in Sri Lanka. Capturing such NTBs would provide more valuable information on impacts of trade liberalisation.

Furthermore, elasticity parameters used in this study were not econometrically estimated. The values used were based on previous studies. The results of this study can be considered reasonable, as the results were robust with different values for elasticity parameters tested by SSA. However, it was noted that some results were sensitive to elasticity parameter values assumed in the model which can be corrected if we econometrically estimate them all.

The theoretical structure of the model used in this study is a static, single-country model. A single-country model assumes that conditions in the rest of the world do not change. One direction for extending the model is to link it with the rest of the world as a multi-country model. This type of extension can be used for analysing the impacts of mega events such as changes in demand for our major exports due to global recession. Further, there are some simplistic assumptions made in developing the theoretical structure such as constant returns to scale assumed in the production. This can be considered as a weakness in the structure of the model. The investment decision of firms is over simplified in a static model. Incorporating investment decisions in the present model to make it a dynamic model would be another possible way to extend the model.

Finally, the regional extension of this model uses a tops-down approach. This approach is not capable of capturing region-specific supply issues as it contains no theory of regional variation of prices. Therefore, development of a bottoms-up regional model like TERM or MMRF would be another possible extension to the present model which could be used to simulate the impacts of region-specific supply shocks.

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## Appendices

### Appendix A.1

**Table A.1: Proportion of employed population by industry and occupation**

Industry	Professional and technical	Administrative and managerial	Clerical	Sales	Services	Agricultural	Production and related transport	Other
Agriculture	0.003	0.000	0.006	0.002	0.007	0.935	0.011	0.037
Forestry and logging	0.029	0.000	0.029	0.086	0.057	0.343	0.400	0.057
Fishing	0.000	0.006	0.006	0.039	0.000	0.910	0.006	0.032
Crude petroleum	0.125	0.000	0.125	0.125	0.125	0.000	0.500	0.000
Mining	0.000	0.000	0.017	0.051	0.006	0.006	0.809	0.112
Manufacture of FB and tobacco	0.004	0.008	0.021	0.080	0.059	0.067	0.653	0.107
Textile, wearing apparel and leather	0.008	0.015	0.028	0.017	0.024	0.005	0.869	0.032
Manufacture of wood and furniture	0.000	0.006	0.006	0.010	0.003	0.081	0.829	0.065
Manufacture of chemicals, rubber and plastic	0.016	0.032	0.079	0.048	0.016	0.000	0.683	0.127
Non-metallic minerals	0.045	0.082	0.100	0.045	0.091	0.009	0.491	0.136
Basic metal industries	0.010	0.000	0.031	0.015	0.010	0.000	0.800	0.133
Fabricated metal products	0.000	0.000	0.034	0.000	0.000	0.000	0.897	0.069
Other manufacturing	0.055	0.000	0.047	0.094	0.024	0.000	0.756	0.024
Electricity, gas and water	0.058	0.018	0.058	0.035	0.012	0.012	0.749	0.058
Construction	0.000	0.000	0.261	0.000	0.217	0.000	0.391	0.130
Wholesale and retail trade	0.020	0.008	0.038	0.114	0.026	0.012	0.667	0.115
Restaurants and hotels	0.007	0.002	0.017	0.891	0.023	0.011	0.035	0.015
Land transport and storage	0.038	0.000	0.051	0.127	0.658	0.006	0.082	0.038
Communications	0.016	0.009	0.193	0.022	0.043	0.006	0.617	0.094
Banking, insurance and real estate	0.047	0.099	0.599	0.123	0.061	0.005	0.061	0.005
Public administration and defence	0.296	0.022	0.311	0.163	0.044	0.000	0.119	0.044
Other services	0.320	0.011	0.144	0.015	0.191	0.006	0.114	0.200

Source: CBSL (1999)

## Appendix A.2

**Table A.2: Average wage rate by occupation**

Occupation	Average wage rate (Rs.)
Legislators, Senior Officials and Managers	16352.45
Technicians and Associate Professionals	11948.68
Clerks	8920.58
Service Workers and Shop and Market Sales Workers	7516.282
Skilled Agricultural and Fishery Workers	4728.268
Plant and Machine Operators and Assemblers	6716.017
Elementary Occupations	4206.553

Source: CBSL (2005b)

### Appendix A.3

**Table A.3: Proportion of labour cost by industry and occupation**

	Professional and technical	Administrative and managerial	Clerical	Sales and services	Agricultural	Production and related transport	Other
Agriculture	0.007	0.001	0.011	0.013	0.920	0.015	0.032
Forestry and logging	0.055	0.000	0.041	0.173	0.261	0.432	0.039
Fishing	0.000	0.021	0.012	0.059	0.872	0.009	0.028
Crude petroleum	0.190	0.000	0.142	0.240	0.000	0.428	0.000
Mining	0.000	0.000	0.023	0.065	0.004	0.835	0.073
Manufacture of FB and tobacco	0.008	0.021	0.029	0.159	0.048	0.667	0.069
Textile, wearing apparel and leather	0.014	0.036	0.037	0.045	0.003	0.845	0.020
Manufacture of wood and furniture	0.000	0.016	0.009	0.015	0.059	0.859	0.042
Manufacture of chemicals, rubber and plastic	0.027	0.074	0.101	0.068	0.000	0.654	0.076
Non-metallic minerals	0.070	0.173	0.116	0.133	0.006	0.428	0.074
Basic metal industries	0.019	0.000	0.042	0.030	0.000	0.824	0.086
Fabricated metal products	0.000	0.000	0.046	0.000	0.000	0.910	0.044
Other manufacturing	0.092	0.000	0.059	0.124	0.000	0.711	0.014
Electricity, gas and water	0.097	0.040	0.073	0.049	0.008	0.699	0.034
Construction	0.000	0.000	0.326	0.229	0.000	0.368	0.077
Wholesale and retail trade	0.036	0.018	0.050	0.156	0.008	0.661	0.072
Restaurants and hotels	0.012	0.004	0.020	0.918	0.007	0.031	0.009
Land transport and storage	0.060	0.000	0.060	0.782	0.004	0.073	0.021
Communications	0.027	0.020	0.242	0.069	0.004	0.582	0.055
Banking, insurance and real estate	0.060	0.173	0.571	0.148	0.002	0.044	0.002
Public administration and defence	0.384	0.039	0.301	0.169	0.000	0.086	0.020
Other services	0.451	0.021	0.151	0.183	0.003	0.091	0.099

Source: Authors' calculations

## Appendix A.4

**Table A.4: Total wage bill matrix by industry and occupation (Rs. Mn)**

Industry	Professional and technical	Administrative and managerial	Clarical	Sales and services	Agricultural	Production and related transport	Other
Tea growing	95.47	17.42	142.55	168.16	12177.73	203.92	425.74
Rubber growing	4.32	0.79	6.45	7.61	551.32	9.23	19.27
Coconut growing	66.02	12.05	98.58	116.29	8421.60	141.02	294.43
Paddy	112.83	20.59	168.47	198.73	14391.28	240.98	503.13
Vegetables	106.73	19.48	159.36	187.99	13613.55	227.96	475.94
Fruit	3.67	0.67	5.48	6.47	468.48	7.84	16.38
Highland crops	72.92	13.31	108.89	128.44	9301.50	155.75	325.19
Potatoes	4.61	0.84	6.88	8.12	588.13	9.85	20.56
Minor export crops	16.59	3.03	24.77	29.22	2115.99	35.43	73.98
Tobacco	1.30	0.24	1.94	2.29	165.67	2.77	5.79
Betel	5.51	1.01	8.23	9.71	703.18	11.77	24.58
Miscellaneous agricultural crops	15.99	2.92	23.88	28.16	2039.59	34.15	71.31
Plantation development	16.38	2.99	24.46	28.85	2089.29	34.99	73.04
Firewood	190.52	0.00	142.24	599.22	904.69	1499.19	134.14
Forestry	24.32	0.00	18.16	76.50	115.50	191.39	17.13
Livestock and fisheries	0.00	258.39	140.96	712.61	10534.57	106.12	332.35
Tea processing	14.09	38.57	52.60	292.49	89.21	1227.55	126.49
Rubber processing	0.26	0.71	0.97	5.40	1.65	22.67	2.34
Coconut processing	4.31	11.79	16.08	89.45	27.28	375.40	38.68
Rice milling	2.01	5.51	7.51	41.78	12.74	175.36	18.07
Flour milling	2.40	6.58	8.97	49.89	15.22	209.37	21.57

Industry	Professional and technical	Administrative and managerial	Clarical	Sales and services	Agricultural	Production and related transport	Other
Food, beverages and tobacco	54.29	148.61	202.67	1127.07	343.76	4730.18	487.42
Textile, footwear and leather	66.78	171.36	174.49	215.28	16.52	4025.54	94.04
Garment	200.33	514.07	523.48	645.85	49.55	12076.61	282.11
Wood and wood products	0.00	9.10	4.96	8.37	32.89	480.27	23.41
Paper and paper products	235.64	0.00	150.79	317.63	0.00	1816.39	35.55
Chemicals and fertiliser	50.66	138.66	189.11	127.47	0.00	1224.42	142.68
Petroleum	85.86	0.00	64.10	108.02	0.00	193.03	0.00
Plastic and rubber products	85.44	233.87	318.95	214.99	0.00	2065.10	240.65
Other manufacturing	1449.53	233.78	1006.88	2535.92	3285.17	3403.44	620.28
Electricity, gas and water	427.96	175.70	319.50	215.36	33.87	3078.94	150.66
Construction	0.00	0.00	17251.41	12113.04	0.00	19482.04	4067.50
Hotels and restaurants	27.77	10.36	47.11	2178.56	15.98	73.78	20.44
Tourist and travel	20.55	7.67	34.87	1612.35	11.83	54.60	15.13
Trade and transport	4910.12	4319.86	7069.70	9927.96	277.57	93834.60	8149.19
Post and communications	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Banking	4231.07	12159.98	40116.92	10380.03	167.43	3091.62	148.96
Owner dwelling	3917.77	181.88	1313.63	1591.70	27.35	785.81	860.87
Public administration and defence	28307.77	2905.56	22190.56	12464.85	0.00	6364.40	1494.87
Other personal services	5637.63	261.72	1890.30	2290.44	39.35	1130.78	1238.78

Source: Authors' calculations based on Amerasinghe and Bandara (2005)

## Appendix A.5

**Table A.5: Household consumption shares by household groups**

Commodity	Western	Central	Southern	Sabara- gamuwa	North Western	Uva	North Central	Northern	Eastern
Tea growing	0	0	0	0	0	0	0	0	0
Rubber growing	0	0	0	0	0	0	0	0	0
Coconut growing	0.107	0.106	0.116	0.117	0.111	0.090	0.120	0.133	0.100
Paddy	0.020	0.053	0.086	0.083	0.139	0.165	0.306	0.031	0.115
Vegetables	0.126	0.114	0.098	0.109	0.124	0.104	0.121	0.102	0.103
Fruit	0.181	0.101	0.109	0.085	0.113	0.088	0.108	0.109	0.105
Highland crops	0.127	0.100	0.123	0.107	0.109	0.099	0.134	0.111	0.090
Potatoes	0.110	0.097	0.094	0.092	0.122	0.099	0.113	0.167	0.106
Minor export crops	0.164	0.075	0.149	0.078	0.144	0.100	0.163	0.042	0.084
Tobacco	0.031	0.095	0.135	0.141	0.123	0.120	0.139	0.101	0.115
Betel	0.027	0.106	0.094	0.116	0.135	0.128	0.142	0.107	0.146
Miscellaneous agricultural crops	0.121	0.097	0.085	0.095	0.177	0.103	0.102	0.094	0.126
Plantation development	0	0	0	0	0	0	0	0	0
Firewood	0.093	0.100	0.085	0.090	0.118	0.087	0.087	0.203	0.137
Forestry	0	0	0	0	0	0	0	0	0
Livestock and fisheries	0.170	0.056	0.112	0.046	0.122	0.040	0.101	0.177	0.176
Tea processing	0.131	0.117	0.109	0.110	0.110	0.112	0.101	0.105	0.104
Rubber processing	0	0	0	0	0	0	0	0	0
Coconut processing	0.113	0.133	0.074	0.107	0.117	0.150	0.138	0.070	0.097
Rice milling	0.121	0.124	0.116	0.139	0.112	0.104	0.075	0.110	0.101
Flour milling	0.041	0.183	0.030	0.065	0.061	0.135	0.063	0.355	0.066
Food, beverages and tobacco	0.175	0.115	0.108	0.093	0.125	0.089	0.101	0.075	0.120
Textile, footwear and leather	0.183	0.113	0.104	0.085	0.134	0.096	0.120	0.070	0.096

Commodity	Western	Central	Southern	Sabara- gamuwa	North Western	Uva	North Central	Northern	Eastern
Garments	0.171	0.127	0.088	0.098	0.118	0.082	0.100	0.074	0.142
Wood and wood products	0.286	0.129	0.121	0.096	0.115	0.063	0.059	0.055	0.076
Paper and paper products	0.187	0.113	0.101	0.111	0.119	0.110	0.079	0.090	0.090
Chemicals and fertiliser	0.162	0.103	0.101	0.093	0.074	0.093	0.119	0.133	0.123
Petroleum	0.203	0.077	0.083	0.069	0.160	0.061	0.112	0.141	0.094
Plastic and rubber products	0.152	0.117	0.108	0.079	0.155	0.107	0.103	0.082	0.097
Other manufacturing	0.184	0.064	0.105	0.077	0.217	0.074	0.107	0.101	0.071
Electricity, gas and water	0.318	0.105	0.102	0.075	0.101	0.064	0.085	0.085	0.065
Construction	0.286	0.129	0.121	0.096	0.115	0.063	0.059	0.055	0.076
Hotels and restaurants	0.403	0.061	0.057	0.042	0.073	0.033	0.060	0.120	0.150
Tourist and travel	0.286	0.129	0.121	0.096	0.115	0.063	0.059	0.055	0.076
Trade and transport	0.216	0.118	0.117	0.113	0.113	0.081	0.092	0.060	0.089
Post and communications	0.281	0.104	0.090	0.064	0.129	0.059	0.077	0.121	0.075
Banking	0.295	0.075	0.132	0.058	0.130	0.041	0.112	0.071	0.085
Owner dwelling	0.318	0.121	0.094	0.083	0.106	0.074	0.084	0.057	0.063
Public administration and defence	0.158	0.079	0.104	0.053	0.225	0.040	0.140	0.019	0.182
Other personal services	0.268	0.103	0.073	0.092	0.022	0.089	0.108	0.132	0.114

Source: CBSL (2005b)

## Appendix A.6

**Table A.6: Gross operating surplus shares by industry**

Industry	Capital	Land
Tea growing	0.290	0.710
Rubber growing	0.290	0.710
Coconut growing	0.290	0.710
Paddy	0.397	0.603
Vegetables	0.290	0.710
Fruit	0.290	0.710
Highland crops	0.290	0.710
Potatoes	0.290	0.710
Minor export crops	0.290	0.710
Tobacco	0.290	0.710
Betel	0.290	0.710
Miscellaneous agricultural crops	0.290	0.710
Plantation development	0.290	0.710
Firewood	0.869	0.131
Forestry	0.869	0.131
Livestock and fisheries	0.619	0.381
Tea processing	1	0
Rubber processing	1	0
Coconut processing	1	0
Rice milling	1	0
Flour milling	1	0
Food, beverages and tobacco	1	0
Textile, footwear and leather	1	0
Garments	1	0
Wood and wood products	1	0
Paper and paper products	1	0
Chemicals and fertiliser	1	0
Petroleum	1	0
Plastic and rubber products	1	0
Other manufacturing	1	0
Electricity, gas and water	1	0
Construction	1	0
Hotels and restaurants	1	0
Tourist and travel	1	0
Trade and transport	1	0
Post and communications	1	0
Banking	1	0
Owner dwelling	0	0
Public administration and defence	0	0
Other personal services	1	0

Source: Authors' calculations based on Narayan and Wamsley (2008)

## Appendix A.7

**Table A.7: Estimated expenditure elasticities used in previous studies**

Commodities	Expenditure elasticities		
	Urban sector	Rural sector	Estate sector
Tea growing			
Rubber growing	-	-	-
Coconut growing	0.36	0.62	0.63
Paddy	-	-	-
Mexcrop	0.36	0.62	0.63
Tobacco	0.36	0.62	0.63
Other-agri	0.36	0.62	0.63
Livestock	0.36	0.62	0.63
Firewood	0.36	0.62	0.63
Forestry	0.36	0.62	0.63
Fishing	0.36	0.62	0.63
Mining	-	-	-
Tea processing	0.36	0.62	0.63
Rubber processing	-	-	-
Coconut processing	0.36	0.62	0.63
Milling	0.36	0.62	0.63
Food, beverages and other	0.36	0.62	0.63
Textiles	0.57	1.9	2.47
Garments	0.57	1.9	2.47
Wood	2.53	2.38	0.47
Paper	2.53	2.38	0.47
Chemicals and fertiliser	2.53	2.38	0.47
Petroleum	2.53	2.38	0.47
Rubber products	2.53	2.38	0.47
Non-metallic mineral products	2.53	2.38	0.47
Basic metal products	-	-	-
Fabricated metal products	2.53	2.38	0.47
Other manufacturing industry	2.53	2.38	0.47
Electricity and water	0.35	0.45	0.48
Construction	-	-	-
Wholesale and retail trade	0.69	0.94	1.02
Hotels and restaurants	0.69	0.94	1.02
Transport	0.69	0.94	1.02
Communication	0.69	0.94	1.02
Banking and insurance	0.69	0.94	1.02
Ownership of dwelling	0.69	0.94	1.02
Public administration and defence	-	-	-
Other services	0.69	0.94	1.02

Source: Naranpanawa (2005)

## Appendix A.8

**Table A.8: Estimates of expenditure elasticities for 40 commodities**

Commodity	Western	Central	Southern	Sabara- gamuwa	North Western	Uva	North Central	Northern	Eastern
Tea Growing	0.36	0.622	0.622	0.631	0.622	0.631	0.622	0.622	0.631
Rubber Growing	0.36	0.622	0.622	0.631	0.622	0.631	0.622	0.622	0.631
Coconut and Toddy	0.36	0.622	0.622	0.631	0.622	0.631	0.622	0.622	0.631
Paddy	0.36	0.622	0.622	0.631	0.622	0.631	0.622	0.622	0.631
Vegetables	0.36	0.622	0.622	0.631	0.622	0.631	0.622	0.622	0.631
Fruit	0.36	0.622	0.622	0.631	0.622	0.631	0.622	0.622	0.631
Highland Crops	0.36	0.622	0.622	0.631	0.622	0.631	0.622	0.622	0.631
Potatoes	0.36	0.622	0.622	0.631	0.622	0.631	0.622	0.622	0.631
Minor Export Crops	0.36	0.622	0.622	0.631	0.622	0.631	0.622	0.622	0.631
Tobacco	0.36	0.622	0.622	0.631	0.622	0.631	0.622	0.622	0.631
Betel and Areca Nuts	0.36	0.622	0.622	0.631	0.622	0.631	0.622	0.622	0.631
Miscellaneous Agriculture Products	0.36	0.622	0.622	0.631	0.622	0.631	0.622	0.622	0.631
Plantation Development	0.36	0.622	0.622	0.631	0.622	0.631	0.622	0.622	0.631
Firewood	0.56	0.467	0.467	0.482	0.467	0.482	0.467	0.467	0.482
Forestry	0.36	0.622	0.622	0.631	0.622	0.631	0.622	0.622	0.631
Livestock and Fisheries	0.36	0.622	0.622	0.631	0.622	0.631	0.622	0.622	0.631
Tea Processing	0.36	0.622	0.622	0.631	0.622	0.631	0.622	0.622	0.631
Rubber Processing	2.53	2.38	2.38	0.47	2.38	0.47	2.38	2.38	0.47
Coconut Processing	0.36	0.622	0.622	0.631	0.622	0.631	0.622	0.622	0.631
Rice Milling	0.36	0.622	0.622	0.631	0.622	0.631	0.622	0.622	0.631
Flour Milling	0.36	0.622	0.622	0.631	0.622	0.631	0.622	0.622	0.631
Food, Beverages and Other	0.36	0.622	0.622	0.631	0.622	0.631	0.622	0.622	0.631

Commodity	Western	Central	Southern	Sabara- gamuwa	North Western	Uva	North Central	Northern	Eastern
Textiles, Footwear and Leather Products	1.242	1.049	1.049	2.47	1.049	2.47	1.049	1.049	2.47
Garment Industry	1.242	1.049	1.049	2.47	1.049	2.47	1.049	1.049	2.47
Wood and Wood Products	2.53	2.38	2.38	0.47	2.38	0.47	2.38	2.38	0.47
Paper and Paper Products	2.53	2.38	2.38	0.47	2.38	0.47	2.38	2.38	0.47
Chemicals and Fertilizer	2.53	2.38	2.38	0.47	2.38	0.47	2.38	2.38	0.47
Petroleum Industry	0.56	0.467	0.467	0.482	0.467	0.482	0.467	0.467	0.482
Plastic and Rubber Products	2.53	2.38	2.38	0.47	2.38	0.47	2.38	2.38	0.47
Other Manufacturing	2.53	2.38	2.38	0.47	2.38	0.47	2.38	2.38	0.47
Electricity, Gas and Water	0.56	0.467	0.467	0.482	0.467	0.482	0.467	0.467	0.482
Construction	0.93	1.03	1.03	1.02	1.03	1.02	1.03	1.03	1.02
Hotels and Restaurants	0.93	1.03	1.03	1.02	1.03	1.02	1.03	1.03	1.02
Tourist Shops and Travel Agents	0.93	1.03	1.03	1.02	1.03	1.02	1.03	1.03	1.02
Trade and Transport	0.93	1.03	1.03	1.02	1.03	1.02	1.03	1.03	1.02
Post and Communications	0.93	1.03	1.03	1.02	1.03	1.02	1.03	1.03	1.02
Banking, Insurance and Real Estate	0.93	1.03	1.03	1.02	1.03	1.02	1.03	1.03	1.02
Ownership of Dwellings	1.312	0.76	0.76	0.427	0.76	0.427	0.76	0.76	0.427
Public Administration and Defence	0.93	1.03	1.03	1.02	1.03	1.02	1.03	1.03	1.02
Other Personal Services	0.93	1.03	1.03	1.02	1.03	1.02	1.03	1.03	1.02

Source: Authors' calculations based on Naranpanawa (2005)

## Appendix A.9

**Table A.9: Regional industry output/industry investment/commodity export shares**

Industry	Western	Central	Southern	Sabara- gamuwa	North Western	Uva	North Central	Northern	Eastern
Tea Growing	0.0345	0.3667	0.234	0.2163	0.0002	0.1484	0	0	0
Rubber Growing	0.3433	0.0269	0.09	0.4956	0.0245	0.0197	0	0	0
Coconut and Toddy	0.1572	0.049	0.1215	0.0738	0.4578	0.0342	0.0529	0.0262	0.0273
Paddy	0.0413	0.0677	0.1166	0.064	0.1341	0.0645	0.2447	0.0291	0.238
Vegetables	0.0262	0.3345	0.0777	0.058	0.0721	0.2684	0.0605	0.0284	0.0741
Fruit	0.1276	0.1102	0.0824	0.0858	0.3081	0.1312	0.0927	0.0092	0.0529
Highland Crops	0.1158	0.1628	0.1665	0.0906	0.1512	0.1178	0.0839	0.0248	0.0867
Potatoes	0	0.1145	0	0	0	0.8735	0	0.0119	0.0001
Minor Export Crops	0.0915	0.2801	0.1938	0.209	0.1168	0.1013	0.0026	0.0014	0.0036
Tobacco	0	0.3866	0	0.0091	0.0973	0.1504	0.2149	0.1203	0.0215
Betel and Areca Nuts	0.1306	0.1239	0.1183	0.3591	0.0409	0.2218	0.0014	0.0023	0.0016
Miscellaneous Agriculture Products	0.1158	0.1628	0.1665	0.0906	0.1512	0.1178	0.0839	0.0248	0.0867
Plantation Development	0.1158	0.1628	0.1665	0.0906	0.1512	0.1178	0.0839	0.0248	0.0867
Firewood	0.1158	0.1628	0.1665	0.0906	0.1512	0.1178	0.0839	0.0248	0.0867
Forestry	0.1158	0.1628	0.1665	0.0906	0.1512	0.1178	0.0839	0.0248	0.0867
Livestock and Fisheries	0.2279	0.0358	0.2408	0.0134	0.2536	0.0179	0.0465	0.0473	0.117
Tea Processing	0.1298	0.1869	0.2235	0.3087	0.0635	0.0644	0.0046	0.0122	0.0063
Rubber Processing	0.1298	0.1869	0.2235	0.3087	0.0635	0.0644	0.0046	0.0122	0.0063
Coconut Processing	0.1298	0.1869	0.2235	0.3087	0.0635	0.0644	0.0046	0.0122	0.0063
Rice Milling	0.3076	0.0991	0.0745	0.0232	0.2427	0.0324	0.1285	0.0174	0.0745
Flour Milling	0.3076	0.0991	0.0745	0.0232	0.2427	0.0324	0.1285	0.0174	0.0745
Food, Beverages and Other	0.7097	0.071	0.0714	0.0425	0.0218	0.0284	0.0417	0.0035	0.0101

Industry	Western	Central	Southern	Sabara- gamuwa	North Western	Uva	North Central	Northern	Eastern
Textiles, Footwear and Leather Products	0.6398	0.0965	0.0698	0.0335	0.1152	0.0113	0.0133	0.0002	0.0205
Garment Industry	0.977	0.0003	0.0004	0.0005	0.0217	0	0	0	0.0001
Wood and Wood Products	0.4161	0.0835	0.0477	0.1349	0.1992	0.058	0.0331	0.0038	0.0236
Paper and Paper Products	0.9822	0.0084	0.0016	0.0013	0.0021	0.0001	0.0001	0.0032	0.001
Chemicals and Fertiliser	0.9873	0.0023	0.0082	0.0013	0.0001	0.0002	0	0.0005	0.0001
Petroleum Industry	1	0	0	0	0	0	0	0	0
Plastic and Rubber Products	0.7523	0.0241	0.0986	0.0974	0.0241	0.0007	0.0028	0	0.0001
Other Manufacturing	0.8057	0.0665	0.0094	0.0188	0.085	0.0049	0.0061	0.0008	0.0028
Electricity, Gas and Water	0.85	0.0011	0.001	0.0059	0.1397	0.0022	0	0	0
Construction	0.529	0.0787	0.1074	0.0354	0.0487	0.0982	0.0322	0.0332	0.0372
Hotels and Restaurants	0.4297	0.1437	0.3434	0.0036	0.0495	0.0036	0.022	0	0.0043
Tourist Shops and Travel Agents	0.4297	0.1437	0.3434	0.0036	0.0495	0.0036	0.022	0	0.0043
Trade and Transport	0.6075	0.0774	0.0841	0.0588	0.0754	0.0324	0.0263	0.0132	0.025
Post and Communications	0.5796	0.0886	0.0873	0.0469	0.0933	0.0304	0.0322	0.0097	0.032
Banking, Insurance and Real Estate	0.7276	0.0601	0.089	0.0293	0.0546	0.0203	0.0172	0.0019	0
Ownership of Dwellings	0.2862	0.1289	0.1216	0.0955	0.1152	0.0625	0.059	0.0556	0.0756
Public Administration and Defence	0.2152	0.101	0.0972	0.0661	0.0918	0.0509	0.0654	0.2002	0.1123
Other Personal Services	0.5721	0.0954	0.0765	0.0456	0.0572	0.0443	0.0376	0.0364	0.0349
Total	15.2604	4.74	4.5851	3.7305	4.1814	3.3303	1.8175	0.8337	1.5214

Source: Authors' calculations

## Appendix A.10

**Table A.10: Regional commodity consumption shares**

Commodity	Western	Central	Southern	Sabara- gamuwa	North Western	Uva	North Central	Northern	Eastern
Tea Growing	0.1067	0.1061	0.1157	0.1172	0.1112	0.0898	0.1197	0.1331	0.1004
Rubber Growing	0.1067	0.1061	0.1157	0.1172	0.1112	0.0898	0.1197	0.1331	0.1004
Coconut and Toddy	0.1067	0.1061	0.1157	0.1172	0.1112	0.0898	0.1197	0.1331	0.1004
Paddy	0.0203	0.0526	0.0864	0.0834	0.1395	0.1654	0.3063	0.031	0.1151
Vegetables	0.1259	0.1138	0.0979	0.1087	0.1241	0.1038	0.1209	0.1019	0.1031
Fruit	0.1813	0.1009	0.1088	0.0849	0.1134	0.0884	0.1082	0.1089	0.1053
Highland Crops	0.1266	0.1003	0.123	0.1074	0.1095	0.0987	0.1336	0.1106	0.0902
Potatoes	0.11	0.0973	0.0945	0.0916	0.1225	0.0993	0.1126	0.1667	0.1055
Minor Export Crops	0.1636	0.0754	0.1492	0.0785	0.1441	0.1005	0.1629	0.042	0.0838
Tobacco	0.0312	0.0951	0.1347	0.141	0.1231	0.12	0.1392	0.1012	0.1146
Betel and Areca Nuts	0.0267	0.1059	0.0939	0.1159	0.1348	0.1275	0.1418	0.1071	0.1464
Miscellaneous Agriculture Products	0.1212	0.0973	0.0846	0.0949	0.1772	0.1031	0.102	0.0938	0.1259
Plantation Development	0.1112	0.2263	0.1592	0.1035	0.1264	0.1557	0.0499	0.0234	0.0445
Firewood	0.0931	0.0996	0.0849	0.0899	0.1179	0.0875	0.087	0.2032	0.1368
Forestry	0.0207	0.1739	0.0438	0.0515	0.2594	0.2722	0.1016	0.0055	0.0716
Livestock and Fisheries	0.1697	0.0559	0.1125	0.0465	0.1222	0.04	0.101	0.1766	0.1757
Tea Processing	0.1314	0.1172	0.1094	0.1102	0.1102	0.1121	0.1008	0.1047	0.1041
Rubber Processing	0.1314	0.1172	0.1094	0.1102	0.1102	0.1121	0.1008	0.1047	0.1041
Coconut Processing	0.1129	0.1332	0.0745	0.1067	0.117	0.1502	0.1384	0.07	0.097
Rice Milling	0.1208	0.1236	0.1157	0.1392	0.1125	0.1036	0.0747	0.1095	0.1005
Flour Milling	0.0413	0.1831	0.0302	0.0655	0.0608	0.1351	0.0633	0.3551	0.0656
Food, Beverages and Other	0.1746	0.1152	0.1076	0.0929	0.1251	0.0894	0.1006	0.0749	0.1198

Commodity	Western	Central	Southern	Sabara- gamuwa	North Western	Uva	North Central	Northern	Eastern
Textiles, Footwear and Leather Products	0.1827	0.1129	0.1041	0.085	0.1337	0.096	0.1198	0.0697	0.0962
Garment Industry	0.171	0.127	0.0876	0.0984	0.1184	0.0816	0.1002	0.0739	0.142
Wood and Wood Products	0.4915	0.1437	0.1119	0.0694	0.096	0.0354	0.0346	0.0024	0.0151
Paper and Paper Products	0.1867	0.1133	0.1006	0.1112	0.1193	0.1101	0.0785	0.0901	0.0902
Chemicals and Fertiliser	0.1616	0.1026	0.1014	0.0932	0.0735	0.0933	0.119	0.1326	0.1229
Petroleum Industry	0.2031	0.0766	0.0832	0.0687	0.1605	0.061	0.1121	0.1411	0.0938
Plastic and Rubber Products	0.1521	0.1165	0.1082	0.0789	0.1548	0.1071	0.1032	0.0819	0.0974
Other Manufacturing	0.1836	0.0639	0.105	0.0775	0.217	0.0735	0.1071	0.1011	0.0713
Electricity, Gas and Water	0.3176	0.1054	0.1022	0.075	0.1006	0.064	0.0852	0.0852	0.0648
Construction	0.4781	0.2021	0.1059	0.0286	0.0523	0.0267	0.0346	0.027	0.0447
Hotels and Restaurants	0.4297	0.1437	0.3434	0.0036	0.0495	0.0036	0.022	0	0.0043
Tourist Shops and Travel Agents	0.4297	0.1437	0.3434	0.0036	0.0495	0.0036	0.022	0	0.0043
Post and Communications	0.2807	0.104	0.0902	0.064	0.1295	0.0591	0.077	0.1209	0.0746
Banking, Insurance and Real Estate	0.2947	0.0753	0.1324	0.0578	0.1298	0.0412	0.1123	0.0713	0.0852
Ownership of Dwellings	0.3181	0.1207	0.0943	0.0831	0.1064	0.0737	0.0839	0.0568	0.063
Public Administration and Defence	0.1578	0.0787	0.1039	0.0532	0.2249	0.04	0.1403	0.0192	0.1821
Other Personal Services	0.6237	0.1032	0.073	0.0515	0.0491	0.0493	0.0408	0.0012	0.0082

Source: Authors' calculations based on CBSL (2005)

## Appendix A.11

**Table A.11: Regional government expenditure shares**

Industry	Western	Central	Southern	Sabara- gamuwa	North Western	Uva	North Central	Northern	Eastern
Tea Growing	0.0306	0.3087	0.3056	0.2632	0	0.092	0	0	0
Rubber Growing	0.3597	0.0301	0.1001	0.4799	0.0201	0.01	0	0	0
Coconut and Toddy	0.2075	0.0349	0.1494	0.0672	0.4197	0.0093	0.0181	0.0798	0.014
Paddy	0.0345	0.0497	0.0909	0.0462	0.114	0.0469	0.329	0.0261	0.2627
Vegetables	0.0258	0.2438	0.0493	0.0513	0.0552	0.4178	0.0675	0.0543	0.035
Fruit	0.0258	0.2438	0.0493	0.0513	0.0552	0.4178	0.0675	0.0543	0.035
Highland Crops	0.0258	0.2438	0.0493	0.0513	0.0552	0.4178	0.0675	0.0543	0.035
Potatoes	0.0258	0.2438	0.0493	0.0513	0.0552	0.4178	0.0675	0.0543	0.035
Minor Export Crops	0.0677	0.1276	0.6365	0.1466	0.0131	0.0081	0.0004	0	0
Tobacco	0.1112	0.2263	0.1592	0.1035	0.1264	0.1557	0.0499	0.0234	0.0445
Betel and Areca Nuts	0.1112	0.2263	0.1592	0.1035	0.1264	0.1557	0.0499	0.0234	0.0445
Miscellaneous Agriculture Products	0.1112	0.2263	0.1592	0.1035	0.1264	0.1557	0.0499	0.0234	0.0445
Plantation Development	0.1444	0.1508	0.2039	0.2542	0.137	0.0573	0.0105	0.0276	0.0144
Firewood	0.0207	0.1739	0.0438	0.0515	0.2594	0.2722	0.1016	0.0055	0.0716
Forestry	0.0207	0.1739	0.0438	0.0515	0.2594	0.2722	0.1016	0.0055	0.0716
Livestock and Fisheries	0.269	0.0011	0.2985	0.0003	0.2059	0.0083	0.0225	0.0325	0.1618
Tea Processing	0.2352	0.1603	0.1672	0.1758	0.2111	0.0478	0.0004	0.0018	0.0003
Rubber Processing	0.2352	0.1603	0.1672	0.1758	0.2111	0.0478	0.0004	0.0018	0.0003
Coconut Processing	0.2352	0.1603	0.1672	0.1758	0.2111	0.0478	0.0004	0.0018	0.0003
Rice Milling	0.6584	0.027	0.0433	0.0245	0.1688	0.0031	0.003	0.0002	0.0717
Flour Milling	0.6584	0.027	0.0433	0.0245	0.1688	0.0031	0.003	0.0002	0.0717
Food, Beverages and Other	0.6584	0.027	0.0433	0.0245	0.1688	0.0031	0.003	0.0002	0.0717
Textiles, Footwear and Leather Products	0.6584	0.027	0.0433	0.0245	0.1688	0.0031	0.003	0.0002	0.0717

Industry	Western	Central	Southern	Sabara- gamuwa	North Western	Uva	North Central	Northern	Eastern
Garment Industry	0.6584	0.027	0.0433	0.0245	0.1688	0.0031	0.003	0.0002	0.0717
Wood and Wood Products	0.4915	0.1437	0.1119	0.0694	0.096	0.0354	0.0346	0.0024	0.0151
Paper and Paper Products	0.4915	0.1437	0.1119	0.0694	0.096	0.0354	0.0346	0.0024	0.0151
Chemicals and Fertiliser	0.6584	0.027	0.0433	0.0245	0.1688	0.0031	0.003	0.0002	0.0717
Petroleum Industry	0.6584	0.027	0.0433	0.0245	0.1688	0.0031	0.003	0.0002	0.0717
Plastic and Rubber Products	0.6584	0.027	0.0433	0.0245	0.1688	0.0031	0.003	0.0002	0.0717
Other Manufacturing	0.6584	0.027	0.0433	0.0245	0.1688	0.0031	0.003	0.0002	0.0717
Electricity, Gas and Water	0.6996	0.0685	0.0567	0.041	0.0653	0.0212	0.0239	0.0064	0.0174
Construction	0.4781	0.2021	0.1059	0.0286	0.0523	0.0267	0.0346	0.027	0.0447
Hotels and Restaurants	0.4297	0.1437	0.3434	0.0036	0.0495	0.0036	0.022	0	0.0043
Tourist Shops and Travel Agents	0.4297	0.1437	0.3434	0.0036	0.0495	0.0036	0.022	0	0.0043
Trade and Transport	0.6075	0.0774	0.0841	0.0588	0.0754	0.0324	0.0263	0.0132	0.025
Post and Communications	0.5796	0.0886	0.0873	0.0469	0.0933	0.0304	0.0322	0.0097	0.032
Banking, Insurance and Real Estate	0.7276	0.0601	0.089	0.0293	0.0546	0.0203	0.0172	0.0019	0
Ownership of Dwellings	0.2862	0.1289	0.1216	0.0955	0.1152	0.0625	0.059	0.0556	0.0756
Public Administration and Defence	0.2152	0.101	0.0972	0.0661	0.0918	0.0509	0.0654	0.2002	0.1123
Other Personal Services	0.5721	0.0954	0.0765	0.0456	0.0572	0.0443	0.0376	0.0364	0.0349

Source: Authors' calculations

## Appendix B.1

**Table B.1: Fan decomposition of simulation I**

Industry	Short-run				Long-run			
	Local Market	Domestic Share	Export	Total	Local Market	Domestic Share	Export	Total
Tea Growing	4.19	163.58	0	167.77	4.40	171.68	0	176.08
Rubber Growing	0.82	32.17	0	33.00	0.85	33.26	0	34.11
Coconut and Toddy	0.74	30.97	0.06	31.77	2.68	105.80	0.03	108.51
Paddy	0.40	15.50	0	15.89	0.67	26.15	0	26.82
Vegetables	1.45	57.38	0.02	58.85	1.38	54.11	0.01	55.50
Fruit	0.30	20.70	0.29	21.29	0.65	31.54	0.17	32.36
Highland Crops	0.67	43.63	0.24	44.53	0.87	44.70	0.14	45.71
Potatoes	-0.06	-0.65	0	-0.71	0.44	18.78	0	19.22
Minor Export Crops	0.05	366.55	9.15	375.75	0.10	412.60	10.26	422.96
Tobacco	0.16	24.72	0.49	25.37	0.44	14.38	0.29	15.11
Betel and Areca Nuts	-0.02	7.77	0.22	7.97	0.33	17.93	0.13	18.39
Miscellaneous Agriculture Products	0.33	12.75	0	13.07	0.67	25.43	0	26.09
Plantation Development	0.13	5.02	0	5.15	0.59	23.11	0	23.71
Firewood	0.08	3.23	0	3.31	0.43	16.79	0	17.22
Forestry	1.28	12.21	0.03	13.52	1.32	19.28	0.02	20.62
Livestock and Fisheries	0.16	21.49	0.38	22.04	0.38	22.96	0.22	23.56
Tea Processing	0.02	163.65	4.18	167.85	0.13	171.74	4.27	176.15
Rubber Processing	0.50	31.70	0.32	32.52	-0.11	31.90	0.93	32.72
Coconut Processing	0.00	9.41	0.24	9.66	0.70	651.14	16.14	667.98
Rice Milling	0.28	16.91	0	17.20	0.67	29.18	0	29.85
Flour Milling	-0.02	1.09	0	1.08	0.52	20.04	0	20.56

Industry	Short-run				Long-run			
	Local Market	Domestic Share	Export	Total	Local Market	Domestic Share	Export	Total
Food, Beverages and Other	-0.08	5.82	0.26	6.00	0.40	23.36	0.15	23.91
Textiles, Footwear and Leather Products	0.06	39.58	1.77	41.42	-0.27	45.06	1.03	45.83
Garment Industry	-0.07	12.96	0.38	13.27	0.25	-66.17	-1.87	-67.78
Wood and Wood Products	0.03	77.78	2.24	80.05	0.09	75.75	1.31	77.15
Paper and Paper Products	-0.01	3.80	0	3.79	0.87	31.71	0	32.57
Chemicals and Fertiliser	0.24	12.86	0.34	13.44	0.94	47.30	0.20	48.43
Petroleum Industry	0.12	9.94	0.21	10.28	0.43	18.87	0.12	19.41
Plastic and Rubber Products	0.06	33.73	1.12	34.91	0.19	37.96	0.65	38.80
Other Manufacturing	0.08	15.81	0.28	16.16	0.19	-18.37	-0.80	-18.97
Electricity, Gas and Water	0.41	15.89	0	16.29	1.08	42.09	0	43.17
Construction	0.23	9.00	0	9.23	0.49	19.00	0	19.49
Hotels and Restaurants	0.43	16.67	0	17.10	0.94	36.76	0	37.70
Tourist Shops and Travel Agents	-0.17	0.76	0.19	0.78	0.62	28.70	0.11	29.44
Trade and Transport	0.05	10.77	0.20	11.02	0.37	18.20	0.12	18.69
Post and Communications	-0.28	0.02	0.26	0.00	0.60	29.25	0.15	30.00
Banking, Insurance and Real Estate	0.12	20.33	0.40	20.85	0.42	25.24	0.23	25.89
Ownership of Dwellings	0.12	4.49	0	4.61	0.50	19.67	0	20.17
Public Administration and Defence	0.00	1.07	0.02	1.10	0.69	27.40	0.01	28.10
Other Personal Services	0.20	7.81	0	8.01	0.82	32.04	0	32.86

Source: Model simulations

## Appendix B.2

**Table B.2: Sales decomposition of simulation I**

Industry	Short-run							Long-run						
	Interme- diate	Invest- ment	House- hold	Export	Govt. demand	Stocks	Total	Interme- diate	Invest- ment	House- hold	Export	Govt. demand	Stocks	Total
Tea Growing	4.19	0	0	0	0	0	4.19	4.40	0	0	0	0.00	0	4.40
Rubber Growing	0.82	0	0	0	0	0	0.82	0.85	0	0	0	0.00	0	0.85
Coconut and Toddy	0.04	0	0.70	0.06	0	0	0.79	1.99	0	0.69	0.03	0	0	2.71
Paddy	0.35	0	0.05	0	0	0	0.40	0.61	0	0.06	0	0	0	0.67
Vegetables	0.05	0	1.40	0.02	0	0	1.47	0.09	0	1.27	0.01	0.02	0	1.39
Fruit	0.09	0	0.15	0.29	0	0	0.53	0.22	0	0.25	0.17	0.18	0	0.81
Highland Crops	0.05	0	0.82	0.24	0	0	1.11	0.08	0	0.92	0.14	0.00	0	1.14
Potatoes	0.05	0	-0.07	0	0	0	-0.02	0.19	0	0.29	0	0.00	0	0.48
Minor Export Crops	0.23	0	0.01	9.15	0	0	9.39	0.27	0	0.04	10.26	0	0	10.57
Tobacco	0.15	0	0.00	0.49	0	0	0.63	0.08	0	0.01	0.29	0	0	0.38
Betel and Areca Nuts	0.00	0	-0.02	0.22	0	0	0.20	0.00	0	0.33	0.13	0	0	0.46
Miscellaneous Agriculture Products	0.34	0	-0.02	0	0	0	0.33	0.50	0	0.11	0	0.04	0	0.65
Plantation Development	0.13	0	0	0	0	0	0.13	0.42	0.17	0	0	0.00	0	0.59
Firewood	0.07	0	0.01	0	0	0	0.08	0.23	0	0.20	0	0	0	0.43
Forestry	0.31	0	0	0.03	0	0	0.34	0.50	0	0	0.02	0	0	0.52
Livestock and Fisheries	0.07	0	0.10	0.38	0	0	0.55	0.03	0	0.31	0.22	0.02	0	0.59
Tea Processing	0.00	0	0.02	4.18	0	0	4.20	0.00	0	0.13	4.27	0.00	0	4.40
Rubber Processing	0.50	0	0	0.32	0	0	0.81	-0.11	0	0	0.93	0.00	0	0.82
Coconut Processing	0.04	0	-0.04	0.24	0	0	0.24	0.37	0.02	0.15	16.14	0.03	0	16.70
Rice Milling	0.01	0	0.42	0	0	0	0.43	0.04	0	0.65	0	0.05	0	0.75
Flour Milling	0.06	0	-0.03	0	0	0	0.03	0.24	0	0.26	0	0.01	0	0.51

Industry	Short run							Long run						
	Interme- diate	Invest- ment	House- hold	Export	Govt. demand	Stocks	Total	Interme- diate	Invest- ment	House- hold	Export	Govt. demand	Stocks	Total
Food, Beverages and Other	0.02	0	-0.13	0.26	0	0	0.15	0.06	0	0.38	0.15	0.01		0.60
Textiles, Footwear and Leather Products	-0.27	0	-0.47	1.77	0	0	1.04	-0.11	0	0.21	1.03	0.00	0	1.15
Garment Industry	0.00	0	-0.05	0.38	0	0	0.33	0.02	0	0.15	-1.87	0.00	0	-1.69
Wood and Wood Products	0.17	-0.14	-0.26	2.24	0	0	2.00	0.30	0.00	0.31	1.31	0.00	0	1.93
Paper and Paper Products	0.08	0.01	0.01	0	0	0	0.09	0.15	0.02	0.34	0	0.31	0	0.81
Chemicals and Fertiliser	0.32	-0.01	-0.31	0.34	0	0	0.34	0.51	0.00	0.46	0.20	0.03	0	1.21
Petroleum Industry	0.17	0	-0.13	0.21	0	0	0.26	0.25	0.01	0.10	0.12	0.01	0	0.49
Plastic and Rubber Products	0.03	-0.10	-0.18	1.12	0	0	0.87	0.20	0.00	0.09	0.65	0.03	0	0.97
Other Manufacturing	0.16	0.01	-0.04	0.28	0	0	0.40	0.19	0.00	0.12	-0.80	0.01	0	-0.47
Electricity, Gas and Water	0.46	0	-0.06	0	0	0	0.41	0.95	0.00	0.07	0	0.06	0	1.08
Construction	0.23	0	0.00	0	0	0	0.23	0.34	0.11	0.03	0	0.00	0	0.49
Hotels and Restaurants	0.01	0	0.41	0	0	0	0.43	0.06	0	0.82	0	0.06	0	0.94
Tourist Shops and Travel Agents	0	0	-0.17	0.19	0	0	0.02	0	0	0.62	0.11	0.00	0	0.74
Trade and Transport	0.11	0	-0.04	0.20	0	0	0.28	0.11	0.02	0.18	0.12	0.03	0	0.47
Post and Communications	0.02	0	-0.28	0.26	0	0	0	0.08	0.00	0.37	0.15	0.14	0	0.75
Banking, Insurance and Real Estate	0.12	0	0.00	0.40	0	0	0.52	0.24	0.05	0.09	0.23	0.04	0	0.65
Ownership of Dwellings	0	0	0.12	0	0	0	0.12	0	0	0.50	0	0	0	0.50
Public Administration and Defence	0.00	0	0.00	0.02	0	0	0.03	0.10	0.01	0.02	0.01	0.56	0	0.70
Other Personal Services	0.19	0	0.01	0	0	0	0.20	0.44	0	0.38	0	0	0	0.82

Source: Model simulations

### Appendix B.3

**Table B.3: Total supply of imports of simulation I (Percentage change)**

Commodity	Short-run	Long-run
Tea Growing	0	0
Rubber Growing	0	0
Coconut and Toddy	0.33	0.65
Paddy	0.15	0.60
Vegetables	1.20	1.29
Fruit	0.40	0.76
Highland Crops	0.54	0.85
Potatoes	-0.09	0.40
Minor Export Crops	0.17	0.62
Tobacco	0.21	0.64
Betel and Areca Nuts	0	0
Miscellaneous Agriculture Products	0.33	0.82
Plantation Development	0	0
Firewood	0	0
Forestry	2.00	1.93
Livestock and Fisheries	0.18	0.53
Tea Processing	0	0
Rubber Processing	0	0
Coconut Processing	0.24	16.70
Rice Milling	-16.67	-8.36
Flour Milling	-1.32	0.81
Food, Beverages and Other	0.02	0.28
Textiles, Footwear and Leather products	0.55	-1.26
Garment Industry	-0.20	1.11
Wood and Wood Products	2.03	1.25
Paper and Paper Products	-0.13	0.93
Chemicals and Fertiliser	0.44	1.05
Petroleum Industry	0.33	0.63
Plastic and Rubber Products	0.66	0.14
Other Manufacturing	0.11	0.25
Electricity, Gas and Water	-0.26	0.32
Construction	0	0
Hotels and Restaurants	0	0
Tourist Shops and Travel Agents	-0.19	0.68
Post and Communications	-0.15	0.66
Trade and transport	-0.51	0.67
Banking, Insurance and Real Estate	0.00	0.62
Ownership of Dwellings	0	0
Public Administration and Defence	0.00	0.63
Other Personal Services	0	0

Source: Model simulations

## Appendix B.4

**Table B.4: Detailed regional advantage matrix (short-run) for simulation I**

Industry	Western	Central	Southern	Sabara- gamuwa	North Western	Uva	North Central	Northern	Eastern
Tea Growing	-0.084	<b>0.280</b>	<b>0.135</b>	<b>0.257</b>	-0.089	<b>0.185</b>	-0.089	-0.089	-0.089
Rubber Growing	-0.001	-0.002	0.000	<b>0.020</b>	-0.002	-0.002	-0.003	-0.003	-0.003
Coconut and Toddy	-0.008	-0.005	<b>0.003</b>	<b>0.004</b>	0.052	-0.003	0.005	0.000	-0.003
Paddy	-0.010	-0.003	<b>0.003</b>	<b>0.002</b>	0.007	0.004	0.063	0.001	0.058
Vegetables	-0.045	0.131	-0.008	0.002	-0.006	0.215	0.032	0.004	0.046
Fruit	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.000	0.000
Highland Crops	-0.017	<b>0.018</b>	<b>0.017</b>	<b>0.013</b>	<b>0.018</b>	<b>0.031</b>	<b>0.028</b>	-0.001	<b>0.028</b>
Potatoes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Minor Export Crops	-0.036	<b>0.095</b>	<b>0.047</b>	<b>0.120</b>	<b>0.019</b>	<b>0.048</b>	-0.041	-0.042	-0.040
Tobacco	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.001	0.000
Betel and Areca Nuts	0.000	0.000	0.000	0.002	0.000	0.001	0.000	0.000	0.000
Miscellaneous Agriculture Products	-0.001	<b>0.001</b>	<b>0.001</b>	<b>0.001</b>	<b>0.001</b>	<b>0.002</b>	<b>0.002</b>	0.000	0.002
Plantation Development	0.000	0.001	0.000	0.000	0.001	0.001	0.001	0.000	0.001
Firewood	-0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001
Forestry	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Livestock and Fisheries	-0.011	-0.012	0.031	-0.015	0.041	-0.012	0.006	0.016	0.042
Tea Processing	-0.014	<b>0.021</b>	<b>0.026</b>	<b>0.085</b>	-0.004	<b>0.006</b>	-0.016	-0.010	-0.016
Rubber Processing	0.000	0.000	<b>0.001</b>	<b>0.002</b>	0.000	0.000	0.000	0.000	0.000
Coconut Processing	-0.001	<b>0.002</b>	<b>0.002</b>	<b>0.006</b>	0.000	0.000	-0.001	-0.001	-0.001
Rice Milling	-0.001	0.000	0.000	-0.001	0.003	0.000	0.004	0.000	0.001
Flour Milling	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Food, Beverages and Other	0.004	-0.002	-0.003	-0.003	-0.008	-0.005	0.002	-0.010	-0.008
Textiles, Footwear and Leather Products	0.003	0.001	-0.004	-0.007	0.007	-0.013	-0.010	-0.016	-0.007
Garment Industry	0.014	-0.016	-0.016	-0.016	-0.012	-0.016	-0.016	-0.016	-0.016

Industry	Western	Central	Southern	Sabara- gamuwa	North Western	Uva	North Central	Northern	Eastern
Wood and Wood Products	-0.001	0.000	-0.001	0.004	0.004	0.001	0.000	-0.002	-0.001
Paper and Paper Products	0.000	0.000	-0.001	-0.001	-0.001	-0.001	-0.001	0.000	-0.001
Chemicals and Fertiliser	0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003
Petroleum Industry	0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Plastic and Rubber Products	0.005	-0.009	0.001	0.010	-0.009	-0.013	-0.012	-0.013	-0.013
Other Manufacturing	0.007	-0.003	-0.012	-0.009	0.001	-0.012	-0.011	-0.013	-0.013
Electricity, Gas and Water	0.007	-0.008	-0.008	-0.006	-0.006	-0.008	-0.008	-0.008	-0.008
Construction	0.034	-0.022	0.017	0.043	-0.040	-0.165	-0.088	-0.055	-0.116
Hotels and Restaurants	0.000	0.001	0.004	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Tourist Shops and Travel Agents	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Post and Communications	0.140	-0.173	-0.071	0.043	-0.217	-0.302	-0.269	-0.116	-0.251
Trade and Transport	0.005	-0.006	-0.002	0.000	-0.009	-0.009	-0.011	-0.002	-0.010
Banking, Insurance and Real Estate	0.043	-0.051	-0.023	-0.021	-0.067	-0.079	-0.080	-0.047	-0.045
Ownership of Dwellings	0.005	-0.006	0.001	0.007	-0.008	-0.015	-0.014	0.001	-0.015
Public Administration and Defence	-0.002	0.000	0.000	0.001	0.000	0.000	0.003	0.021	0.006
Other Personal Services	0.007	-0.012	-0.002	0.004	-0.009	-0.021	-0.021	-0.003	-0.007
<b>Total contributions</b>	<b>0.044</b>	<b>0.216</b>	<b>0.135</b>	<b>0.541</b>	<b>-0.336</b>	<b>-0.186</b>	<b>-0.550</b>	<b>-0.412</b>	<b>-0.483</b>

Source: Model simulations

## Appendix B.5

**Table B.5: Detailed regional advantage matrix (long-run) for simulation I**

Industry	Western	Central	Southern	Sabara- gamuwa	North Western	Uva	North Central	Northern	Eastern
Tea Growing	-0.08	0.28	0.13	0.26	-0.09	0.18	-0.09	-0.09	-0.09
Rubber Growing	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
Coconut and Toddy	-0.03	-0.02	0.01	0.01	<b>0.16</b>	-0.01	0.02	0.00	-0.01
Paddy	-0.01	0.00	0.00	0.00	<b>0.01</b>	0.00	0.07	0.00	0.06
Vegetables	-0.04	0.11	-0.01	0.00	0.00	0.17	0.03	0.00	0.04
Fruit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Highland Crops	-0.01	0.02	0.01	0.01	<b>0.02</b>	0.03	0.02	0.00	0.02
Potatoes	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Minor Export Crops	-0.04	0.10	0.05	0.13	<b>0.02</b>	0.05	-0.04	-0.05	-0.04
Tobacco	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Betel and Areca Nuts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Miscellaneous Agriculture Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Plantation Development	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Firewood	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Forestry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Livestock and Fisheries	-0.01	-0.01	0.02	-0.01	0.03	-0.01	0.00	0.01	0.03
Tea Processing	-0.01	0.02	0.02	0.08	0.00	0.01	-0.02	-0.01	-0.01
Rubber Processing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coconut Processing	-0.07	0.10	0.12	0.40	-0.02	0.03	-0.08	-0.05	-0.07
Rice Milling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Flour Milling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Food, Beverages and Other	0.01	-0.01	-0.01	-0.01	-0.02	-0.01	0.00	-0.02	-0.02
Textiles, Footwear and Leather Products	0.00	0.00	0.00	-0.01	0.01	-0.01	-0.01	-0.01	-0.01

Industry	Western	Central	Southern	Sabara- gamuwa	North Western	Uva	North Central	Northern	Eastern
Garment Industry	-0.07	0.09	0.09	0.09	<b>0.06</b>	0.09	0.09	0.09	0.09
Wood and Wood Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paper and Paper Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chemicals and Fertiliser	0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Petroleum Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Plastic and Rubber Products	0.00	-0.01	0.00	0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Other Manufacturing	-0.01	0.01	0.02	0.01	0.00	0.02	0.02	0.02	0.02
Electricity, Gas and Water	0.01	-0.02	-0.02	-0.02	0.01	-0.02	-0.02	-0.02	-0.02
Construction	-0.01	0.02	0.05	0.05	-0.01	0.01	-0.03	0.01	-0.04
Hotels and Restaurants	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Tourist Shops and Travel Agents	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Post and Communications	0.01	-0.01	-0.01	0.00	-0.01	-0.03	-0.02	-0.04	-0.03
Trade and transport	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Banking, Insurance and Real Estate	0.01	-0.01	0.00	-0.02	-0.01	-0.02	-0.02	-0.03	-0.04
Ownership of Dwellings	0.00	0.00	0.00	0.01	0.00	-0.01	-0.01	0.01	0.00
Public Administration and Defence	-0.02	0.00	0.00	0.01	0.00	0.00	0.03	0.22	0.06
Other Personal Services	0.00	0.00	0.00	0.01	0.00	-0.01	-0.01	0.00	0.00
<b>Total contributions</b>	<b>-0.36</b>	<b>0.64</b>	<b>0.50</b>	<b>1.02</b>	<b>0.13</b>	<b>0.45</b>	<b>-0.08</b>	<b>-0.005</b>	<b>-0.08</b>

Source: Model simulations

## Appendix B.6

**Table B.6: Base year commodity tariff rates (%), export shares and import shares**

Commodity	Tariff rate	Export share	Import share
Tea Growing	0	0	0
Rubber Growing	0	0	0
Coconut and Toddy	0	2.40	0.03
Paddy	39.9	0	0.36
Vegetables	0.1	0.86	0.68
Fruit	7.3	12.52	49.99
Highland Crops	0.4	10.21	52.66
Potatoes	0	0	58.11
Minor Export Crops	37.7	89.31	87.90
Tobacco	32.9	21.36	83.85
Betel and Areca Nuts	0	9.45	0
Miscellaneous Agriculture Products	18.7	0	8.55
Plantation Development	0	0	0
Firewood	0	0	0
Forestry	0	1.16	58.63
Livestock and Fisheries	2.4	16.56	20.17
Tea Processing	0	129.07	0
Rubber Processing	0	24.46	0
Coconut Processing	0	93.13	25.03
Rice Milling	0	0	0.84
Flour Milling	0	0	3.11
Food, Beverages and Other	7.6	11.35	22.86
Textiles, Footwear and Leather Products	0.1	76.68	92.91
Garment Industry	0.9	111.49	26.70
Wood and Wood Products	0.2	97.00	91.57
Paper and Paper Products	4.3	0	46.77
Chemicals and Fertiliser	2.3	14.64	65.50
Petroleum Industry	1.6	9.21	29.96
Plastic and Rubber Products	2.5	48.49	53.58
Other Manufacturing	6.6	40.07	76.79
Electricity, Gas and Water	0	0	0.19
Construction	0	0	0
Hotels and Restaurants	0	0	0
Tourist Shops and Travel Agents	0	8.27	75.09
Trade and transport	0	8.85	8.18
Post and Communications	0	11.28	11.64
Banking, Insurance and Real Estate	0	17.33	1.61
Ownership of Dwellings	0	0	0
Public Administration and Defence	0	1.02	1.60
Other Personal Services	0	0	0

Source: Authors' calculations based on Amarasinghe and Bandara (2005)

## Appendix B.7

**Table B.7: Sales decomposition value of imports for simulation II**

Industry	Short-run					Long-run				
	Interme- diate	Invest- ment	House- hold	Govt. demand	Stocks	Interme- diate	Invest- ment	House- hold	Govt. demand	Stocks
Tea Growing	0	0	0	0	0	0	0	0	0	0
Rubber Growing	0	0	0	0	0	0	0	0	0	0
Coconut and Toddy	0.00	0	0	0	0	0.02	0	0	0	0
Paddy	0.18	0	0	0	0	1.05	0	0	0	0
Vegetables	0.03	0	0.00	0	0	0.15	0	-0.01	0	0
Fruit	0.46	0	4.39	0	0	2.64	0	4.52	0	0
Highland Crops	6.69	0	1.24	0	0	51.59	0	1.06	0	0
Potatoes	0.00	0	-0.10	0	0	0.03	0	0.55	0	0
Minor Export Crops	78.82	0	56.78	0	0	107.24	0	56.86	0	0
Tobacco	50.29	0	0	0	0	99.97	0	0	0	0
Betel and Areca Nuts	0	0	0	0	0	0	0	0	0	0
Miscellaneous Agriculture Products	0.57	0	0.01	0	0	3.25	0	0.00	0	0
Plantation Development	0	0	0	0	0	0	0	0	0	0
Firewood	0	0	0	0	0	0	0	0	0	0
Forestry	3.30	0	0	0	0	18.14	0	0	0	0
Livestock and Fisheries	1.34	0	4.17	0	0	8.41	0	7.94	0.38	0
Tea Processing	0	0	0	0	0	0	0	0	0	0
Rubber Processing	0	0	0	0	0	0	0	0	0	0
Coconut Processing	0.01	0	0	0	0	-5.67	0	0	0	0
Rice Milling	0	0	-0.46	0	0	0	0	3.46	0	0
Flour Milling	0	0	0.52	0	0	0	0	-4.92	0	0

Industry	Short-run					Long-run				
	Interme- diate	Invest- ment	House- hold	Govt. demand	Stocks	Interme- diate	Invest- ment	House- hold	Govt. demand	Stocks
Food, Beverages and Other	9.48	0	-121.58	0	0	55.84	0	-665.08	1.34	0
Textiles, Footwear and Leather										
Products	33.52	0	11.43	0	0	-1560.56	0	12.16	0.45	0
Garment Industry	0.11	0	-0.57	0	0	2.48	0	6.88	0	0
Wood and Wood Products	2.04	0.26	0	0	0	9.23	-0.068	0	0	0
Paper and Paper Products	0.56	-0.05	-1.21	0	0	5.13	0.314	5.76	0.24	0
Chemicals and Fertiliser	5.68	-0.08	-3.14	0	0	25.57	0.617	9.71	0.91	0
Petroleum Industry	4.87	0	11.47	0	0	30.64	0	22.77	0.68	0
Plastic and Rubber Products	1.26	-0.01	-0.13	0	0	-22.61	4.38	1.24	0.06	0
Other Manufacturing	22.11	-0.30	-4.94	0	0	-321.67	49.19	31.95	1.60	0
Electricity, Gas and Water	0	0	-0.01	0	0	0	0	0.00	0.00	0
Construction	0	0	0	0	0	0	0	0	0	0
Hotels and Restaurants	0	0	0	0	0	0	0	0	0	0
Tourist Shops and Travel Agents	0	0	-1.41	0	0	0	0	6.76	0	0
Trade and transport	0	0	-5.36	0	0	0	0	5.77	0	0
Post and Communications	0	0	-1.87	0	0	0	0	0.51	0	0
Banking, Insurance and Real Estate	0	0	-0.05	0	0	0	0	-0.13	0	0
Ownership of Dwellings	0	0	0	0	0	0	0	0	0	0
Public Administration and Defence	0	0	0.07	0	0	0	0	0.43	0	0
Other Personal Services	0	0	0	0	0	0	0	0	0	0
Total	221.306	-0.177	-50.766	0	0	-1489.13	54.433	-491.82	5.652	0

Source: Model simulations

## Appendix B.8

**Table B.8: Fan decomposition for simulation II**

Industry	Short-run			Long-run		
	Local Market	Domestic Share	Export	Local Market	Domestic Share	Export
Tea Growing	0.0313	1.2206	0	-0.2275	-8.8735	0
Rubber Growing	0.0085	0.3334	0	-0.1754	-6.8403	0
Coconut and Toddy	0.0102	0.6192	0.0057	-0.2216	-7.5069	0.0292
Paddy	0.0078	0.284	0	0.0403	1.4654	0
Vegetables	0.007	0.3512	0.002	0.0416	2.0352	0.0105
Fruit	0.2881	9.6828	0.0296	0.4624	21.3877	0.1526
Highland Crops	0.0242	1.6649	0.0242	0.1336	7.3877	0.1245
Potatoes	-0.0023	-0.0342	0	0.0214	0.9529	0
Minor Export Crops	0.0242	0.4756	2.2318	0.086	-7.3678	2.0262
Tobacco	-0.5789	-310.488	0.0506	-0.2367	-377.606	0.2604
Betel and Areca Nuts	-0.003	0.7549	0.0224	-0.0217	3.646	0.1152
Miscellaneous Agriculture Products	0.0709	2.6069	0	0.3506	12.6313	0
Plantation Development	0.0027	0.1034	0	0.0001	0.0033	0
Firewood	0.0492	1.9191	0	0.3109	12.1247	0
Forestry	0.1425	0.9745	0.0028	0.7792	5.1402	0.0142
Livestock and Fisheries	0.0378	2.9997	0.0392	0.0588	9.6057	0.202
Tea Processing	-0.0007	1.2204	0.032	0.0032	-8.882	-0.2309
Rubber Processing	0.0175	0.2573	-0.0109	-0.2554	-16.6256	-0.1709
Coconut Processing	-0.0004	0.1771	0.0052	-0.0681	-97.7828	-2.475
Rice Milling	0.0075	0.3493	0	0.0561	1.803	0
Flour Milling	0.0564	2.1552	0	0.393	16.9563	0
Food, Beverages and Other	0.0317	6.2071	0.0269	0.2256	36.2641	0.1383
Textiles, Footwear and Leather Products	0.0022	3.6345	0.1815	-0.2968	31.1445	0.935
Garment Industry	-0.0027	0.3477	0.0108	0.0182	-64.7519	-1.6694
Wood and Wood Products	0.0045	8.8847	0.2297	0.0249	48.9461	1.1828
Paper and Paper Products	0.0009	0.2116	0	0.0556	1.7197	0

Industry	Short-run			Long-run		
	Local Market	Domestic Share	Export	Local Market	Domestic Share	Export
Chemicals and Fertiliser	0.0029	1.4121	0.0347	0.0443	7.9953	0.1785
Petroleum Industry	0.0145	0.8512	0.0218	0.0739	5.8367	0.1122
Plastic and Rubber Products	0.0054	0.5694	0.0065	-0.0042	24.9035	0.5912
Other Manufacturing	0.0044	0.6453	0.0114	-0.0536	-25.1055	-0.6093
Electricity, Gas and Water	0.0186	0.7273	0	-0.0698	-2.7288	0
Construction	0.0053	0.2067	0	0.0173	0.6739	0
Hotels and Restaurants	0.0134	0.5233	0	0.0553	2.1548	0
Tourist Shops and Travel Agents	-0.007	0.4904	0.0196	0.0336	5.244	0.1009
Trade and transport	0.0037	1.016	0.021	-0.0089	3.7856	0.1079
Post and Communications	-0.0289	0.0022	0.0267	0.031	6.6696	0.1375
Banking, Insurance and Real Estate	0.0092	1.9648	0.041	0.0539	10.3812	0.2113
Ownership of Dwellings	0.0069	0.2693	0	-0.0284	-1.1067	0
Public Administration and Defence	0.0005	0.1139	0.0024	0.0519	2.5286	0.0124
Other Personal Services	0.0071	0.2759	0	0.0035	0.1368	0

Source: Model simulations

## Appendix B.9

**Table B.9: Impact on short-run variable cost of domestic industries for simulation II (percentage changes)**

Industry	p1mat	p1lab_o	Total
Tea Growing	-0.001	-0.055	-0.056
Rubber Growing	0.002	-0.026	-0.025
Coconut and Toddy	-0.001	-0.053	-0.054
Paddy	-0.004	-0.051	-0.055
Vegetables	-0.005	-0.041	-0.046
Fruit	0.084	-0.049	0.036
Highland Crops	0.006	-0.062	-0.056
Potatoes	-0.015	-0.034	-0.049
Minor Export Crops	-0.414	-0.058	-0.472
Tobacco	-16.967	-0.012	-16.979
Betel and Areca Nuts	0.003	-0.065	-0.062
Miscellaneous Agriculture Products	-0.24	-0.054	-0.293
Plantation Development	-0.004	-0.037	-0.041
Firewood	0.001	-0.066	-0.065
Forestry	0.002	-0.067	-0.065
Livestock and Fisheries	-0.063	-0.029	-0.092
Tea Processing	-0.019	-0.004	-0.022
Rubber Processing	-0.003	0	-0.003
Coconut Processing	-0.016	-0.009	-0.026
Rice Milling	-0.048	-0.001	-0.049
Flour Milling	-0.312	-0.002	-0.314
Food, Beverages and Other	-4.426	-0.009	-4.435
Textiles, Footwear and Leather Products	0.018	-0.014	0.004
Garment Industry	0.009	-0.007	0.002
Wood and Wood Products	-0.172	-0.013	-0.185
Paper and Paper Products	0.002	-0.012	-0.01
Chemicals and Fertiliser	-0.091	-0.005	-0.095
Petroleum Industry	0.005	0	0.005
Plastic and Rubber Products	-0.034	-0.013	-0.047
Other Manufacturing	0.003	-0.009	-0.006
Electricity, Gas and Water	0.004	-0.039	-0.035
Construction	-0.01	-0.032	-0.042
Hotels and Restaurants	-0.097	-0.018	-0.114
Tourist Shops and Travel Agents	0.008	-0.027	-0.02
Trade and transport	0.003	-0.033	-0.029
Post and Communications	0.019	0	0.019
Banking, Insurance and Real Estate	0.001	-0.052	-0.051
Ownership of Dwellings	-0.002	-0.067	-0.068
Public Administration and Defence	-0.027	-0.039	-0.065
Other Personal Services	-0.006	-0.043	-0.049

Source: Model simulations

## Appendix B.10

**Table B.10: Impact on index of production costs in long-run for simulation II (percentage changes)**

Industry	p1	p1cap	p1lnd	p1lab	Total
Tea Growing	0.012	0.014	-0.104	0.147	0.069
Rubber Growing	0.014	0.022	-0.279	0.043	-0.2
Coconut and Toddy	0.019	0.013	-0.069	0.147	0.11
Paddy	0.023	0.019	0.086	0.136	0.263
Vegetables	0.025	0.017	0.147	0.094	0.283
Fruit	0.094	0.016	0.655	0.118	0.882
Highland Crops	0.022	0.018	0.328	0.131	0.499
Potatoes	0.038	0.013	0.088	0.094	0.233
Minor Export Crops	-0.155	0.018	-0.058	0.127	-0.068
Tobacco	-14.078	0.006	-3.133	0.043	-17.162
Betel and Areca Nuts	0.007	0.019	0.21	0.136	0.372
Miscellaneous Agriculture Products	-0.113	0.017	0.444	0.124	0.471
Plantation Development	0.047	0.012	0.067	0.105	0.232
Firewood	0.009	0.056	0.061	0.138	0.264
Forestry	0.008	0.056	0.037	0.138	0.241
Livestock and Fisheries	-0.118	0.036	0.155	0.067	0.141
Tea Processing	0.085	0.009	0	0.014	0.107
Rubber Processing	0.028	0.006	0	0.001	0.035
Coconut Processing	0.048	0.068	0	0.018	0.135
Rice Milling	0.228	0.011	0	0.002	0.242
Flour Milling	-0.229	0.026	0	0.006	-0.197
Food, Beverages and Other	-2.038	0.066	0	0.018	-1.954
Textiles, Footwear and Leather Products	0.042	0.04	0	0.04	0.122
Garment Industry	0.026	0.025	0	0.025	0.075
Wood and Wood Products	-0.132	0.025	0	0.044	-0.063
Paper and Paper Products	0.014	0.016	0	0.043	0.074
Chemicals and Fertiliser	-0.056	0.027	0	0.016	-0.014
Petroleum Industry	0.041	0.007	0	0.002	0.05
Plastic and Rubber Products	-0.014	0.05	0	0.033	0.069
Other Manufacturing	0.02	0.024	0	0.033	0.077
Electricity, Gas and Water	0.013	0.084	0	0.055	0.153
Construction	0.067	0.023	0	0.112	0.202
Hotels and Restaurants	-0.111	0.014	0	0.067	-0.029
Tourist Shops and Travel Agents	0.006	0.035	0	0.085	0.126
Trade and Transport	0.046	0.056	0	0.077	0.18
Post and Communications	0.129	0.036	0	0	0.166
Banking, Insurance and Real Estate	0.051	0.022	0	0.183	0.256
Ownership of Dwellings	0.017	0	0	0.287	0.304
Public Administration and Defence	0.005	0	0	0.166	0.171
Other Personal Services	0.065	0.015	0	0.162	0.242

Source: Model simulations

## Appendix B.11

**Table B.11: Detailed regional advantage matrix (short-run) for simulation II**

Industry	Western	Central	Southern	Sabara- gamuwa	North Western	Uva	North Central	Northern	Eastern
Tea Growing	0	0	0	0	0	0	0	0	0
Rubber Growing	0	0	0	-0.0006	0.0001	0	0.0001	0.0001	0.0001
Coconut and Toddy	0.0002	0.0001	-0.0001	-0.0001	-0.0011	0.0001	-0.0001	0	0.0001
Paddy	0.0006	0.0002	-0.0002	-0.0001	-0.0004	-0.0002	-0.0037	-0.0001	-0.0034
Vegetables	0.0008	-0.0022	0.0001	0	0.0001	-0.0035	-0.0005	-0.0001	-0.0007
Fruit	-0.0002	0.0001	0	0.0001	0.0006	0.0004	0.0003	-0.0001	0.0001
Highland Crops	-0.0002	0.0002	0.0002	0.0001	0.0002	0.0003	0.0003	0	0.0003
Potatoes	0	0	0	0	0	-0.0007	0	0	0
Minor Export Crops	-0.0001	0.0004	0.0002	0.0005	0.0001	0.0002	-0.0002	-0.0002	-0.0002
Tobacco	0.0025	-0.0085	0.0025	0.0021	-0.0005	-0.0052	-0.0124	-0.009	0.0011
Betel and Areca Nuts	0	0	0	-0.0001	0	-0.0001	0	0	0
Miscellaneous Agriculture Products	-0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0	0.0002
Plantation Development	0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0002	-0.0002	0	-0.0002
Firewood	-0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0	0.0002
Forestry	0	0	0	0	0	0	0	0	0
Livestock and Fisheries	-0.0009	-0.0009	0.0025	-0.0012	0.0033	-0.001	0.0004	0.0012	0.0033
Tea Processing	0	0	0	0	0	0	0	0	0
Rubber Processing	0	0	0	0	0	0	0	0	0
Coconut Processing	0.0001	-0.0002	-0.0002	-0.0007	0	0	0.0001	0.0001	0.0001
Rice Milling	0	0	0	0	-0.0001	0	-0.0002	0	-0.0001
Flour Milling	0	0	0	0	0.0002	0	0.0002	0	0.0001
Food, Beverages and Other	0.0029	-0.0017	-0.002	-0.002	-0.0062	-0.0036	0.0012	-0.0073	-0.0062

Industry	Western	Central	Southern	Sabara- gamuwa	North Western	Uva	North Central	Northern	Eastern
Textiles, Footwear and Leather Products	0.0002	0.0001	-0.0002	-0.0004	0.0004	-0.0007	-0.0006	-0.001	-0.0004
Garment Industry	-0.0009	0.0011	0.001	0.001	0.0008	0.0011	0.0011	0.0011	0.0011
Wood and Wood Products	-0.0001	0	-0.0001	0.0003	0.0003	0	0	-0.0002	-0.0001
Paper and Paper Products	-0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Chemicals and Fertiliser	0	0	0	0	0	0	0	0	0
Petroleum Industry	0	0	0	0	0	0	0	0	0
Plastic and Rubber Products	-0.0001	0.0002	0	-0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Other Manufacturing	-0.0003	0.0001	0.0004	0.0003	0	0.0004	0.0004	0.0005	0.0005
Electricity, Gas and Water	-0.0002	0.0003	0.0003	0.0002	-0.0002	0.0002	0.0003	0.0003	0.0003
Construction	0.0021	-0.0007	-0.0009	0	-0.0034	-0.0069	0.0034	-0.007	-0.007
Hotels and Restaurants	0	0	-0.0002	0.0001	0	0.0001	0	0.0001	0.0001
Tourist Shops and Travel Agents	0	0	-0.0002	0.0001	0	0.0001	0	0.0001	0.0001
Trade and transport	-0.0003	0.0003	0.0002	-0.0001	0.0002	0.0007	0.0006	0.001	0.0007
Post and Communications	0	0	0	0	0	0.0001	0	0.0002	0
Banking, Insurance and Real Estate	0.0006	-0.0005	-0.0001	-0.0007	-0.0005	-0.0009	-0.0008	-0.0014	-0.0015
Ownership of Dwellings	0.0002	-0.0003	0.0001	-0.0001	-0.0001	-0.0004	-0.0004	-0.0012	-0.0006
Public Administration and Defence	0.0011	-0.0002	-0.0001	-0.0003	-0.0002	-0.0001	-0.0015	-0.0126	-0.0037
Other Personal Services	0.0002	-0.0004	0	0	0	-0.0004	-0.0005	-0.0002	-0.0001

Source: Model simulations

## Appendix B.12

**Table B.12: Detailed regional advantage matrix (long-run) for simulation II**

Industry	Western	Central	Southern	Sabara- gamuwa	North Western	Uva	North Central	Northern	Eastern
Tea Growing	0.006	-0.018	-0.009	-0.017	0.006	-0.012	0.006	0.006	0.006
Rubber Growing	0	0	0	-0.005	0	0	0.001	0.001	0.001
Coconut and Toddy	0.002	0.002	-0.001	-0.001	-0.016	0.001	-0.002	0	0.001
Paddy	0	0	0	0	0	0	-0.001	0	-0.001
Vegetables	0	0.001	0	0	0	0.001	0	0	0
Fruit	0	0	0	0	0.001	0.001	0.001	0	0
Highland Crops	-0.002	0.002	0.002	0.002	0.002	0.004	0.004	0	0.004
Potatoes	0	0	0	0	0	0	0	0	0
Minor Export Crops	0.001	-0.002	-0.001	-0.002	0	-0.001	0.001	0.001	0.001
Tobacco	0.003	-0.011	0.003	0.003	-0.001	-0.007	-0.016	-0.011	0.001
Betel and Areca Nuts	0	0	0	0	0	0	0	0	0
Miscellaneous Agriculture Products	-0.001	0.001	0.001	0.001	0.001	0.002	0.002	0	0.002
Plantation Development	0	0	0	0	0	0	0	0	0
Firewood	-0.001	0.001	0.001	0.001	0.002	0.003	0.002	0	0.002
Forestry	0	0	0	0	0	0	0	0	0
Livestock and Fisheries	-0.004	-0.004	0.011	-0.005	0.015	-0.004	0.002	0.006	0.015
Tea Processing	0.001	-0.001	-0.002	-0.005	0	0	0.001	0.001	0.001
Rubber Processing	0	0	0	-0.001	0	0	0	0	0
Coconut Processing	0.01	-0.015	-0.019	-0.061	0.003	-0.004	0.012	0.007	0.011
Rice Milling	0	0	0	0	0	0	0	0	0
Flour Milling	-0.001	0	0	-0.001	0.003	0	0.003	0	0.001
Food, Beverages and Other	0.02	-0.012	-0.014	-0.014	-0.043	-0.025	0.008	-0.05	-0.042
Textiles, Footwear and Leather	0.002	0.001	-0.003	-0.005	0.005	-0.009	-0.007	-0.011	-0.005

Industry	Western	Central	Southern	Sabara- gamuwa	North Western	Uva	North Central	Northern	Eastern
Products									
Garment Industry	-0.066	0.078	0.078	0.077	0.057	0.078	0.078	0.078	0.078
Wood and Wood Products	0	0	-0.001	0.002	0.002	0	0	-0.001	-0.001
Paper and Paper Products	0	0	0	0	0	0	0	0	0
Chemicals and Fertiliser	0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Petroleum Industry	0	0	0	0	0	0	0	0	0
Plastic and Rubber Products	0.003	-0.006	0	0.006	-0.006	-0.008	-0.008	-0.008	-0.008
Other Manufacturing	-0.012	0.006	0.02	0.015	-0.001	0.02	0.018	0.021	0.02
Electricity, Gas and Water	-0.001	0.002	0.002	0.002	-0.002	0.002	0.002	0.002	0.002
Construction	-0.002	0	0.002	-0.004	0.002	0.002	0.011	0.003	0.008
Hotels and Restaurants	0	0	0	0	0	0	0	0	0
Tourist Shops and Travel Agents	0	0	0.001	0	0	0	0	0	0
Trade and transport	0.003	-0.002	-0.002	0.001	-0.002	-0.006	-0.005	-0.009	-0.006
Post and Communications	0	0	0	0	0	0	0	-0.001	0
Banking, Insurance and Real Estate	0.007	-0.006	-0.001	-0.009	-0.006	-0.011	-0.01	-0.017	-0.018
Ownership of Dwellings	0	0	0	-0.001	0	0	0	0	0
Public Administration and Defence	-0.001	0	0	0	0	0	0.001	0.009	0.003
Other Personal Services	0	0	0	-0.001	0	0	0.001	0.001	0.001

Source: Model simulations

## Appendix B.13

**Table B.13: Sales decomposition for simulation III**

Industry	Short-run						Long-run					
	Interme- diate	Invest- ment	House- hold	Export	Govt. demand	Stocks	Interme- diate	Invest- ment	House- hold	Export	Govt. demand	Stocks
Tea Growing	0.11	0	0	0	0	0	-0.02	0	0	0.00	0.00	0
Rubber Growing	0.74	0	0	0	0	0	1.41	0	0	0.00	0.00	0
Coconut and Toddy	0.01	0	0.35	0.01	0	0	1.23	0	0.25	-0.01	0.00	0
Paddy	0.01	0	0	0	0	0	0.03	0	0	0.00	0.00	0
Vegetables	0	0	0.12	0	0	0	0.01	0	0.12	0.00	0.00	0
Fruit	0.01	0	0.01	0.03	0	0	0	0	0.02	-0.04	0.02	0
Highland Crops	0	0	0.06	0.03	0	0	0	0	0.09	-0.03	0.00	0
Potatoes	0	0	-0.01	0	0	0	0.02	0	0.03	0.00	0.00	0
Minor Export Crops	0.05	0	0	2.08	0	0	0.07	0	0.01	2.72	0.00	0
Tobacco	0.02	0	0	0.05	0	0	-0.01	0	0	-0.07	0.00	0
Betel and Areca Nuts	0	0	0	0.02	0	0	0	0	0.04	-0.03	0.00	0
Miscellaneous Agriculture												
Products	0.03	0	0	0	0	0	0.03	0	0.01	0.00	0.00	0
Plantation Development	0.06	0	0	0	0	0	0.23	0.12	0	0.00	0.00	0
Firewood	0.01	0	0	0	0	0	0	0	0.02	0.00	0.00	0
Forestry	0.04	0	0	0	0	0	0.08	0	0	0.00	0.00	0
Livestock and Fisheries	0.01	0	-0.01	0.04	0	0	-0.02	0	0.03	-0.06	0.00	0
Tea Processing	0	0	0	0.11	0	0	0	0	0.01	-0.03	0.00	0
Rubber Processing	0.07	0	0	0.87	0	0	-0.19	0	0	2.08	0.00	0
Coconut Processing	0.01	0	0	0.08	0	0	0.21	0.01	0.03	10.25	0.00	0
Rice Milling	0	0	0.01	0	0	0	0	0	0.03	0.00	0.01	0
Flour Milling	0.01	0	0	0	0	0	0	0	0.03	0.00	0.00	0

Industry	Short-run						Long-run					
	Interme- diate	Invest- ment	House- hold	Export	Govt. demand	Stocks	Interme- diate	Invest- ment	House- hold	Export	Govt. demand	Stocks
Food, Beverages and Other	0	0	-0.01	0.03	0	0	0	0	0.04	-0.04	0.00	0
Textiles, Footwear and Leather Products	-0.03	0	-0.05	0.19	0	0	-0.05	0	0.02	-0.26	0.00	0
Garment Industry	0	0	-0.01	0.04	0	0	0	0	0.02	-0.46	0.00	0
Wood and Wood Products	0.02	-0.02	-0.03	0.24	0	0	-0.03	0.01	0.02	-0.33	0.00	0
Paper and Paper Products	0.01	0	0	0	0	0	0	0.01	0.03	0.00	0.03	0
Chemicals and Fertiliser	0.04	0	-0.04	0.04	0	0	0.13	0	0.04	-0.05	0.00	0
Petroleum Industry	0.02	0	-0.01	0.02	0	0	-0.01	0	0	-0.03	0.00	0
Plastic and Rubber Products	0.01	-0.01	-0.01	0.12	0	0	0.01	0	0.01	-0.16	0.00	0
Other Manufacturing	0.02	0	0	0.03	0	0	0.03	0.01	0.01	-0.21	0.00	0
Electricity, Gas and Water	0.08	0	-0.01	0	0	0	0.36	0	0.01	0.00	0.01	0
Construction	0.03	0	0	0	0	0	0.07	0.08	0	0.00	0.00	0
Hotels and Restaurants	0	0	0.03	0	0	0	0	0	0.06	0.00	0.01	0
Tourist Shops and Travel Agents	0	0	-0.02	0.02	0	0	0	0	0.06	-0.03	0.00	0
Trade and transport	0.01	0	0	0.02	0	0	-0.01	0.01	0.02	-0.03	0.00	0
Post and Communications	0	0	-0.03	0.03	0	0	0	0	0.03	-0.04	0.01	0
Banking, Insurance and Real Estate	0.01	0	0	0.04	0	0	0.02	0.03	0.01	-0.06	0.00	0
Ownership of Dwellings	0	0	0.01	0	0	0	0	0	0.03	0	0	0
Public Administration and Defence	0	0	0	0	0	0	0.01	0.01	0	0	0.05	0
Other Personal Services	0.03	0	0	0	0	0	0.09	0	0.03	0	0	0

Source: Model simulations

## Appendix B.14

**Table B.14: Detailed regional advantage matrix (short-run) for simulation III**

Industry	Western	Central	Southern	Sabara- gamuwa	North Western	Uva	North Central	Northern	Eastern
Tea Growing	-0.001	0.004	0.002	0.003	-0.001	0.002	-0.001	-0.001	-0.001
Rubber Growing	-0.001	-0.001	0	0.016	-0.001	-0.001	-0.002	-0.002	-0.002
Coconut and Toddy	-0.003	-0.002	0.001	0.001	0.02	-0.001	0.002	0	-0.001
Paddy	0.001	0	0	0	-0.001	0	-0.007	0	-0.006
Vegetables	-0.002	0.006	0	0	0	0.01	0.001	0	0.002
Fruit	0	0	0	0	0	0	0	0	0
Highland Crops	-0.001	0.001	0.001	0	0.001	0.001	0.001	0	0.001
Potatoes	0	0	0	0	0	-0.001	0	0	0
Minor Export Crops	-0.008	0.021	0.01	0.026	0.004	0.01	-0.009	-0.009	-0.009
Tobacco	0	0	0	0	0	0	0	0	0
Betel and Areca Nuts	0	0	0	0	0	0	0	0	0
Miscellaneous Agriculture Products	0	0	0	0	0	0	0	0	0
Plantation Development	0	0	0	0	0	0	0	0	0
Firewood	0	0	0	0	0	0	0	0	0
Forestry	0	0	0	0	0	0	0	0	0
Livestock and Fisheries	0	0	-0.001	0	-0.001	0	0	-0.001	-0.001
Tea Processing	0	0	0	0.001	0	0	0	0	0
Rubber Processing	0	0	0.001	0.002	0	0	0	0	0
Coconut Processing	0	0	0	0.001	0	0	0	0	0
Rice Milling	0	0	0	0	0	0	0	0	0
Flour Milling	0	0	0	0	0	0	0	0	0
Food, Beverages and Other	-0.001	0.001	0.001	0.001	0.002	0.001	0	0.002	0.002

Industry	Western	Central	Southern	Sabara- gamuwa	North Western	Uva	North Central	Northern	Eastern
Textiles, Footwear and Leather Products	0	0	0	0	0	-0.001	-0.001	-0.001	0
Garment Industry	-0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Wood and Wood Products	0	0	0	0	0	0	0	0	0
Paper and Paper Products	0	0	0	0	0	0	0	0	0
Chemicals and Fertiliser	0	0	0	0	0	0	0	0	0
Petroleum Industry	0	0	0	0	0	0	0	0	0
Plastic and Rubber Products	0	-0.001	0	0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Other Manufacturing	0	0	0	0	0	0	0	0	0
Electricity, Gas and Water	0	0	0	0	0	0	0	0	0
Construction	0	0.002	0.005	0.008	-0.002	-0.007	-0.005	-0.004	-0.006
Hotels and Restaurants	0	0	0	0	0	0	0	0	0
Tourist Shops and Travel Agents	0	0	0	0	0	0	0	0	0
Trade and transport	-0.001	0.001	0.001	0	0.001	0.003	0.002	0.004	0.003
Post and Communications	0	0	0	0	0	0	0	0	0
Banking, Insurance and Real Estate	0	0	0	0	0	0	0	0	0
Ownership of Dwellings	0	0	0	0	-0.002	-0.001	-0.001	-0.001	-0.001
Public Administration and Defence	0.002	0	0	-0.001	0	0	-0.003	-0.024	-0.007
Other Personal Services	0	0	0	0.001	-0.001	-0.001	-0.001	-0.001	0

Source: Model simulations

## Appendix B.15

**Table B.15: Detailed regional advantage matrix (long-run) for simulation III**

Industry	Western	Central	Southern	Sabara- gamuwa	North Western	Uva	North Central	Northern	Eastern
Tea Growing	0.002	-0.008	-0.004	-0.007	0.002	-0.005	0.002	0.002	0.002
Rubber Growing	-0.001	-0.003	0.000	0.031	-0.003	-0.002	-0.004	-0.004	-0.004
Coconut and Toddy	-0.014	-0.009	0.006	0.006	0.090	-0.006	0.009	0.000	-0.006
Paddy	0.001	0.000	0.000	0.000	-0.001	0.000	-0.009	0.000	-0.008
Vegetables	-0.001	0.003	0.000	0.000	0.000	0.004	0.001	0.000	0.001
Fruit	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Highland Crops	0.001	-0.001	-0.001	0.000	-0.001	-0.001	-0.001	0.000	-0.001
Potatoes	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000
Minor Export Crops	-0.010	0.027	0.013	0.034	0.005	0.013	-0.012	-0.012	-0.011
Tobacco	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Betel and Areca Nuts	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000	0.000
Miscellaneous Agriculture Products	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Plantation Development	-0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.001
Firewood	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001	0.000	-0.001
Forestry	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Livestock and Fisheries	0.003	0.003	-0.008	0.004	-0.010	0.003	-0.001	-0.004	-0.010
Tea Processing	0.000	-0.001	-0.001	-0.002	0.000	0.000	0.000	0.000	0.000
Rubber Processing	-0.001	0.001	0.001	0.003	0.000	0.000	-0.001	0.000	-0.001
Coconut Processing	-0.042	0.060	0.077	0.250	-0.013	0.017	-0.048	-0.030	-0.046
Rice Milling	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Flour Milling	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000
Food, Beverages and Other	-0.002	0.001	0.001	0.001	0.005	0.003	-0.001	0.005	0.004
Textiles, Footwear and Leather Products	-0.001	0.000	0.001	0.002	-0.002	0.004	0.004	0.006	0.003

Industry	Western	Central	Southern	Sabara- gamuwa	North Western	Uva	North Central	Northern	Eastern
Garment Industry	-0.021	0.024	0.024	0.024	0.018	0.024	0.024	0.024	0.024
Wood and Wood Products	0.000	0.000	0.000	-0.001	-0.001	0.000	0.000	0.000	0.000
Paper and Paper Products	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Chemicals and Fertiliser	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Petroleum Industry	-0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Plastic and Rubber Products	-0.001	0.002	0.000	-0.002	0.002	0.003	0.003	0.003	0.003
Other Manufacturing	-0.004	0.002	0.007	0.006	0.000	0.007	0.007	0.008	0.008
Electricity, Gas and Water	0.003	-0.005	-0.005	-0.005	0.004	-0.005	-0.005	-0.005	-0.005
Construction	-0.008	0.009	0.018	0.020	-0.002	0.020	-0.006	0.003	-0.006
Hotels and Restaurants	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Tourist Shops and Travel Agents	0.000	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000
Trade and transport	-0.005	0.005	0.003	-0.002	0.003	0.012	0.010	0.017	0.012
Post and Communications	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Banking, Insurance and Real Estate	-0.003	0.003	0.000	0.004	0.003	0.005	0.004	0.007	0.008
Ownership of Dwellings	0.000	0.000	0.000	0.001	0.000	0.000	-0.001	0.000	-0.001
Public Administration and Defence	0.001	0.000	0.000	0.000	0.000	0.000	-0.001	-0.009	-0.003
Other Personal Services	-0.001	0.001	0.002	0.004	0.000	0.001	-0.001	0.000	0.000

Source: Model simulations