Chapter 5: Analytical Framework

5.1 Introduction

This chapter presents the analytical framework of the dissertation. In order to achieve the objectives set out in the introductory chapter, we develop a simple empirical model to determine the effect of export growth on the growth of the economy as a whole. A GDP growth equation is derived from a two-sector neoclassical model.[1] Unlike the traditional neoclassical growth model, the proposed model incorporates the effect of export on GDP in addition to the traditional sources of growth (factor supply growth and technological change). Under this theoretical framework, we conduct an econometric analysis to find answers to the following questions :

1. Does export growth positively affect economic growth, after controlling for the effects of changes in input supplies and the state of technology?
2. Does the change in the composition of export affect economic growth?
3. Does the effect of private investment on GDP growth differ from that of public investment?

This chapter is organised as follows: Section 5.2 deals with the methods of preliminary investigation. Section 5.3 presents the theoretical model. The empirical model is presented in Section 5.4. Estimation techniques and hypotheses are discussed in Section 5.5. Section 5.6 presents the data sources and the definition of each variable used.

5.2 The Method of Preliminary Investigation

Our preliminary investigation includes an analysis of the properties of the data based on descriptive statistics and graphs of the key variables. More specifically, we examine the pattern of changes in GDP over time and investigate whether there exists a systematic relationship between GDP growth and each of the potential determinants

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[1]The study adopts a theoretical model developed by Feder (1983). The distinguishing characteristics of our econometric model compared to that of Feder are presented at the end of this chaper.

of GDP such as labour force growth, investment, technological change and export growth. The properties of the data are investigated by means of the following :

- time series plot of each variable;
- mean and standard deviation of each time series; and
- simple correlation coefficient

The whole sample period is sub-divided into three identifiable policy regimes :

(i) Pre-liberation Regime: 1961 - 1971

(ii) Post-liberation Regime I : 1972-1982

(iii) Post- liberation Regime II : 1983 - 1992

In Table 5.1, the major economic characteristics of each policy regime are presented.

Table 5.1	Major economic characteristics
a) Pre-liberation Regime, 1961-1971	i) Pegged Foreign Exchange rate. ii) Import Substitution: large and small scale industrialisation under high tariff and non-tariff protection . iii) Over-valued exchange rate, concentration on few primary product exports which discouraged investment in export oriented manufacturing industries.
b) Post-liberation Regime, 1972- 1982	i) Exchange control and import substitution under tariff and non-tariff barrier. ii) Nationalisation of major industries such as jute, cotton, textile, sugar mills, banks and insurance companies . iii) Initially (1972-75), government pursued public ownership strategy towards socialistic goal. This goal was abandoned in early 1975 in favour of a mixed economy. iv) A system of managed float was prevalent. Taka was pegged to Pound Sterling and its value was determined by the weighted value of the currencies of other major trading partners.
c) Post-liberation Regime II, 1983-1992	i) Denationalisation and privatisation policy. ii) Adoption of the New Industrial Policy in 1982 and Revised Industrial Policy in 1986 for liberalisation in the industrial sector. Restructuring of the financial sector. iii) Adoption of liberal trade policy under a system of managed float. Initially, Taka was pegged with US Dollar. Now Taka is convertible under a floating exchange rate system

Analysing the statistical properties of the data for each regime, the study determines the effect of policy changes on the relation between GDP growth and export growth. [2] In addition we use Pearson's correlation coefficient to measure the relationship between GDP and export. The sample correlation coefficient between two variables, X and Y with sample standard deviations $\hat{\sigma}_x$ and $\hat{\sigma}_y$ is calculated as :

$$r = \frac{\text{cov}(X,Y)}{\sqrt{\hat{\sigma}_x \hat{\sigma}_y}} \quad \text{where, } -1 \leq r \leq 1$$

The correlation analysis is concerned with measuring the strength of linear relationship between two variables. If $r = 1$, there is a perfect positive relationship between the two variables. If $r = -1$, there is a perfect inverse relationship between the two variables. If two variables are linearly independent, $r = 0$. To test whether the population correlation coefficient ρ equals zero, we use the following t-test :

$$t = \frac{r}{\sqrt{\frac{(1-r^2)}{(n-2)}}}$$

The null hypothesis that $\rho = 0$ is rejected if this test statistic exceeds $t_{\alpha/2,n-2}$ or is less than $-t_{\alpha/2,n-2}$, where α is the significance level and 'n-2' is the degrees of freedom.

5.3 The Theoretical Model

5.3.1 The conceptual framework

This section investigates the potential positive effect of export on economic growth. Exports' greatest contribution is perhaps specialisation due to increase in market size.

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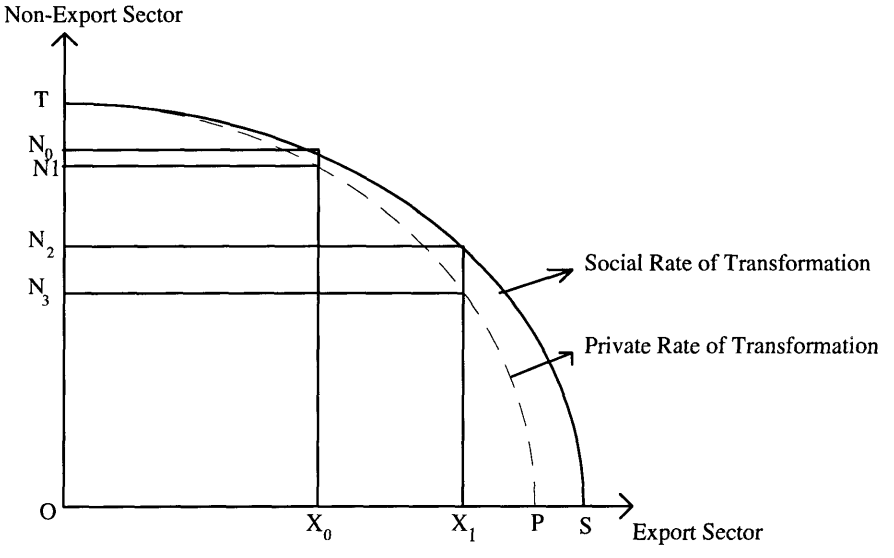
[2]The methodology is originated in the work of Michalopoulous and Jay (1973) and empirically used by Balassa (1978, 1985), Kavoussi (1984), Ram (1985,1987), Moschos (1989) and Salvalor and Hatcher (1991) and few others.

There are two channels through which export affect GDP growth. These are externality effect and productivity differential effect.

The externality effect can be clearly illustrated by means of a two sector production general equilibrium model. In Figure 5.1, TS represents the production possibility curve when the export sector generates positive production externality and the slope of this curve measures the marginal social rate of transformation between exportables and non-exportables.

Figure 5.1 Positive externality effect of export

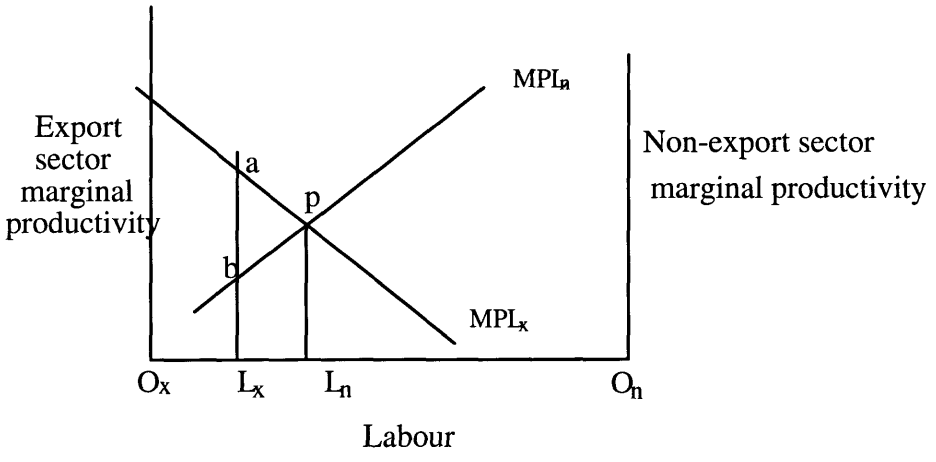


In the absence of externality, the production possibility curve could be represented by TP. The slope of TP measures the marginal private rate of transformation. When, the output of the export sector is OX_0, the output of the non-export sector is ON_0 and the distance, N_0N_1 measures the externality effect i.e., the increment in the non-export sector output due to positive production externality generated by the export sector. It is clear from the diagram that the magnitude of the externality effect increases with the expansion of the export sector. Thus, we expect a positive effect of export growth on GDP growth. The beneficial externality effect represents the development of efficient and internationally competitive management, the introduction of improved production techniques, training of high quality labour, steadier flow of imported inputs etc.

Factor productivity in the export sector may differ from that of the non-export sector due to several reasons. First, export industries use improved technology and skilled workers which enhance factor productivities. Second, factors of production may not be perfectly mobile between two sectors. This arises from institutional constraint as

well as differential skill requirements across sectors. In the absence of perfect mobility of factors, the value of the marginal productivity of each input in the export sector is likely to be higher than that of the non-export sector. This is illustrated with the aid of Figure 5.2. Assuming that both sectors use homogeneous labour, marginal productivity of labour curves for both export (MPL_X) and non-export (MPL_n) sectors are drawn in the same diagram.

Figure 5.2 Productivity differential effect



L_n represents the efficient labour allocation between two sectors because at this point marginal productivity of labour in the export sector is equal to that of the non-export sector. However, due to imperfect mobility of labour, the actual labour allocation might occur at L_x where the export sector employs O_XL_X amount of labour and the non-export sector employs the rest of the work force, O_nL_X. Given the marginal productivity gap, 'ab' at the actual labour allocation, an expansion of the export will increase gross domestic product of the economy. The productivity gap would be larger if we allow the skill composition of the worker force to differ between sectors. Thus, export expansion may raise the total factor productivity in the economy through its favourable effect on the efficiency of resource allocation.

As noted earlier, in our conceptual framework, the economy is divided into two distinct sectors, one produces export commodities and the other produces commodities for domestic consumption. The theoretical model is based on the following assumptions :

(i) The production function or the state of technology differs across sectors but remains constant within a sector over time.

(ii) The allocation of resources between export and non export sectors is non-optimal due to the presence of non-priced externality and imperfect mobility of factors of production.

These are reasonable assumptions in the context of Bangladesh. First, the leading export oriented industries such as garments, leather and jute manufacturing use sophisticated technology relative to that of leading non-export industries such as food grains, housing and non-traded services. Bangladesh can be viewed as a typical Lewis-Fei-Ranis 'dual economy' where most industries in the non-export sector use traditional technology while major industries in the export sector use modern technology imported from abroad. Second, factors of production are not perfectly mobile across sectors in Bangladesh. Skills requirement in the export sector differs from those of the non-export sector. More specifically, the export-oriented industries are largely based on skills which are acquired primarily through on-the-job training rather than general secondary or tertiary education. Non-export sector, on the other hand, is primarily based on skills acquired either through intergenarational transmission of skills, (e.g. commercial activities in the urban informal sector and subsistence activities in the rural sector) or through the completion of general college or university education. Thus skills used in one sector may not be readily transferable to the other sector. Furthermore, in a hierarchical society of Bangladesh individuals often forego higher wages to enjoy non-pecuniary benefits of working in white collar occupations, in the form of higher social status. Individuals may prefer to work in family business at a subsistance reward instead of working in blue collar occupations as wage workers. These preferences simply reflect a strong positive relation between occupational status and social status. Hence, one cannot expect perfect mobility of labour across sectors in the presence of the above cultural constraint.

5.3.2 A Formal Model

An augmented neoclassical sources of growth equation is derived in this sub-section following Feder (1983).

The sector specific production function can be expressed as:

$$N = F(K_n, L_n, X) \quad (5.1)$$

$$X = H(K_x, L_x) \quad (5.2)$$

where,

N = non-export sector output,

X = export sector output,

K_n, K_x = sector specific capital stock and

L_n, L_x = sector specific labour employment.

Taking total differential of equations 5.1 and 5.2, we get

(5.3) $dN = F_k dK_n + F_L dL_n + F_x dX$

(5.4) $dX = H_k dK_x + H_L dL_x$

where F_k and F_L stand for marginal productivities of capital and labour respectively in the non-export sector and H_k and H_L are the marginal productivities of capital and labour in the export sector. The term F_x can be interpreted as the externality effect of a change in export on the output of the non-export sector. It is assumed that the productivity of each input in the export sector differs from that of the non-export sector by a factor δ and the intersectoral productivity differential is captured by the following pair of equations:

(5.5) $H_k = (1 + \delta) F_k$

(5.6) $H_L = (1 + \delta) F_L$

The change in GDP, can be expressed as

(5.7) $dY = dN + dX.$

First substituting equations (5.3) and (5.4) into (5.7) and then using equations (5.5) and (5.6) we find the following GDP growth equation. [3]

(5.8) $dY / Y = \beta_1 (I / Y) + \beta_2 dL / L + \beta_3 X / Y (dX / X)$

where

$Y = N+X$, gross domestic product of the economy;

$I = dK_n + dK_x$, total investment in the economy;

$L = L_n + L_x$, total labour employed in the economy;

$\beta_1 = F_k$, the marginal productivity of capital in the non-export sector,

$\beta_2 = F_L / (Y / L)$, the ratio of the marginal productivity of labour in the non-export sector to the economy-wide average productivity of labour,

$\beta_3 = \delta / (1+\delta) + F_x$, the sum of the productivity differential effect and the externality effect.

The term, $\frac{dX}{X}.\frac{X}{Y}$ can be interpreted as the weighted export growth, i.e. the export growth rate weighted by the share of export in GDP. β_3 measures the percentage change in GDP as the weighted export by 1 percent. Since this is the key coefficient of interest in the

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[3]Detailed derivation of equation (5.8) is given in Appendix 10.

present study, it is important to further clarify the theoretical meaning of this coefficient. Using equations (5.5) and (5.6) we can show that,.[4]

$$\frac{\delta}{1+\delta} = \frac{H_i - F_i}{H_i}, \quad \text{where, i = K, L} \tag{5.9}$$

Thus $\frac{\delta}{1+\delta}$ measures the private marginal factor productivity gap between export and non-export sector relative to the marginal productivity of the factor in the export sector.
Now using expression (5.9) we can write

$$\frac{\delta}{1+\delta} + F_x = \frac{H_i - F_i}{H_i} + F_x$$

$$= \frac{H_i + F_x H_i - F_i}{H_i}$$

Denoting, $SMP_i^x = H_i + F_x H_i$ we obtain,

$$\frac{\delta}{1+\delta} + F_x = \frac{SMP_i^x - F_i}{H_i}, \tag{5.10}$$

We interpret the term, $(H_i + F_x H_i)$ as the social marginal product of factor i in the export sector (SMP_i^x) which takes into account both the direct effect of factor i on GDP through its effect on export (H_i) and the indirect effect of factor i on GDP through its externality effect on the non-export sector $(F_x . H_i)$. Thus equation (5.10) explains the coefficient of the weighted export growth rate, β_3 as the social marginal productivity gap between the export and non-export sector relative to the private marginal productivity in the export sector. Note that if marginal productivities are equalised across sector δ=0 and if there is no export externality (F_X = 0), then equation (5.8) reduces to the familiar neo-classical formulation of sources of growth.

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[4]This expression is derived by recognising that : $\delta = (H_i - F_i)/F_i$ and $1+\delta = H_i / F_i$ where i = K,L

5.4 The Empirical Model

This section presents an empirical model based on the theoretical framework presented in the last section. In addition, we discuss the empirical issues with respect to the data and the estimation technique.

5.4.1 The Empirical Specification

Incorporating a constant term, β_0 and an error term, e_1 in the theoretical GDP growth equation (5.8) the following multiple linear regression model is specified

$$(5.11)\quad \dot{Y} = \beta_0 + \beta_1 \frac{I}{Y} + \beta_2 \dot{L} + \beta_3 (\frac{X}{Y} * \dot{X}) + e_1$$

The model states that the annual rate of growth of GDP is linearly dependent on the annual investment-GDP ratio, annual growth rate of labour force, and weighted growth rate of export. The constant term β_0 can be interpreted as an indicator of the state of technology and the skill composition of the labour force. The error term, e_i captures the effects of omitted factors such as natural calamity and political instability. The error term also represents measurement errors in the growth rate of GDP. It is assumed that $e_{1i} \sim N[0,\sigma^2]$ and it satisfies the assumptions of nonautocorrelation $[\text{cov}(\varepsilon_{1i}, \varepsilon_{1j}) = 0 \text{ if } i \neq j]$ and the uncorrelatedness of regressors and the disturbances. Under these assumptions the ordinary least square technique was initially applied to estimate the parameters of equation (5.11).

However, contrary to the theoretical expectation, the OLS technique yields a negative coefficient for the variable $\frac{I}{Y}$. Recall that the coefficient of $\frac{I}{Y}$ measures the marginal productivity of capital in the non-export sector which cannot be negative in a labour-surplus economy like Bangladesh. Hence, we examined the data carefully and observed that in abnormal years (periods of war, natural calamity and political instability) GDP growth rates were negative or close to zero but the investment-GDP ratios were large. Further investigation of the data suggests that in abnormal years public investment, mainly financed by foreign donors, was primarily used to rebuild economic infrastructure and production plants, destroyed by natural and man-made calamities, rather than to augment the pre-disaster stock of capital. This provides a possible explanation for the inverse relationship between the investment-GDP ratio and the GDP growth rate in abnormal years. In order to address this empirical issue,

equation (5.11) is augmented by including an interaction variable $D*\frac{I}{Y}$ which is the product of the dummy variable for the abnormal years (D) and the investment-GDP ratio. The augmented model is :

$$(5.12) \qquad \dot{Y} = \beta_0 + \beta_1 \frac{I}{Y} + \beta_2 \dot{L} + \beta_3 (\frac{X}{Y} * \dot{X}) + \beta_4 D * \frac{I}{Y} + e_2$$

where, β_1 now measures the marginal productivity of capital in the non-export sector in normal years and $(\beta_1 + \beta_4)$ measures the same in abnormal years.

It is important to note that equations (5.11) and (5.12) are specified under the assumption that the state of technology, the skill composition of labour force and the characteristics of socio-economic institutions remain unchanged over the sample period, 1961-1992. Strictly speaking, none of the above factors was constant during this period. Last three decades in Bangladesh witnessed the gradual adoption of the HYV technology in agriculture, emergence of the garment industry which requires industry-specific skills, a significant increase in the adult literacy rate and an expansion of the underground economy through the institutionalisation of malpractices. It is difficult, if not impossible, to obtain time series data on each of the above factors. As a second-best option, equation (5.12) is modified by including a trend variable (T). The coefficient of the trend variable is expected to capture the net marginal effect of the above set of factors on the GDP growth rate. Thus the final version of our empirical model can be expressed as :

$$(5.13) \qquad \dot{Y} = \beta_0 + \beta_1 \frac{I}{Y} + \beta_2 \dot{L} + \beta_3 (\frac{X}{Y} * \dot{X}) + \beta_4 D * \frac{I}{Y} + \beta_5 T + e_3$$

Expected signs of the coefficients and their meanings are outlined below :

1. $\beta_1 > 0$: The marginal productivity of capital in the non-export sector in a normal year must be positive.
2. $\beta_2 > 0$: The ratio of the marginal productivity of labour in the non-export sector to the economy-wide average productivity of labour is positive.
3. $\beta_3 > 0$: The sum of the productivity differential and the externality effect is positive.
4. $\beta_4 < 0$: The marginal productivity of capital in the non-export sector in an abnormal year is less than that of a normal year. β_4 measures the deviation of marginal productivity of capital in an abnormal year from that of a normal year. In an abnormal year, the marginal productivity of capital is the sum of β_1 and β_4

5. $\beta_5 \geq or \leq 0$: The sign of β_5 is a priori indeterminate. Because β_5 measures the net marginal impacts of the state of technology, the extent of corruption, and the skill composition of the labour force. The state of technology and skill level improved over time but the extent of corruption increased. The former is likely to increase total factor productivity while the latter may lead to a decrease in GDP growth through misallocation of resources as well as under reporting. Hence, the sign of β_5 is an empirical matter.

5.5 Estimation Techniques

We begin the estimation exercise by employing the OLS technique to estimate the population parameters in equations (5.11), (5.12) and (5.13). Diagnostic tests were conducted to examine whether the OLS residuals derived from each equation satisfy the assumption of the classical linear regression model (CLR). The test results suggest that in all equations the assumption of homocedasticity is violated because the error variance follows a first order Auto Regressive Conditional Heteroscedastic (ARCH) process. Following Engle (1982), the error variance conditional on the past can be expressed as :

$$(5.14) \quad \text{var}[e_t / e_{t-1}] = \alpha_0 + \alpha_1 e_{t-1}^2, \quad t=1,....T,$$

Empirical estimation of this equation involves the regression of the square of the OLS residual, $\hat{e}_t^2$ on the lagged variable, $\hat{e}_{t-1}^2$ (Green, 1993):

$$(5.15) \quad \hat{e}_t^2 = \alpha_0 + \alpha_1 \hat{e}_{t-1}^2$$

A Lagrange Multiplier (LM) test of the null hypothesis of no ARCH effect (the classical regression model) can be conducted using the following χ^2 statistics:

$$\chi^2 = TR^2$$

where, T is the number of observations and R^2 is the coefficient of determination associated with the OLS estimate of equation (5.15). The null hypothesis of no ARCH effect is rejected if the computed χ^2 is greater than the critical χ^2 with 1 degree of freedom. An application of the above LM test suggests that conditional error variance follows a first order ARCH process in all three equations (5.11, 5.12 and 5.13) of the GDP growth rate.The result on the LM test are presented in Table 6.4 in the next chapter. Engle, Lilien and Robins (1987) has developed an efficient non linear estimation technique to estimate a model with an ARCH process. This technique involves the maximum likelihood estimation (MLE) of the parameters of the GDP growth equation and the error variance equations simultaneously.

The empirical results derived from both the OLS and the MLE technique are presented and analysed in the next chapter.

5.6 Variable Definition and the Data

5.6.1 Definition of variables

- **Gross Domestic Product:**

  The growth rate of GDP is measured as

  $$\dot{Y} = \frac{Y_t - Y_{t-1}}{Y_{t-1}}$$

  where GDP is evaluated at 1984-85 constant prices.

- **Investment:**

  The share of investment in GDP is measured as :

  $\frac{I_t}{Y_t}$; where I is the sum of private and public investment, measured at 1984-85 constant price.

Public sector investment includes expenditure on construction, machinery equipments, land improvement, economic infrastructure etc. Private sector investment primarily consists of expenditure on construction materials, machinery, equipments and transport equiptments as mentioned in the BBS (1993).

- **Exports**

Exports include receipts or inflow of funds on account of merchandise (f.o.b.) and non-factor services, where the former comprises the market value of goods including non monetary gold. It also includes the market value of related distributive services up to the customs frontier of the exporting economy, that is f.o.b. (free on board) value (which excludes insurance and freight and other charges recoverable from importer). Non-factor services comprises of shipment, passenger and other transport services and travel, as well as current account transactions not separately reported.
The growth rate of export is calculated as :

$\dot{X}_t = \frac{X_t - X_{t-1}}{X_{t-1}}$ measured in real terms as before.

- **Labour Force**

Growth rate of labour force is defined as:

$$\dot{L}_t = \frac{L_t - L_{t-1}}{L_{t-1}}$$

The labour force data for the whole sample period are not available for Bangladesh. Hence we were faced with two alternatives, one is to generate labour force data from the available data pools using a growth formula and the other is to use population growth rate as a proxy variable. The former yields a labour force growth series with little fluctuation over time and use of this artificially generated variable is not desirable in a regression equation. Therefore the study uses the population growth rate as a proxy for the labour force growth. rate. [5]

- **Interaction Dummy Variable**

The interaction dummy, is defined as $D*\frac{I}{Y}$ where, D = 1 for an abnormal year and D = 0 for a normal year.

- **Trend variable**

The trend variable takes a value of 1 (one) for the first year of the sample and 2 (two) for the second year and so on.

5.6.2 Data sources

The annual time series data are used covering the period from 1960 to 1992. The sample covers both the pre-independence(1961-62 to 1971-72) and the post independence period(1972-73 to 1991-92). The data are given on a fiscal year (July-June) basis for the flow variables and midyear basis for stock variables.

In the present study, Bangladesh Bureau of Statistics (BBS) is the prime source of the data for the post liberation period . The data on GDP, investment, (private and public), population and export for the post liberation period are collected from the publication entitled 'Twenty years of National Accounting in Bangladesh' (BBS, 1993). The data on merchandise export, composition of the export, terms of trade, direction of export are collected from 'Export from Bangladesh 1972-73 to 1991-92' (Export Promotion Bureau), Economic Trend, (Bangladesh Bank 1994), Annual Report 1992-93 (Bangladesh Bank), Statistical Digest 1973 (BBS 1973) and Statistical Year Book (BBS 1993) .

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[6]Other studies such as Feder 1983, Ram 1985, Balassa 1985, Greenaway and Sapsford 1994 used population growth as proxy for the labour force growth rate, in the context of LDCs

The data for the pre-independence period have been collected from both national and international sources which include Research Report Series 7 of Bangladesh Institute of Development Studies (Alamgir and Berlage 1972) and World Tables (World Bank, 1988-89 and 1992).Alamgir and Berlege (1972) provides data for the period 1960-69 on GDP, investment and export. For the period 1969-70 to 1971-72, the World Table 1988-89 has been used as these observations are not found in Alamgir and Berlege (1972). Due to unavailibility of the data for the period 1960-72 in the BBS, rigorous efforts have been devoted in collecting and compiling consistent time series data using multiple sources. The accuracy and consistency of the data have been checked using publications of both national and international agencies.

Chapter: 6 Empirical Results

6.1 Introduction

The objective of this chapter is to present and analyse the empirical results of this study. The empirical work is based on a sample of 32 annual observations. When we transform the data into growth from its level we loose one observation. Hence we use 31 observations in our econometric analysis covering the period 1961-62 to 1991-92. The empirical analysis is conducted for the whole sample as well as for the two sub-periods:

(i) Pre-liberation period : 1961-62 to 1971-72.

(ii) Post-liberation period : 1972-73 to 1991-92.

Though Bangladesh declared its independence on 26 March 1971, it emerged as an independent state on 16 December 1971, after nine months of liberation war. So we include the fiscal year, June 1971 to July 1972 in the pre-liberation period. Most government sources in Bangladesh compiled data from 1972-73 and consider it as the first fiscal year of the post-liberation period. We follow this official tradition in dividing the whole sample into two sub-samples.

The chapter is organised in the following way. Section 6.2 presents the results of our preliminary investigation in terms of descriptive statistics. The correlation analysis and the OLS results for the whole sample period is presented in section 6.3. The maximum likelihood estimates of the ARCH model is analysed in section 6.4. Section 6.5 includes the results for pre-liberation and post-liberation periods. The effects and the composition of exports on GDP growth for the post-liberation period are discussed in section 6.6. Section 6.7 presents the results for the effects of private vis-a-vis public investment. The final section summarises the key findings of our empirical work and compare these with previous other studies.

6.2 Some Preliminary Results

In this section, we will discuss the descriptive statistics of the key variables. These statistics are expected to complement the graphical illustration of variables presented in chapter 4. Table 6.1 presents descriptive statistics of the variables for the whole sample period as well as for two sub-periods. Mean GDP, export, population and

investment were higher in the post liberation period. We also observe higher average annual growth rates of GDP and exports in the post liberation period. Similar pattern is observed in case of the investment-GDP ratio.

Table 6.1 Descriptive statistics of key variables

	Mean and Standard Deviation		
Variables	**1961-62 to 1991-92 31 observations**	**1961-62 to 1971-72 11 observations**	**1972-73 to 1991-92 20 observations**
GDP	316,400	195,800	382,730
	(113400)	(29237)	(82476)
Population	82.737	64.649	92.685
	(16.697)	(4.8035)	(11.596)
Export	31142	17936	38405
	(19476)	(2949.1)	(20925)
Investment	36222	19048	45667
	(19200)	(5201.7)	(17412)
Growth Rate of GDP	0.0433	0.0416	0.0443
	(0.0401)	(0.0444)	(0.0387)
Investment-GDP Ratio	0.1095	0.0981	0.11582
	(0.0299)	(0.0239)	(0.0316)
Growth Rate of Population	0.0221	0.0232	0.0215
	(0.0038)	(0.0053)	(0.0027)
Growth Rate of Export	0.0747	-0.0241	0.1291
	(0.1979)	(0.1334)	(0.2091)

Note: Figures in the parenthesis are standard deviation.

The average annual growth rates of GDP and export were 4.4 and 12.9 percent respectively in the post liberation period, and 4.16 and -2.4 percent in the pre-liberation period, again respectively. From the average figure one may infer that the growth rate of export stimulated the growth rate of GDP in the country.

The average annual growth of export stood negative (-2.4) in the pre-liberation period due to the inclusion of two abnormal years (political instability and liberation war of 1970-71 and 1971-72) in the pre liberation sample.

6.3 The Results of the Whole Sample Period

6.3.1 The Correlation analysis

The correlation co-efficient between GDP and export for the whole sample period is shown in table 6.2. The correlation co-efficient between the levels of GDP and export is 0.878 with a t-statistic of 9.88. Similar strong and highly significant relationship is also found between per-capita GDP and per-capita export. These results may not be a reflection of causal relationship between GDP and export.

Table 6.2 Correlation between GDP and exports
period : 1961-62 to 1991-92 (whole sample period)

Measures	Correlation Coefficient
(1) GDP and Export	0.878 (9.88)
(2) Percapita GDP and Percapita Export	0.704 (5.34)
(3) GDP net of Export and Export	0.828 (7.95)
(4) GDP and Ratio of Export to GDP	0.428 (2.55)
(5) GDP net of Export and Ratio of Export to net GDP	0.356 (2.05)
(6) Growth rate of GDP and growth rate of Export	0.331 (1.88)
(7) Growth rate of GDP, and weighted growth rate of exports $= \frac{X}{Y} * \dot{X}$	0.313 (1.77)

Note : Figures in parenthesis shows computed t-statistics; Critical $t_c = t_{\alpha/2,29} = 2.04$

Since export is a component of GDP one would normally expect a high correlation coefficient. In order to determine a systematic economic relationship rather than an accounting relationship, we report alternative correlation co-efficients. A positive and statistically significant association between GDP and the share of export in GDP is observed. The correlation coefficient between GDP net of exports and export is 0.83 which indicates a significant positive association between export and non-export sector output. The result seems to be consistent with our theoretical framework where

export sector can generate positive production externality in the non-export sector. The correlation between GDP net of export (net GDP) and the ratio of export to net GDP is reported in row 5 of the table. This correlation co-efficient is positive but small in magnitude (0.356). We also find a low correlation coefficient between GDP growth and export growth. The correlation coefficient decreases from 0.88 to 0.33, when we express the variable in terms of growth, rather than level. It simply indicates that both export and GDP have strong trend components. Similar relationship exist between the growth rate of GDP and the weighted growth rate of export (r = 0.313).

6.3.2 The OLS results

This sub-section presents the OLS estimates of the GDP growth equations 5.11, 5.12 and 5.13. The results are presented in table 6.3. The estimated equation (6.1) yields a low $R^2 = 0.16$. The weighted export growth has a significant positive effect on GDP growth. If weighted export grows by 1 percent, GDP increases by 1.04 percent. None of the other variables are statistically significant. As noted in chapter 5, the coefficient of investment-GDP ratio measures the marginal productivity of capital in the non-export sector which is found to be negative but statistically insignificant in equation 6.1.

2

Table 6.3 Results of the OLS estimates for the whole sample

Period 1961-62 to 1991-92

Equation	Constant	I/Y	$\dot{L}$	$X/Y*\dot{X}$	DI	Trend	R^2	F-Value	No. of obs.
OLS (6.1)	-0.025 (-0.38)	-0.010 (-0.04)	2.721 (1.27)	1.037 (2.17)	-	-	0.16	1.67	31
OLS (6.2)	-0.062 (-1.00)	0.061 (0.26)	4.271 (2.04)	1.301 (2.85)	-0.399 (2.33)	-	0.30	2.82	31
OLS (6.3)	-0.059 (-0.97)	0.229 (0.89)	4.148 (2.02)	1.521 (3.22)	-0.422 (-2.51)	-0.001 (-1.47)	0.36	2.79	31

Note:
Numbers in parentheses are t-statistics.
The critical value of F-statistics at the 5 percent level of significance for each OLS equation is given below:
Equation (6.1): F[3,27] = 2.96
Equation (6.2): F[4,26] = 2.74
Equation (63): F[5,25] = 2.60

Theoretically, an increment in capital stock cannot decrease output. To identify possible causes of this unexpected result, we investigate the data carefully and find that in some abnormal years the GDP growth has decreased despite an increase in investment. These abnormal years include periods of wars, natural calamities and political turmoils. Each of these events involve destruction of infrastructure and other forms of capital stock. Hence, investment in an abnormal year was primarily used for maintaining existing capital stock or financing depreciation expenditure. Therefore, one may expect a statistically insignificant effect of an increase in the investment-GDP ratio on GDP growth. Finally, in equation (6.1), the growth rate of population has a positive but statistically insignificant (at the 5 percent level) effect on GDP growth. The F-test suggests that the set of all explanatory variables in equation 6.1 has statistically insignificant effect on GDP growth rate at the 5 percent level of significance.

In order to isolate the effects of investment in abnormal years from that of normal years we introduce an interaction dummy, which is the product of the investment-GDP ratio and the dummy variable (D) for abnormal years. Equation 6.2 includes the interaction dummy variable, D*I/Y as an additional regressor.

The coefficient of the interaction dummy is negative and highly significant which indicates that GDP growth declined in abnormal years despite an increase in the share of investment in GDP. Marginal productivities of capital in normal and abnormal periods are 0.062 and -0.337 (=0.062-0.399) respectively. In equation 6.2 both the population growth and the weighted export growth variables obtain theoretically expected positive and significant coefficients.

The empirical model is further augmented by including a trend variable. The rationale for including this variable is discussed in section 5.4. Equation 6.3 in table 6.3 presents the corresponding OLS estimates. The coefficient of the trend variable is negative but insignificant at the 5 percent level. The trend variable obtains a negative coefficient of -0.001 with a t-statistics of -1.47. The result seems to suggest that positive effects of technological improvement and human capital accumulation on GDP growth were outweighted by the negative effects of corruption and political uncertainty. In addition, adoption of inappropriate technology due to factor price distortion in some industries adversely affected the growth of the economy. Most of the nationalised industries experienced large losses and inefficiencies and the state failed to channel the accumulated riches into productive industrial investment (Khan and Hossain, 1989). Absence of a political framework, inadequacy of infrastructure,

illegal enrichment, over and under invoicing of purchase and sale had contributed to a consistent expansion of short term speculative activities over time, rather than long-term productive activities. Thus, the negative coefficient of the trend variable is consistent with these stylised facts in Bangladesh.

Both the population growth and the weighted export growth variables have statistically significant positive effects on GDP growth. Estimates of the marginal productivity of capital in the non-export sector is positive in a normal year and negative in an abnormal year. However, the former is not statistically different from zero even at the 10 percent level of significance.

6.3.3 Summary of the OLS results

We now summarise the OLS results reported in the table 6.3. The null hypothesis that all of the coefficients except the constant term are zero can be rejected at the 5 percent level of significance for the OLS equations (6.2) and (6.3) but not for the OLS equation (6.1). This result is derived using the F-test at the 5 percent level of significance. This F-test justifies the inclusion of the interaction dummy and the trend variable as additional regressors in the initial empirical specification. This modification of our initial specification increases the R^2 from 0.16 to 0.36.

With respect to the individual parameters, we observe that signs of the coefficients of population growth and weighted export growth remain positive in all OLS equations but the magnitudes of the coefficients vary across equations. The key parameter of interest, the coefficient of weighted export growth, lies between 1.04 and 1.52. This means that 1 percent growth in weighted export leads to more than 1 percent growth in GDP.

The coefficient of the population growth rate lies between 2.72 and 4.27. Recall that unlike the traditional neoclassical growth equation, in the present theoretical framework the coefficient of population growth rate (a proxy for labour force growth) measures the ratio of marginal productivity of labour in the non-export sector (MP_L^N) to economy-wide average productivity of labour (AP_L). In a labour surplus economy like Bangladesh one would expect a qualitatively negligible marginal effect of population growth on GDP growth. We explore some plausible reasons for obtaining a large coefficient for the population growth variable. Firstly, the empirical model assumes that skills of the labour force remain unchanged over the sample period. This assumption is obviously unrealistic because all measures of educational attainment

(adult literacy rate, enrolment in educational institutions) improved significantly over the period 1961-1992. Unfortunately, a consistent time series for measuring skills or educational attainment was not available for the full sample. Consequently, the empirical model omit the impact of human capital accumulation. Hence, it is reasonable to expect that the coefficient of population growth rate (as well as the coefficient of the trend variable) partly captures the effect of human capital accumulation. The second explanation for the large coefficient of population growth may be related to the measurement of labour force. A change in the population growth rate this year is likely to be reflected in the labour force growth rate after 15 years. Hence, the population growth rate may not be a very good proxy for labour force growth rate. However, the present study uses this proxy like other studies on economic growth of LDCs such as Feder (1983), Balassa (1985), Ram (1987), Greenaway and Sapsford (1994) , due to data limitations.

The OLS result on the coefficient of the investment- GDP ratio is puzzling. This coefficient measures the marginal productivity of capital in the non-export sector and is found to be insignificantly different from zero. But the marginal productivity of capital cannot be zero in a capital scarce economy like Bangladesh. Hence, we conduct diagnostic tests of OLS residuals to verify whether they satisfy the assumptions of classical linear regression model. The result suggests that all OLS equations in table 6.2 violate the assumption of homoscedasticity. Thus, the OLS estimator does not yield most efficient parameter estimates in this context. Next section presents results derived from a more efficient estimator which yields estimates of the parameters of the GDP growth equation and the error variance equation simultaneously.

6.4 The Results of the Auto Regressive Conditionally Heterocedastic (ARCH) Model

In general, heteroscedasticity is associated with the cross-sectional data. Time series are often investigated in the context of homocedasticity. However, analysing macro economic time series on inflation, Engle (1982, 1983) and Craig (1982), observed that large and small forecast errors, occur in clusters. This finding implies that the variance of the current forecast error depends on the size of the last period's error, That is the conditional error variance, Var $[e_t / e_{t-1}]$ follows an auto regressive process. Our graphical investigation of the OLS residuals for each equation seems to indicate that large and small residuals occur in clusters. This preliminary evidence induces us to apply a formal test for the ARCH process. The test-statistic is explained

in section 5.5 and the test results are reported in table 6.4. As noted in chapter 5 the LM test-statistic follows a χ^2 distribution with 1 degree of freedom.

Table 6.4: Lagrange Multiplier (LM) test for the first order ARCH process

Equations	Computed LM statistics
OLS equation (6.1)	8.684
OLS equation (6.2)	8.583
OLS equation (6.3)	10.957

Note: Critical $\chi^2_{0.05,1} = 3.84$

The computed χ^2 is greater than critical $\chi 2=3.84$ at the 5 percent level of significance for each OLS equation which means that the null hypothesis of no ARCH effect is rejected. Thus the classical linear regression model is incompatible with the data and the OLS is no longer the most efficient estimator. Hence we adopt the estimation technique developed and used by Engle (1982) and Engle, Lilien and Robins (1987) which involves the maximum likelihood estimation (MLE) of the model with an ARCH process. The MLE results for the modified GDP growth equation (5.13) and the corresponding variance equation (5.14) are presented in Table 6.5.

Table 6. 5 The ARCH MODEL

(6.4) GDP Growth Equation:

$$\dot{Y} = -0.045 + 0.351\frac{I}{Y} + 2.589\dot{L} + .957\frac{X}{Y} * \dot{X} - 0.301DI - 0.001T$$

(-0.99) (1.92) (1.69) (2.88) (-2.83) (-1.75)

Log-likelihood function = 66.51

(6.5) Variance Equation:

$$\sigma_t^2 = 0.0004 + 0.598e_{t-1}^2$$

(2.46) (1.69)

Where, σ_t^2 is the variance conditional on past error, i.e.

$\sigma_t^2 = Var[e_t / e_{t-1}]$

Note : Numbers in parentheses are computd t-statistics.

Critical t statisticts: $t_{0.05,25} = 1.71$, $t_{0.05,25} = 1.71$ and $t_{0.10,25} = 1.32$

It may be noted that initially we estimated three versions of GDP growth equations (5.11, 5.12 and 5.13) under the ARCH framework. Investigating the results we accept the modified GDP growth equation on both conceptual and empirical ground. The rational for the modification of the model by including an interaction dummy and a trend variable is discussed in section 5.4. The empirical reason for accepting the modified growth equation is that it yields the highest value for the log likelihood function. The estimated variance equation in table 6.3 satisfy the stationarity condition because the coefficient of e^2_{t-1} is less than unity.

The MLE estimates of the ARCH model yields more efficient parameter estimates than the OLS estimates of the classical linear regression (CLR) model. For all coefficients we obtain theoretically expected results with smaller standard errors. The marginal productivity of capital in the non-export sector is 0.35 in a normal year and 0.05 (= 0.35-0.30) in an abnormal year. An alternative interpretation to this result is that, if the investment-GDP ratio increases by 1 percent, GDP increases by 0.35 percent in a normal year and 0.05 percent in an abnormal year. The t-statistics of both the investment-GDP ratio and the interaction dummy suggest that the above findings are statistically significant at the 5 percent level. The population growth rate variable obtains a positive coefficient with a t-statistic of 1.69. For the export variable, we observe that GDP increases by 0.957 percent when weighted export grows by 1 percent. The result suggests that the sum of the productivity differential and externality effect is close to unity.

6.4.1 The Likelihood Ratio test for the significance of export

As an alternative to t-test, the Likelihood Ratio Test (LR) is conducted to find whether the weighted export growth has statistically significant effect on GDP growth. the (LR) test can be defined as LR=-2 (InLc - InLu) where, InLc is the log of the likelihood function associated with the constrained equation as follows:

$$\dot{Y} = \beta_0 + \beta_1 \frac{I}{Y} + \beta_2 \dot{L} + \beta_4 D^* \frac{I}{Y} + \beta_5 T + U \tag{6.6}$$

and LnLu is the log likelihood function of the unconstrained equation of (6.4); and U_t is the error term in the constrained regression. We test the following hypothesis

$$H_0: \beta_3 = 0,$$

$$H_1: \beta_3 \neq 0$$

where β_3 is the coefficient of weighted export growth in the unconstrained equation (6.4).

Substitution of estimated log likelihood functions in the expression for LR statistic yields the following value: LR= -2 (64.7641-66.5101)=3.492. The null hypothesis of no-significant effect of weighted export growth on GDP growth can be rejected at the 10 percent level of significance but not at the 5 percent level of significance since $\chi^2_{(0.10,1)} = 2.71$ and $\chi^2_{0.05,1} = 3.84$. Since the computed LR statistics is very close to $\chi^2_{0.05,1}$, we conclude that the export promotion has statistically significant positive effect on GDP growth. This result compliment our earlier t-test for the coefficient of weighted export growth. The trend variable has a negative and statistically significant effect at the 5 percent level. Given our empirical framework in section 5.4, this finding seems to indicate that introduction of inappropriate technology, institutionalisation of corruption and political instability in Bangladesh negatively affected GDP growth. The annual GDP growth rate in Bangladesh would be 0.1 percent higher in the absence of any systematic negative impacts of the trend variable.

6.5 The Results for Post Liberation (1972-73 to 1991-92) and Pre Liberation Periods (1961-62 to 1971-72).

6.5.1 Correlation analysis for sub-periods

The results of the correlation analysis for two sub periods are reported in table 6.6. The correlation coefficient for the post liberation period between GDP and export is 0.954 with a t-statistic of 13.50, which implies both variables are directly and highly correlated. The correlation between per-capita GDP and percapita export shows a similar coefficient of 0.928 with the t-statistic of 10.57. To identify the economic relationship rather than the accounting relationship we estimate the degree of correlation between GDP and the ratio of export to GDP. The coefficient takes a value of 0.919. GDP net of export and export itself is also strongly correlated. Between the growth rate of GDP and the growth rate of export we find a positive correlation coefficient of 0.31. For weighted exported growth rate we get a correlation coefficient of 0.306.

The pre libation period includes eleven observations. In this period the relationships between GDP and export, GDP and the ratio of export to GDP, GDP net of export and export, and per-capita GDP and per-capita export, all appear unexpectedly negative. But the relationship between the growth rate of GDP and the growth rate of export is positive (r=0.476). Further investigation of the data suggests that in this sub-sample of 11 annual observations the correlation coefficient are dominated by abnormal observations (on liberation war period). After excluding these abnormal observations we obtain positive correlation coefficients for the pre-liberation period.

In the multiple regression model, the dummy variable for the abnormal years is employed instead of excluding abnormal years from the sample.

To capture the effects of policy changes, we further sub-divide the post-liberation period into two periods: 1972-73 to 1981-82 and 1982-83 to 1991-1992. The latter period was characterised by more outward-oriented policies than the former period. The major characteristics of each policy regime were outlined in Table 5.1 in chapter 5. In Table 6.7, we observe all correlation coefficients are statistically significant, and greater in 1982-83 to 1991-92 than those of 1972-73 to 1981-82. This may be attributed to the change in the policy regime in Bangladesh.

Table 6.6 Correlation coefficient between different measures of GDP and export Sub-Periods : 1972-73 to 1991-92 and 1961-62 to 1971-72

Measures	Correlation Coefficient
Period : 1972-73 to 1991-92	
1). GDP and Export	0.954 (13.50)
(2) Percapita GDP and Percapita Export	0.928 (10.57)
(3) GDP net of Export and Export	0.919 (9.88)
(4) GDP and Ratio of Export to GDP	0.912 (9.43)
(5) GDP net of Export and Ratio of Export to net GDP	0.870 (7.49)
(6) Growth rate of GDP and growth rate of Export	0.310 (1.38)
(7) Growth rate of GDP, and weighted growth rate of exports $((X \setminus Y^* \dot{X})$	0.306 (1.36)
Period 1961-62 to 1971-72	
(1). GDP and Export	-0.304 (-0.96)
(2) Percapita GDP and Percapita Export	-0.449 (-1.51)
(3) GDP net of Export and Export	-0.392 (-1.28)
(4) GDP and Ratio of Export to GDP	-0.825 (-4.38)
(5) GDP net of Export and Ratio of Export to net GDP	-0.880 (-5.56)
(6) Growth rate of GDP and growth rate of Export	0.476 (1.62)
(7) Growth rate of GDP, and weighted growth rate of exports $(X \setminus Y^* \dot{X})$	0.444 (1.48)

Figures in parenthesis are computed t-statistics

Critical $t_c = t_{.025,18} = 2.10$, Critical $t_c = t_{0.29,9} = 2.26$

From 1983 the government had adopted the policies of privatisation, denationalisation of the banking and industrial sector which was followed by structural adjustment program (under the sponsorship of World Bank) and the liberalisation of trade and finance sector in Bangladesh. Thus the correlation analysis seems to provide empirical support for the strategy of export oriented growth.

Table 6.7 Results of correlation co-efficient for sub sample of 1971-72 to 1981-82 and 1982-83 to 1991-92

Measures	Correlation Co-efficient
1971-72 to 1981-82	
1. GDP and Export	0.861
2. Per capita GDP and Per capita Export	0.592
3. GDP net of Export and GDP	0.779
4. GDP and Ratio of Export to GDP	0.732
5. GDP net of Export and Ratio of Export to net GDP	0.627
6. Growth rate of GDP and Weighted Growth rate of Export	0.384
1982-83 to 1991-92	
1. GDP and Export	0.935
2. Per capita GDP and per capita, Export	0.910
3. GDP net of Export and GDP	0.854
4. GDP and Ratio of Export to GDP	0.859
5. GDP net of Export and Ratio of Export to net GDP	0.756
6. Growth rate of GDP and weighted growth rate of Export	0.455

6.5.2 The OLS results for sub - periods

The OLS results for the post liberation period (1972-73 to 1991-92) is presented in the first three rows of Table 6.8. The results show that weighted export has significant positive effect on GDP growth rate in all empirical specifications of the theoretical model. The coefficient of export growth lies between 0.89 and 1.24 in the post-liberation sample. The interaction dummy significantly and adversely affected GDP growth in abnormal years. Note that the coefficient of the investment-GDP ratio remains insignificantly different from zero even after the inclusion of the interaction dummy variable.

Table 6.8 The OLS results for two sub periods

Equation	Constant	I/Y	$\dot{L}$	$X/Y\dot{X}$	$D*\frac{I}{Y}$	TREND	R2	F-value
Post-liberation Period : 1972-73 to 1991-92								
6.7	-0.030	-0.316	4.60	0.892	-	-	0.30	2.30
	(-0.032)	(-1.15)	(1.36)	(1.71)				
6.8	-0.134	-0.140	8.612	1.234	-0.410	-	0.48	3.45
	(-1.42)	(-0.55)	(2.46)	(2.52)	(-2.27)			
6.9	-0.196	-0.278	10.636	1.24	-0.390	.0015	0.49	2.73
	(-1.41)	(-0.813)	(2.21)	(2.49)	(.-2.08)	(0.63)		
Pre-liberation Period : 1961-62 to 1971-72								
6.10	-(0.193)	1.283	4.688	2.287	-	-	0.63	4.14
	(-2.31)	(2.71)	(2.01)	(1.95)				
6.11	-0.158	0.866	5.25	3.295	-0.649	-	0.74	4.35
	(-1.98)	(1.71)	(2.42)	(2.64)	(-1.56)			
6.12	-0.187	0.863	5.528	4.333	-0.820	0.004	0.80	3.93
	(-2.29)	(1.74)	(2.61)	(2.86)	(-1.90)	(1.15)		

Note : Numbers in parenthesis are t-statistics

The effect of population growth on GDP growth is positive but unexpectedly high in magnitudein both sub-samples. The coefficient of the trend variable is not significantly different from zero. The OLS results for the pre-liberation sample are given in the last three rows of Table 6.6. We obtain theoretically expected results for all explanatory variables in case of the pre-liberation sample. Weighted export growth has a larger marginal impact on GDP growth in pre liberation period than the post liberation period. The marginal productivity of capital in the non-export sector was positive and significantly different from zero in the pre liberation period.
We do not provide the ARCH model results for the sub-periods because a test for the first-order autoregressive process in the error variance may not be reliable in a very small smaple.

We now try to reconcile the OLS results for the sub periods with our earlier OLS findings for the whole sample. The OLS results for the full sample period show that the coefficient of weighted export growth lies between 1.03 and 1.52 (see table 6.3). Comparing this finding with the results of two sub periods in table 6.8. We observe

that the results for the full sample period with respect to the weighted export variable are dominated by the post-liberation period observations. This is simply because the post liberation period includes almost two-third of the full sample. Similar arguments may also be applicable to the coefficients of other explanatory variables except population growth. Due to the small size of each sub-sample, one should interpret the results with proper caution.

6.6 Effects of the Composition of Export on GDP Growth for the Post -Liberation period (1972-73 to 1991-92)

This section investigates the effect of the change in the composition of exports on GDP growth. The pre liberation period is excluded from this analysis due to lack of data. We include weighted export growth at a disaggregated level in the empirical specification. More specifically, the weighted export growth is decomposed into manufacturing and non-manufacturing export growth and the basic empirical model is modified in the following way.

$$\dot{Y} = \beta_0 + \beta_1 \frac{I}{Y} + \beta_2 \dot{L} + \gamma_1 (\frac{X_M}{Y} . \dot{X}_M) + \gamma_2 (\frac{X_N}{Y} . X_N)\dot{} + e_1$$

where X_M and X_N stand for annual growth rate of manufacturing and non-manufacturing export respectively. If $\gamma_1 = \gamma_2$, this equation reduces to our earlier specification (5.11). The OLS results for this model and its augmented versions (which include interaction dummy and time variable) are presented in Table 6.9. The first two estimated equations (6.13 and 6.14) of table 6.9 show that the effect of manufacturing export growth is greater than that of non-manufacturing export. This is consisted with our a priori expectation. However in all specifications we obtain large standard errors (low t-statistics) for coefficients of both the manufacturing and non-manufacturing export growth variables. We suspect that large standard errors are primarily attributed to high degree of collinearity between manufacturing and non-manufacturing export growth. The multilinearity problem becomes severe when we include the trend variable (equation 6.15), because the composition of exports has changed consistently overtime in favour of the manufacturing exports. The weighted growth rate of manufacturing export obtains a relatively small co-efficient in equation (6.15) which seem to indicate that time 'variable' is capturing some of the effects of manufacturing export growth.

We obtain statistically significant positive coefficient for the trend variable, and a negative coefficient for the interaction dummy. The former finding contradicts the

result for the whole sample while the latter finding is consistent with the results for full sample.

Table 6. 9 The OLS results for 1973-74 to 1991-1992

Equation	Constant	$\frac{I}{Y}$	$\dot{L}$	$\frac{X_M}{Y}*\dot{X}_M$	$\frac{X_N}{Y}*\dot{X}_N$	$D*\frac{I}{Y}$	TREND	R2	F-value
6.13	-0.086	0.204	4.378	0.963	0.080		-	0.17	0.73
	(-1.09)	(0.702)	(1.59)	(1.05)	(0.16)				
6.14	0.190	0.432	8.229	0.846	0.339	-0.468	-	0.62	4.32
	(-3.09)	(2.043)	(3.82)	(1.32)	(0.923)	(-3.965)			
6.15	0.312	0.138	12.250	0.288	0.425	-0449	0.003	0.72	5.09
	(-3.78)	(0.573)	(4.38)	(0.45)	(1.27)	(-4.20)	(1.99)		

Note: The data on export at the disaggregated level are not available for the pre-liberation period. For calculation of growth of manufacturing and non-manufacturing export , we lose the first observation, i.e.the data for 1972-73.

6.7 The OLS Results for the Effects of Private vis-a-vis Public Investment

In order to determine whether the effect of private investment on GDP growth differs from that of public investment ,we include private and public investment separately in the regression model. The purpose of this empirical exercise is to determine whether the effects of export growth on GDP growth is sensitive to the assumption that private and public investment have identical impact on GDP growth. In this section, we relax this assumption and re-estimate the growth equations using the OLS. The results are presented in Table 6.10 The first estimated equation (6.16) shows that the private investment-GDP ratio positively affect GDP growth but the public investment GDP ratio has a negative effect. However, both coefficients are statistically insignificant at the 5 percent level of significance. The possible reason for negative effect of government investment may be due to conspicuous and unproductive investment and expenditure on maintaining existing infrastructure instead of financing business fixed investment in capital goods.[1]

[1]Bakht and Bhattachary (1991).observe that the capital productivity in the manufacturing sector during 1980s has not registered any improvement.

In equation 6.17, after adding interaction dummy. we get positive but insignificant effects on both private and public investment. The growth rate of labour force has significant effect on GDP growth rate, but the coefficient of weighted export growth variable obtains statistically insignificant coefficient.

Table 6.10: The OLS results for the post-liberation period: private vis-a-vis public investment (1972-73 to 1991-92)

Equation	Constant	$\frac{PI}{Y}$	$\frac{GI}{Y}$	$\dot{L}$	$\dot{X}(\frac{X}{Y})$	$D(\frac{PI}{Y})$	$D(\frac{GI}{Y})$	Trend	R^2	F Value
6.16	0.009 (-0.09	0.261 (0.47)	-1.109 (-1.54)	4.001 (1.18)	0.666 (1.21)	-	-	-	.36	2.13
6.17	-0.142 (-2.07)	0.195 (.51)	0.362 (.58)	7.107 (2.80)	0.303 (.721)	3.302 (2.99)	-5.181 (-3.71)	-	0.77	7.21
6.18	-0.243 (-2.52)	0.198 (.54)	-0.285 (-0.38)	10.60 (3.08)	0.297 (.74)	-3.023 (-2.80)	-4.77 (-3.47)	.0024 (1.44)	0.80	6.98

Note: Numbers in parenthesis are computed t-statistics

$\frac{PI}{Y}$ = the ratio of private investment to GDP, $\frac{GI}{Y}$ = the ratio of public investment to GDP;. = the dummy variable for abnormal year (D=1, for abnormal years and 0 'zero' otherwise).

Public investment constitutes a significant portion of manufacturing investment in Bangladesh and most of it is used in non-profiteering activities eg nationalised industries such as jute, textile and public transport. The negative relationship between GDP growth and the share of government investment may be attributed to non-profit maximising behaviour of public enterprises.

In general, the OLS results on the impacts of private vis-a-vis public investment are very sensitive to the empirical specification. Coefficients of most explanatory variables change substantially when we move from the basic GDP growth equation (6.16) to the modified growth equations. Our investigation to the data suggests that the inclusion of investment at the disaggregated level and the interaction dummies in the growth equations (6.17,6.18) create a serious multicollinearity problem. Thus the empirical model cannot precisely estimate the partial effects of the explanatory variables.

6.8 Major Findings

In this section we summarise the empirical results and compare the findings of the present study with previous empirical work. The correlation coefficient between different measure of GDP and export support the proposition that export growth strongly and positively related with GDP growth. Computing the descriptive statistics of the data for different sub-periods, we also observe that the average annual growth rate of GDP is high when the average annual export growth is high.

We specify an econometric equation based on the neoclassical sources of growth model. The major findings of the full sample are outlined below:

1. Regardless of the empirical specification and the estimation technique used, we observe that an increase in weighted export growth leads to an increase in GDP export . Our preferred empirical specification , the ARCH model (6.4) suggests that if weighted export grows by 1 percent GDP increases by 0.957 percent. The error variance equation (6.5) associated with the ARCH model suggests that the volatility in GDP growth is finite. This means that any volatility in GDP growth, originating from natural disaster or random human behaviour, will diminish over time.

2. The ARCH model of GDP growth shows that marginal productivity of capital (in the non-export sector) is higher in a normal year than that of an abnormal year. If the share of investment in GDP increases by 1 percent, we expect 0.35 percent increase of GDP in a normal year and 0.05 percent in an abnormal year. This study represents the first attempt in driving this result.

3. The population growth rate (a proxy for labour force growth) has a theoretically expected positive effect on GDP growth. However, the magnitude of the co-efficient is high (greater than unity). Considering that Bangladesh is a labour surplus economy, one would expect a coefficient less than unity which implies that 1 percent increase in labour force leads to less than 1 percent increase in GDP. We have explored possible reasons for obtaining high elasticity of GDP with respect to population in sub-section 6.3.3.

The study has also made a rigorous attempt to examine whether the impact of export growth on GDP growth changes over time. Dividing the sample into pre-liberation and post liberation period, we run separate regression for each period. Recognising that a test for an autoregressive process in error variance may be unreliable in small

sample, we present the OLS estimates, rather than the estimates of the ARCH model, for each sub- sample. (See Table 6.8). The regression analysis suggests that the effect of (weighted) export growth on GDP growth was greater in the pre-liberation period than that of the post- liberation period. However we obtain an opposite finding from the correlation analysis. Since regression coefficient measures the partial impact of weighted export growth and the correlation coefficient measures the degree of correlation between GDP and export growth without taking into account the effects of other explanatory variables on GDP growth, we don't see any obvious need to further explore the reasons for the above differential results.

This study also made an attempt to determine the effect of a change in the composition of export on GDP growth. As discussed in chapter 4, the linkage effects of export depends on the composition of exports. This analysis is restricted to the sub-period, 1973-74 to 1991-92.We observe that manufacturing export growth has greater (smaller) impact on GDP growth than that of non-manufacturing export growth, when the trend variable is excluded from (included in) the GDP growth equation. The results indicate the model does not yield precise estimates of the partial impacts of manufacturing vis-a-vis non-manufacturing export growth because the multicolinearity problem becomes severe when we include the trend variable. This problem results from the fact that the composition of export is systematically related to the trend variable .

This study also investigated whether the effect of private investment on GDP growth is different from that of public investment. Due to lack of data, the focus of this investigation was also on the post- liberation period. Both the private investment and the public investment -GDP ratio obtained statistically insignificant coefficients due to high degree of collinearly between the two variables. Hence, it is not possible to draw any firm conclusion in relation to the effects of private vis-a -vis public investment.

We now compare our results with the findings of other studies in this area.In general, we observe positive robust impact of the weighted export growth on GDP growth. This finding provides empirical support for the export led growth strategy in Bangladesh. Our finding compliments the earlier studies by Balassa (1985), Ram (1985), Kavoussi (1984), and others. Table 6.11, presents the coefficients of export growth estimated in the previous empirical studies. Many studies use simple export growth $(\frac{\Delta X}{X})$ as an independent variable in the GDP growth equation. The coefficient of simple export growth can be interpreted as the partial elasticity of GDP with

respect to export. The table 6 shows that this partial elasticity coefficient lies between 0.10 and 0.57 (coefficients with superscript 'a'). On the other hand, the coefficient of the weighted export growth lies between 0.42 and 2.24 (coefficients with superscript 'b').

Table 6.11 Estimated coefficient of export growth in models of GDP growth

Study	Nature of the study	Co-efficient of Export Growth
Kavoussi (1984, p. 247)	A cross section analysis of 73 developing countries, 1960-1978	0.105^a
Ram (1985, p. 419)	A cross section study of 73 LDCs, 1970-1977	0.148^a
Balassa (1985, p.33)	A cross section study of 43 developing countries, 1973-78	0.161^a
Tyler (1986, p.128)	A cross section study of 55 middle income LDCs, 1960-1977	0.57^a
Feder (1983, p. 128)	A cross section study of 31 LDCs, 1964-1973	0.422^b
Ram (1987, p. 61)	A cross section study of 34 countries (low income) 1978-82	1.266^b
Sattar (1993)	A time series analysis on Bangladesh covering 1979-92	2.24^b
Greenaway and Sapsford (1944, p.161)	A time series study on Pakistan, 1971-85.	1.971^b
The present study	A time series study on Bangladesh, 1962-1992	0.957^b

Note: a. The coefficient of annual rate of growth of exports, $\dot{X}$

b. The coefficient of weighted annual export growth rate, $\frac{X}{Y} * \dot{X}$

Feder (1983), Greenaway and Sapsford (1994), Ram (1987) and Sattar (1993) used the weighted growth rate of export $(\frac{\Delta X}{X} * \frac{X}{Y})$ as an explanatory variable in the GDP growth equation and their estimated coefficients are 0.422 and 1.97, 1.27 and 2.24

respectively. Our ARCH model provides a coefficient of 0.957 which lies within the range of previous estimates. The study by Sattar (1993) is based on a sample of only 13 observations. He observes that if weighted export grows by 1 percent GDP increases by 2.24 percent. This finding should be interpreted with caution due to very small size of the sample. UN study (1985) on selected developing economies of ESCAP region including India, Pakistan, Sri Lanka, Myanmar and Bangladesh, concludes that countries with high export growth rates have generally experienced high growth rate of GDP. Thus our study supports the hypothesis that a rapid growth of exports accelerates the economy's growth which is in line with the previous studies.

Chapter 7 : Summary, Conclusions and Policy Implications

7.1 Restatement of the Problem

Trade sector plays a vital role in the development process of any country. An assessment of the role of export in economic growth is of obvious importance both at the theoretical and empirical level. The standard neoclassical trade argument would postulate a substantial positive impact of exports on aggregate economic performance due to better allocation of resources. The 'two gap' model of development also suggests an important role of export to bridge the foreign resource gap. The historical experience of presently developed countries shows that industrialisation is an inescapable part in the process of increasing per-capita income. Export oriented industrialisation is advocated on the basis of :

- a positive externality and productivity impacts;
- a source of scarce foreign exchange and;
- a measure of employment generation.

Bangladesh has neither the natural resource base nor the domestic market to sustain industrial growth based on a restricted trade policy. Indeed, industrial raw materials and other intermediate goods accounted for over 65 percent of total imports in 1991 and this is the pre requisite for industrial growth. Hence export growth is necessary to finance growing import demand for industrial raw materials. Due to limited purchasing power of the vast majority of the population, the opportunities for efficient import substitution may not exist in Bangladesh. Moreover, the agricultural sector cannot provide employment to a rapidly growing labour force as the bringing of new land under cultivation is totally exhausted.

One of the basic problems facing the policy makers in Bangladesh is the allocation of scarce resources more efficiently to increase the productive capacity of the economy. Under our present framework, the essence of the problem is to determine the optimal allocation of resources between the export and non-export sector of the economy. In order to address this important policy issue, we put forward two basic questions:

1. Is the factor productivity in the export sector greater than that of the non-export sector?

2. Does the export sector generate positive production externality for the non-export sector?

If the sum of the productivity differential and externality effects is positive, then any marginal reallocation of resources from the non-export sector to the export sector will increase GDP growth. This is obviously an empirical issue, and the central aim of this dissertation is to investigate this issue under a well structured analytical framework.

7.2 Summary and Conclusion

The objectives of this dissertation are:

(i) to estimate the effect of aggregate export growth on economic growth of Bangladesh;

(ii) to investigate the composition of export and its relation with GDP growth;

(iii) to determine whether the relation between export growth and GDP growth is sensitive to the change in the policy regime. In addition, this study examines whether the effect of private investment on GDP growth differs from that of public investment.

There exists an extensive empirical literature on the relation between export and economic growth, particularly in the context of semi-industrialised countries. We present a comprehensive review of the literature in Chapter 2. The literature suggests that there is no unique strategy for economic growth. For example, the NICs pursued industrialisation under tariff protection and government regulations in the early stage of development, which was followed by trade liberalization and financial sector deregulation. However, in the context of Bangladesh the infant industries remained "infant" under the tariff umbrella. Given this disappointing experience, Bangladesh has been actively pursuing the export-oriented industrialisation since the early 1980s. There exits only one empirical study (Satter, 1993) which made an attempt to determine the effect of export on economic growth based on 13 annual observations. Due to the small size of the sample it is impossible to draw any sound econometric inference from this study. The distinguishing features of our study compared to the previous empirical work are the following. First, this study uses a well structured theoretical framework, and attempts to solve relevant empirical problems by means of the modification of the basic GDP growth model and applying the ARCH model. Second, this dissertation investigate the effects of policy changes on export and

growth by sub-dividing the whole sample into clearly identifiable policy regimes. Third, this study uses the largest available sample (1961-1992) for empirical analysis.

We investigate the structure of export and government policies towards enhancing export performance in chapter 4. Regarding the composition of export we observe a drastic fall in the volume of traditional exports (raw jute and jute goods) and a significant increase in non-traditional export such as ready made garments, frozen fish, leather goods and fertiliser, in the last two decades. Manufacturing exports became prominent in the 1980s and by 1992-93, its share in total export reached to 86.8 percent.

Using descriptive statistics and graphs we tried to analyse the properties of the data. The preliminary analysis suggests that the volatility in export growth and the investment-GDP ratio were greater than that of the GDP growth, over the period 1961-1992. For the whole sample period, the average annual GDP growth rate was 4.3 percent, the share of investment in GDP was 10.9 percent, the growth rate of population was 2.2 percent and the growth rate of export was 7.4 percent. Sub-dividing the whole sample period into pre- and post-liberation period, we observe that in the pre-liberation period average annual growth rates of GDP, population and exports were 4.1, 2.3 and -2.4 percent respectively.[1] In the post-liberation period, average annual growth rates of GDP, population and exports stand as 4.4, 2.1 and 12.9 percent respectively. The mean investment-GDP ratio stands at 9.8 percent in the pre-liberation period and 11.5 percent in the post-liberation period.

The study adopted an augmented neoclassical sources of growth model, following Feder (1983). The empirical results suggest that the weighted growth rate of export has a positive effect on economic growth, that is the sum of productivity and externality differential effects of the export sector is positive. The null hypothesis that weighted export growth has no effect on GDP growth is rejected. This finding is not sensitive to the specification of the model and the estimation technique. With respect to the composition of export, we observe that the weighted growth rate of manufacturing export has quantitatively greater positive effect on GDP growth than that of primary export, when the trend variable is excluded from the GDP growth

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[1]Due to the inclusion of two large negative figures for export growth in the pre-liberation period (-28.6 and -22.4 percent during the period of liberation war), the average annual growth rate reduces to a negative figure.

equation. However, this result is not statistically significant. Population growth rate positively and significantly affects the growth rate of GDP. The magnitude of the partial elasticity of GDP with respect to population is unexpectedly high in our study. The effect of the investment-GDP ratio on GDP growth is positive and significant in a normal year but close to zero in an abnormal year. Private investment has greater effect on economic growth than government investment, however, the results should be interpreted with caution because of large standard errors of the coefficients resulting from the multicollinearity problem.

The data seem to suggest a relatively superior export performance after 1985, which is the period of trade liberalisation and deregulation. The average annual growth rate of export was more than 12 percent in real terms in the post liberation period. Obviously this is a significant improvement which is expected to generate employment and overall economic growth in Bangladesh. The expansion of export oriented garment sector stimulated the whole economy through its linkage effects and employment generation. The expansionary impact is likely to be greater for the non-traditional exports, because the export performance will not be subject to any demand constraint Other non traditional export item such as fish, leather products, chemical products, electronic goods have high demand in overseas markets. It may be relevant to note that growth rates of non-traditional exports in Bangladesh and Maldives were much faster then the standards set by the Asian NIEs in the 1980s (UN 1990).

Externalities of export production steaming from better trained, more productive labour force, innovative technology and efficient management have produced higher GDP growth rate by benefiting the non-export sector. The findings of this study is consistent with the result of some previous empirical studies (Ram 1987, Feder 1983, Balassa 1985 and others) on the effect of export on economic growth .

7.3 Policy Implications

The export expansion strategy must focus on solidifying the gains already achieved in the export sector by taking effective steps to create new market opportunities globally and a supportive and congenial environment domestically. To finance the recurring cost of import, Bangladesh cannot always rely on external assistance. Hence there is an urgent need to accelerate export growth based on a more outward looking industrial strategy.

There is a scope for more active and well designed government role in the identification and promotion of investment opportunities in the export sector. The

evidence of positive production externality and/or higher marginal productivity in the export sector provides the theoretical justification for government's supportive role in the Bangladesh export sector. The key ingredients of such strategy should be the following :

- .Identification of activities with proven or potential comparative advantage.
- .Providing a competitive cost structure to exporters by keeping real wage in line with productivity.
- .Eliminating any anti-export bias in the tariff and quantitative restriction regime.
- .Maintaining a competitive real effective exchange rate (REER) ..
- Streamlining the regulatory and incentive framework.

7.3.1 Policies to promote export-oriented growth

Bangladesh's external competitiveness is needed to improve for the success of a export led growth strategy. But the success of the export led growth strategy is intimately related to the extent of distortion in domestic prices which is turn depends on budgetary and monetary measures.

- **Exchange rate and fiscal policy** :

Bangladesh had a managed exchange rate system with partially flexible exchange rate. Given the high unemployment rate in Bangladesh, government may intervene to depreciate the exchange rate and increase net exports and thus aggregate demand. The depreciation of the exchange rate switches expenditure towards domestic goods which in turn improve the balance of trade.

Volatility in interest rate generate uncertainly in the economy and adversely affects the export sector because of its heavy reliance on the formal credit market. A change in both the level and composition of government expenditure is needed to reduce pressure on the interest rate. In the last decade the substantial shift in the composition of public expenditure in favour of wages and subsidies exerted an upward pressure on domestic prices and interest rate which in turn adversely affected the competitiveness of the export sector.

- **Reduction of anti-export bias**

Previous empirical work suggests that during 1975-88 import substitution industries received higher effective rate of assistance than export oriented industries in Bangladesh (Haque and Sahota, 1989, 1991). However, in recent years nominal tariff protection rate decreased from 94 percent in 1989 to 50 percent in 1993. Due to this favourable development, we observe a consistent increase in the volume of export since 1985. Given our empirical findings on the effect of export on economic growth, we suggest that the government should continue to pursue the policy of reducing anti-export bias in Bangladesh.

- **Research and development**

Research and development activities are the essence of any long run development strategy of a country. R&D activities, specially for some key export product such as garments and textiles, frozen fish, leather and jute products and handicraft deserve attention. In determining the optimal level of R&D activity the policy makers need to compare marginal cost of this activity with marginal gain , in the form of economic growth. Our analyses of the marginal impact of export growth on GDP has obvious relevance in evaluating the ultimate benefits of export-oriented R&D activity. Malaysia has invested heavily in R&D acyivities in rubber and palm oil technology. Unlike some other African countries, she was able to overcome the adverse affects of the low prices of primary commodities in the international market by involving in R and D activities to lower production cost of labour and palm oil, in the face of competition from synthetic rubber and soybean oil (Arif 1994).

- **Deregulation and trade liberalisation**

This study observes that the average annual growth rate of export was higher during the policy regime (1983-92) which implemented the policies of government deregulation and promoted trade liberalisation. Government of Bangladesh has developed a growth oriented reform program towards reforming public enterprises and financial sectors Bangladesh should continue to pursue trade liberalisation and deregulation policies. An efficient regulatory framework for private sector investment must be developed. This will assist investors to operate in a more predictable economic environment. Trade liberalisation should be accompanied by a private sector development program comprising of a wide range of deregulatory and promotional actions; legal system reforms, and institutions building to support them.

The continued dominance of the public enterprises in many key sectors and their commercial outlook, wage policy, adversely affect private sector performance. In East Asian countries, government played a crucial and pivotal role for the success of export led growth strategy. Government of Bangladesh should be more penetrating, effective and efficient in pursuance of external sector development strategy. Often entrepreneurs in Bangladesh specially exporters complain about government inactiveness, unwillingness and demotivated attitude at home and abroad in the High Commissions towards coordination and development of liaison. Government and other political agents should create congenial atmosphere for investment, specially in export oriented industries and coordination among all market agents is a necessity..

- **Identification of potential export and competitive cost structure**

On the basis of Bangladesh's resource endowment (cheap and abundant unskilled labour and plentiful reserves of natural gas), there is a presumption that potential comparative advantage might lie in yarn and textile fabric as inputs to garment sector, leather products (shoes, luggage, bags etc.) fish processing, chemical products, special jute products and handicrafts. The exporters should be provided a package of incentives given the existence of non-priced production externality in the export sector.

For export oriented industries such as garments we should focus on investments in promoting backward linkage industries so that within a few years around 80 percent of the foreign exchange lost in importing fabrics and accessories and other input for garments is domestically manufactured. Setting up of more Export-processing zones (EPZ)[2] with tax free privileges and adequate provision for infrastructural facilities is likely to encourage both domestic and foreign investors to establish industries in non garment sector such as leather, electronic goods etc. Current investment in Dhaka and Chittagong export processing zone is estimated at US $131 million (June 1994) which is very low in relation to the other Asian neighbours (Mahmood, 1994).

Foreign direct investment was one of the major factor for successful development of the domestic sector as well as the external sector in the East Asian countries. Bangladesh should create adequate facility to attract foreign investors in the export-oriented industries.

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[2]Export processing zone is out of the purview of our discussion

- **Trade Blocks**

Bangladesh commodity exports with its regional block, South Asian Association for Regional Cooperation (SAARC) is very meagre. It varies from 2 to 5 percent of total exports in member countries. Bangladesh should try to reduce her chronic trade deficit with India and Pakistan. In 1991-92, the merchandise trade deficit with India was Tk.4294 million and with Pakistan was Tk.3038 million (BBS 1993). A number of steps must be taken to realize the full benefits from regional association. Removal of existing constraints on cross border flow of goods and factors of production, the development of transport and communication and a prior understanding of the distribution of potential gains from trade among the participants are some of the necessary steps.

The Uruguay Rounds of General Agreement for Trade and Tariff (GATT) have been a major step towards liberalisation of world trade and strengthening of the multilateral trading system. An increased realization among the countries on the globalization of the international economy is necessary because no country could afford to be left out of this process.

7.4 Limitation of the Study

The first limitation of the study relates to the lack of time series data on labour force for the whole sample period. Generation of the data by using a growth formula might not be an appropriate method of addressing the problem. Hence we use population as a proxy for labour force. The focus of the study is on the aggregate analysis of the effects of export on economic growth. Due to financial and time constraint, the time series data for the whole sample period on exports at the disaggregated level could not be collected.

In this study, we employed a single equation growth model. It could take the form of a simultaneous equation model where export growth would be treated as an endogenous variable. We tried at the first instance but the data on several determinants of export such as the real effective exchange rate, the government policy parameters and the incentive structure were not available for the pre-liberation period.

Further, due to small sample size of 31 observations, we could not adopt a more sophisticated multivariate time series model such as the vector ARMA model.

7.5 Suggestions for Future Research

Future research may be directed to overcome the limitations of the present study. In particular, the following suggestions are made:

- A simultaneous equation model could be taken to investigate the determinants of export performance and overall economic growth of the country. Under a reduced form equation, combining demand and supply side factors influencing export, one can assess the effects of different policy variables on export performance. This could give the policy direction to government and other institutions.

- A commodity specific disaggregated analysis could be conducted to evaluate the effect of the change of the composition of export on economic growth.

The impact of remittances on economic growth can be investigated. Remittances by Bangladeshi nationals is an important source of foreign exchange earnings for the country.

- An evaluation of the effects of the exports of services, including both non-factor and factor services, on economic growth is an important area of research .

- The employment impact of the growth of export sector is also an important research area given the high unemployment rate in Bangladesh.

- Further research should be directed to import to investigate the effect of the liberalisation and adjustment policies on export performance and economic growth in Bangladesh.

So far we have suggested export and export related issues for further studies. But there are other determinants of economic growth. They are the factor endowment other than labour and capital, skills, political stability, domestic macroeconomic policies, access to foreign capital and technology. Depending on the availability of data some of these growth related factor can be incorporated in future empirical analysis on Bangladesh.

Appendix 1

Basic Indicators (at current price)

	1960	1972	1982	1992
GNP Per Capita (US $)	-	80	160	220
Population (Million)	53.5	70	91	114
GDP at market price (Billion Taka = BT)	15.09	27.74	260.33	906.50
Export of goods & NF Services (BT)	1.508	1.57	16.88	94.11
Import of goods and NF Services (BT)	1.404	3.81	53.93	147.62
Gross Domestic Investments (BT)	1.040	1.30	39.84	109.85
Gross Domestic Saving (BT)	1.131	0.93	2.76	56.34
Private Consumption (BT)	13.007	28.67	239.01	725.23
Government Consumption (BT)	0.934	0.0	18.56	124.94
Balance of Payment				
Export of goods and Services (US$ million)	329	355	874	2557.6
Imports of goods and services (US$ million)	320	800.8	2890.0	4049.0
Conversion Factor				
Bangladesh Taka per US$	4.762	6.030	20.04	38.11
External Debt (Total) US$ (Million)	-	161	5014	13189
Social Indicators				
Urban population (%)	5.1	8.3	12.3	17.6
Life expectancy at Birth	37.3	44.9	48.6	55.5
Infant mortality rate per thousand	159.0	140.0	128.0	91.0
Food production per capita (1987=100)	-	104.9	105.3	101.6
Labour force (thousand)	19256	21323	26618	35533
Female as percentage of labour force		5.6	6.5	7.6

Source :World Bank 1984-85, 1994

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Appendix 2

Balance of payments of Bangladesh in crore Taka

1 Crore = 10 million

Items	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92
Current Account :							
Imports (f.o.b.)	6353.8	7185.2	8393.2	9748.9	11125.3	11151.2	11891.9
Exports (f.o.b.)	2716.6	3064.3	3704.5	4116.1	4892.9	5955.9	7262.7
Freight and Insurance							
(a) On import	711.3	778.2	939.6	1063.3	1250.1	1229.3	1323.9
(b) Earned	7.6	6.8	5.5	4.2	8.0	8.7	7.5
(c) Net	-703.7	-771.4	-934.1	-1059.1	-1242.1	-1220.6	-1316.4
Other goods and services-net	-4.9	-97.6	-34.0	-49.4	-41.6	226.0	253.8
Balance	-4345.8	-4989.9	-5656.8	-6777.3	-7432.9	-6149.9	-5691.8
Investment income net	-376.7	-372.6	-415.4	-433.1	-404.6	-365.6	-338.7
Transfer by Bangladesh nationals	1569.3	1927.4	2461.1	2686.0	2631.2	3016.9	3723.7
Grants, donations etc. cash or kind	1639.0	2032.4	2578.5	2185.4	2461.5	2966.3	3116.7
Deficit/surplus current account	-1514.2	-1402.7	-1032.6	-2339.0	-2679.8	-532.3	-810.7
Capital Account :							
Aid and loan net	1682.8	1667.7	1474.6	2489.6	2122.4	1969.3	1766.9
(a) Long term net	1515.8	1887.7	1900.2	2793.0	2709.8	2402.5	1988.9
(b) Short term net	167.0	-220.0	-425.6	303.4	-587.4	-433.2	-222.0
Other capital transactions	-185.1	-127.9	-405.1	20.4	807.3	-1094.9	-2274.5
Errors and ommissions	16.5	-137.1	-36.9	130.2	249.9	-342.1	-303.1
Surplus on capital budget	1514.2	1402.7	1032.6	2339.0	2679.8	532.3	810.7

Source : BBS 1993.

Appendix 3

Export,foreign exchane reserve and official exchange rate

Year	Merchandise Export Million Dollar	Foreign Exchange Reserve Million Dollar	Taka Per US $ Period Average Official Rate
1972-73	348	_	7.30
1973-74	372	-	7.87
1974-75	383	_	7.97
1975-76	380	_	8.88
1976-77	417	_	15.05
1977-78	494	269	15.43
1978-79	619	393	15.12
1979-80	749	275	15.22
1980-81	710	250	15.49
1981-82	626	122	16.26
1982-83	687	358	20.07
1983-84	811	539	23.80
1984-85	934	395	24.94
1985-86	819	476	25.96
1986-87	1074	715	29.89
1987-88	1231	856	30.63
1988-89	1292	913	31.24
1989-90	1524	520	32.14
1990-91	1718	880	32.92
1991-92	1994	1608	35.68
1992-93	2383	2121	38.15

Source: 1. Export Promotion Bureau 1993

2. Bangladesh Bank 1994

Appendix 4

GDP, investment and export (at constant 1984-85 prices in million Taka)and population in million.

YEAR	GDP	PINV	GINV	EXPORT	POPULATION	INVESTMENT
1961	146947	-	-	16092	56.47	10882
1962	156275	-	-	17392	57.73	14340
1963	156856	-	-	16797	59.03	14475
1964	173101	-	-	18962	60.37	17923
1965	178131	-	-	18457	61.73	21992
1966	185010	-	-	20813	63.13	16775
1967	190193	-	-	19153	64.55	22050
1968	206019	-	-	19576	66.01	22912
1969	210459	-	-	20644	66.67	23732
1970	228456	-	-	20077	68.60	27378
1971	241307	-	-	14323	70.63	18754
1972	228002	-	-	11107	72.70	9197
1973	264555	9533	342	18777	74.30	9875
1974	289931	14370	10054	13249	76.40	24424
1975	278078	10358	8671	14862	78.00	19029
1976	293821	12174	10328	18543	79.90	22502
1977	301675	12528	15875	23263	81.80	28403
1978	323015	16958	18776	21479	83.70	35734
1979	338525	20030	19770	25024	85.70	39800
1980	341298	26541	23203	25263	87.70	49744
1981	352883	30601	21528	32343	89.90	52129
1982	357224	26787	18844	37556	91.60	45631
1983	374705	24954	21523	41895	93.50	46477
1984	395035	27006	22780	37721	95.50	49786
1985	406933	29912	22755	31189	97.50	52667
1986	424593	50530	26255	39653	99.40	76785
1987	442347	31724	29839	48764	101.50	61563
1988	455135	29881	28107	52313	103.40	57988
1989	466603	30303	29886	53681	105.50	60189
1990	497527	30770	30690	68728	107.50	61460
1991	514442	29344	28638	73392	109.60	57982
1992	536189	33452	27729	90398	111.40	61181

Note: PINV = Private Investment; GINV = Government Investment or Public Investment

Source : BBS 1993; Alamgir and Berlege 1972; and World Bank 1988-89.

Appendix 5

Per-capita export, per capita GDP and per capita investment
In constant 1984-85 Taka

YEAR	Per-capita Export	Per-capita GDP	Per capita Investment
1961	284.96	2602.18	192.70
1962	301.28	2707.10	248.41
1963	284.54	2657.12	245.20
1964	314.11	2867.50	296.90
1965	298.99	2885.61	356.26
1966	329.71	2930.81	265.74
1967	296.70	2946.33	341.58
1968	296.55	3120.96	347.09
1969	309.64	3156.68	355.96
1970	292.68	3330.36	399.11
1971	202.79	3416.54	265.53
1972	152.78	3136.25	126.51
1973	252.72	3560.63	132.91
1974	173.42	3794.91	319.69
1975	190.54	3565.10	243.96
1976	232.08	3677.36	281.63
1977	284.39	3687.96	347.22
1978	256.62	3859.20	426.93
1979	292.00	3950.12	464.41
1980	288.06	3891.65	567.21
1981	359.77	3925.28	579.86
1982	410.00	3899.83	498.16
1983	448.07	4007.54	497.08
1984	394.98	4136.49	521.32
1985	319.89	4173.67	540.17
1986	398.92	4271.56	772.48
1987	480.43	4358.10	606.53
1988	505.93	4401.69	560.81
1989	508.82	4422.78	570.51
1990	639.33	4628.16	571.72
1991	669.64	4693.81	529.03
1992	811.47	4813.19	549.20

Source : Appendix 4

Appendix 6

Balance of of Merchandise Trade and Export as percentage of Import

(Current Crore Taka)				Percentage
1crore= 10 million				
Year	Export	Import	Balance	Export/Import
1962	130.1	87.5	42.8	148.69
1963	124.9	101.9	23.2	122.57
1964	122.4	144.9	-22.5	84.47
1965	126.8	170.2	-43.4	74.50
1966	151.4	132.8	18.6	114.01
1967	157.5	156.7	0.8	100.51
1968	148.4	132.8	15.6	111.75
1969	154.3	194.5	-30.2	79.33
1970	167.0	181.3	-14.3	92.11
1971	125.1	157.5	-32.4	79.43
1972	104.1	25.4	78.7	409.84
1973	286	768	-482	37.24
1974	252	680	-428	37.06
1975	342	1057	-715	32.36
1976	481	1910	-1429	25.18
1977	712	1307	-595	54.48
1978	755	2164	-1409	34.89
1979	892	2498	-1606	35.71
1980	1151	3546	-2395	32.46
1981	1334	4266	-2932	31.27
1982	1454	5220	-3766	27.85
1983	1861	5513	-3652	33.76
1984	2051	5869	-3818	34.95
1985	2521	6874	-4353	36.67
1986	2717	7065	-4348	38.46
1987	3064	8026	-4962	38.18
1988	3705	9329	-5624	39.71
1989	4116	10848	-6732	37.94
1990	4893	12374	-7481	39.54
1991	5956	12378	-6422	48.12
1992	7263	13211	-5948	54.98
1993	8371	15601	-7230	53.66
1994	9388	16282	-6894	57.66

Source :1. BBS 1973
2. Bangladesh Bank 1994.

Appendix 7

Commodity wise Export Receipts

Figures are in Crore Taka

1 crore = 10 million

1	2	3	4	5	6	7	8	9	10
Period	**Ready Made Garments all sorts**	**Jute Manu-factures**	**Fish & Prawns**	**Hides, Skins & Leather**	**Raw Jute**	**Tea**	**Fertilizer**	**Others**	**Total**
1972-73	-	155	2	15	101	-	-	13	286
1973-74	-	127	9	14	85	10	-	7	252
1974-75	-	188	7	20	99	20	-	8	342
1975-76	-	258	19	43	125	21	-	15	481
1976-77	-	307	33	66	194	66	-	46	712
1977-78	-	384	28	68	156	63	-	56	755
1978-79	-	421	46	104	194	63	-	64	892
1979-80	1	559	57	131	213	47	-	143	1151
1980-81	4	639	66	81	205	63	-	276	1334
1981-82	19	647	106	121	194	84	-	283	1454
1982-83	27	802	182	133	259	116	-	342	1861
1983-84	84	891	205	184	217	182	43	245	2051
1984-85	276	1090	242	215	272	147	12	267	2521
1985-86	444	1013	344	224	322	104	8	258	2717
1986-87	791	907	440	310	294	89	7	226	3064
1987-88	1288	876	455	372	258	119	49	288	3705
1988-89	1378	960	501	450	368	135	169	255	4116
1989-90	1949	1013	542	549	371	116	51	302	4893
1990-91	2812	1008	609	492	429	144	156	306	5956
1991-92	3967	1102	625	533	403	187	49	397	7263
1992-93	4802	1050	794	592	292	147	182	512	8371
1993-94	5646	956	1013	632	256	175	17	532	9388

Source : Bangladesh Bank, 1994

Appendix 8

Year	Share of commodities in total export						
	Readymade garment	Jute goods	Fish	Leather	Raw Jute	Tea	Fertilizer
1972-73	0.00	54.20	0.70	5.24	35.31	0.00	0.00
1973-74	0.00	50.40	3.57	5.56	33.73	3.97	0.00
1974-75	0.00	54.97	2.05	5.85	28.95	5.85	0.00
1975-76	0.00	53.64	3.95	8.94	25.99	4.37	0.00
1976-77	0.00	4 3.12	4.63	9.27	27.25	9.27	0.00
1977-78	0.00	50.86	3.71	9.01	20.66	8.34	0.00
1978-79	0.00	47.20	5.16	11.66	21.75	7.06	0.00
1979-80	0.09	48.57	4.95	11.38	18.51	4.08	0.00
1980-81	0.30	47.90	4.95	6.07	15.37	4.72	0.00
1981-82	1.31	44.50	7.29	8.32	13.34	5.78	0.00
1982-83	1.45	43.10	9.78	7.15	13.92	6.23	0.00
1983-84	4.10	43.44	10.00	8.97	10.58	8.87	2.10
1984-85	10.95	43.24	9.60	8.53	10.79	5.83	0.48
1985-86	16.34	37.28	12.66	8.24	11.85	3.83	0.29
1986-87	25.82	29.60	14.36	10.12	9.60	2.90	0.23
1987-88	34.76	23.64	12.28	10.04	6.96	3.21	1.32
1988-89	33.48	23.32	12.17	10.93	8.94	3.28	4.11
1989-90	39.83	20.70	11.08	11.22	7.58	2.37	1.04
1990-91	47.21	16.92	10.22	8.26	7.20	2.42	2.62
1991-92	54.62	15.17	8.61	7.34	5.55	2.57	0.67
1992-93	57.36	12.54	9.49	7.07	3.49	1.76	2.17
1993-94	60.14	10.18	10.79	6.73	2.73	1.86	0.18

Source : Appendix 6

Appendix 9

Share and growth rates of primary and manufacturing commodities.

Share of primary commodities	share of manufacturing commodities	Growth of Primary commodities	Growth of manufacturing.
42.97	56.99		
41.22	58.81	5.24	13.20
31.89	68.08	-20.39	19.15
42.11	57.89	138.01	53.26
42.83	57.17	15.33	11.96
34.45	65.55	-4.78	35.77
38.07	61.93	38.53	18.39
30.75	69.24	-2.18	35.42
29.48	70.52	-1.10	5.09
33.68	66.32	23.66	1.80
35.42	64.58	35.38	25.35
34.71	65.29	20.68	24.48
33.89	66.11	18.49	22.91
36.54	63.46	8.54	-3.38
27.72	72.28	1.80	52.87
23.28	76.72	-1.96	23.85
23.28	76.72	7.58	7.59
21.20	78.80	10.58	24.77
17.82	82.18	2.33	26.90
13.45	86.55	-5.44	32.02
13.17	86.83	19.48	22.34

Export Promotion Bureau (1994)

Appendix 10

DERIVATION OF THE GDP GROWTH EQUATION

Following Feder (1983), the study adopts a supply side approach in modelling economic growth of Bangladesh. Production functions for the non-export and export sectors are given by

(A5.1) $$N = F(K_n, L_n, X)$$

(A5.2) $$X = H(K_x, L_x)$$

where, N = non-export sector output
X = export sector output
K_n, K_x = respective sector capital stocks
L_n, L_x = respective sector labour forces

Taking total differential of equations (1) and (2) we get :

(A5.3) $$dN = F_k dK_n + F_L dL_n + F_x dX$$

(A5.4) $$dX = H_k dK_x + H_L dL_x$$

The change in GDP can be expressed as :

(A5.5) $$dY = dN + dX$$

Substitute (5.3) and (5.4) into (5.6) to obtain

(A5.6) $$dY = F_k dK_n + F_L dL_n + F_x dX + H_k dK_x + H_L dL_x$$

We express the factor productivity gap between export and non-export sector in terms of the following pair of equations:

(A5.7) $$H_k = (1+\delta)F_k$$

(A5.8) $$H_L = (1+\delta)F_L, \quad \text{where, } \delta > 0$$

Substituting equations (5.7) and (5.8) into (5.6), we get

$$dY = F_k dK_n + F_L dL_n + F_x dX + (1+\delta)F_k dK_x + (1+\delta)F_L dL_x$$

or $$dY = F_k dK_n + F_L dL_n + F_x dX + F_K dK_x + \delta F_k dK_x + F_L dL_x + \delta F_L dL_x$$

or $$dY = F_x(dK_n + dK_x) + F_L(dL_n + dL_x) + F_x dX + \delta F_L dL_x + \delta F_k dK_x$$

(A5.9) $$dY = F_k dK + F_L dL + F_x dX + \delta F_L dL_x + \delta F_x dK_x$$

Where, $dK = dK_n + dK_x$ and $dL = dL_n + dL_x$

Recall that,

$$dX = H_k dK_x + H_L dL_X = (1+\delta)F_k dK_x + (1+\delta)F_L dL_x$$

Then,

$$\frac{dX}{1+\delta} = F_k dK_x + F_L dL_x$$

(A5.10) $$(\frac{\delta}{1+\delta})dX = \delta F_L dL_x + \delta F_k dK_x$$

Substitute (5.10) into (5.9) to obtain

$$dY = F_k dK + F_L dL + F_x dX + (\frac{\delta}{1+\delta})dX$$

$$dY = F_k dK + F_L dL + [F_x + \frac{\delta}{1+\delta}]dX$$

Dividing both sides by Y and denoting $\beta_1 = F_k$ and $\beta_2 = \frac{F_L}{(Y/L)}$ and $\beta_3 = \frac{\delta}{1+\delta} + F_x$, we find the GDP growth equation :

(A5.11) $$\frac{dY}{Y} = \beta_1 \frac{dK}{Y} + \beta_2 \frac{dL}{L} + \beta_3 \frac{X}{Y}(\frac{dX}{X})$$

Where β_1 represents the marginal productivity of capital in the non-export sector, β_2 is the ratio of marginal productivity of labour in the non-export sector to the economy-wide average productivity of labour and β_3 captures the externality and productivity differential effects of export, as explained in the text.

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