

MIMAP-Bangladesh Micro Impacts of Macroeconomic and Adjustment Policies in Bangladesh

Focus Study No. 03 Trade Liberalisation and Economic Growth: Empirical Evidence on Bangladesh

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Abbreviations

ACFs	Autocorrelation functions
ADF	Augmented Dickey Fuller
ADP	Annual Development Programme
DF	Dickey-Fuller
DW	Durbin-Watson
ECM	Error-Correction Model
ECT	Error-Correction Term
ELG	Export-led growth
ESAF	Extended Structural Adjustment Facility
HS	Harmonised System
IFS	International Financial Statistics
IMF	International Monetary Fund
MFA	Multi-Fibre Arrangement
NBR	National Board of Revenue
NTBs	Non-tariff Barriers
OLS	Ordinary Least Squares
PHFMOLS	Phillips-Hansen Fully Modified Ordinary Least Squares
QRs	Quantitative Restrictions
R&D	Research and Development
RER	Real Exchange Rate
RMG	Ready-made garments
SAF	Structural Adjustment Facility
UK	United Kingdom
USA	United States of America
VAT	Value Added Tax
WES	Wage Earners' Scheme
XPB	Export Performance Benefit

Chapter 1

Introduction

“...[L]iberalisation of trade and payments is crucial for industrialisation and economic development. While other policy changes also are necessary, changing trade policy is among the essential ingredients if there is to be hope for improved economic performance.”

- Anne O. Krueger (1997), “Trade Policy and Economic Development: How We Learn?” *American Economic Review*, vol.87, p.1.

“...[T]he nature of the relationship between trade policy and economic growth remains very much an open question. The issue is far from having been settled on empirical grounds. We are in fact sceptical that there is a general unambiguous relationship between trade openness and growth waiting to be discovered.”

- Francisco Rodriguez and Dani Rodrik (2000) “Trade Policy and Economic Growth: A Skeptic’s Guide to Cross National Evidence”, *NBER Macroeconomics Annual 2000*, p.264.

1.1. From Inward-looking to Outward-oriented Trade Regime

At the time of independence in 1971, Bangladesh inherited a very rigid import substituting industrialization strategy, which continued till the 1970s and early 1980s. The typical instruments of inward-looking development paradigm such as widespread quantitative restrictions on imports, high import tariffs, foreign exchange rationing, and overvalued exchange rate became characteristics of Bangladesh’s trade and industrial policy environment. The principal objectives of such policies were to (i) protect the infant industries of the newly independent country; (ii) lessen the balance of payments deficit; (iii) ensure efficient use of the available foreign exchange; (iv) protect the economy from international capital market and exchange rate shocks; (v) reduce fiscal imbalance; and (vi) achieve higher economic growth and ‘self-sufficiency’ of the nation. It was believed that by replacing the imported goods with domestic production, import-substituting industrialisation strategy would ease the balance of

payments problem and, at the same time, accomplish high economic growth promoting industrialisation and reducing unemployment.

However, the anomalous and irrational tariff structure introduced under the inward-looking strategy along with other non-tariff barriers not only proved to be a major constraining factor for sustained growth of an efficient industrial structure but also generated a distorted incentive structure resulting in an “anti-export” bias and thereby undermining the potentials for export growth. Therefore, although macroeconomic concerns about the balance of payments and fiscal imbalance were important factors in making a choice in favour of the inward-looking development strategy, even after a decade of highly protected trade regime both the internal and external balance situations of the country continued to worsen. It was against the backdrop of serious macroeconomic imbalances of the early 1980s and the stagnating export performance that the policy of reforms for stabilization and structural adjustment was undertaken. The pressure from the World Bank and the IMF and the world-wide turn against the import substituting development policies also contributed to the consideration of a policy reversal in Bangladesh.¹

1.2. Nature and Extent of Trade Liberalisation

Trade liberalisation policies pursued by Bangladesh have passed through three phases. The first phase (1982-86) was undertaken as Bangladesh came under the purview of the policy based lending of the World Bank; the second phase (1987-91) began with the initiation of the three-year IMF structural adjustment facility (SAF) in 1986; and finally, the third phase since 1992, was preceded by the IMF sponsored Enhanced Structural Adjustment Facility (ESAF). These reform measures led to a significant decline in quantitative restrictions, opening up of trade in many restricted items, rationalisation and diminution of import tariffs, and liberalisation of foreign exchange regime, which are summarised below.

¹ Many consider the World Bank and the IMF as the driving force in promoting the case for trade liberalisation and the resultant reform measures across the developing countries. Influences rendered by these institutions are believed to be transmitted through their lending programmes, policy dialogues and applied research on trade policy (Lateef, 1995). In an attempt to evaluate the World Bank's role in the recent surge in trade liberalisation across the global economies, Edwards (1997, p.47) observes: “...the Bank has contributed somewhat (but not a whole lot) to these policies.”

1.2.1. Removal of Quantitative Restrictions (QRs)

The liberalisation process toward removal of QRs began in 1985. Initially Bangladesh had a so-called “positive list” specifying the items that could be imported. This positive list was replaced by a “negative list” recording the commodities which cannot be imported freely. Since then the range of products subject to import ban or restriction has been reduced quite significantly. Table 1 shows while in 1987-88 about 40 per cent of all import lines at HS-8 digit level was subject to QRs, by the mid 1990s this had come down to a mere 2 per cent.

Table 1.1: Removal of QRs at 8-digit HS Classification Level

Year	Number of Controlled Items (HS-8 level)	Share of controlled items as per cent of total number of HS-8 lines
1987-88	2306	39.5
1988-89	1907	32.7
1989-90	1525	26.1
1990-91	1257	21.5
1991-92	1103	18.9
1992-93	584	10.0
1993-94	350	6.0
1994-95	117	2.0

Source: World Bank (1996) and Bakht (2000).

Table 1.2: Removal of QRs at 4-digit HS Classification Level

Year	Total	Restricted for trade reasons			Restricted for non-trade reasons
		Banned	Restricted	Mixed	
1985-86	478	275	138	16	49
1986-87	550	252	151	86	61
1987-88	529	257	133	79	60
1988-89	433	165	89	101	78
1989-90	315	135	66	52	62
1990-91	239	93	47	39	60
1991-92	193	78	34	25	56
1992-93	93	13	12	14	54
1993-94	109	7	19	14	69
1994-95	114	5	6	12	92
1995-97	120	5	6	17	92
1997-2002	124	5	6	17	96

Source: Compiled from Bayes *et al.* (1995), Hussain, *et al.* (1997) and World Bank (1999).

Similarly, at the HS-4 digit level a total of 429 commodities were covered under import restrictions for trade reasons in 1985-86, which fell to only 28 by the end of the 1990s (Table 1.2). Table 1.2 shows that currently there are only 5 commodities subject to import ban due to trade reasons as compared to 275 in 1986.

1.2.2. Liberalisation and Rationalisation of Tariffs

In addition to dismantling non-tariff restrictions, Bangladesh has lowered its import tariffs substantially. The policy of tariff reforms and rationalisation of tariff structures was initiated in the late 1980s and was further reinforced in the early 1990s with the beginning of the third phase of trade liberalisation programmes. As part of rationalisation of tariff structures, the highest tariff rate was brought down from as high as 350 per cent in 1992 to 50 per cent in 1996 and was further reduced to only 40 per cent in 1999. Taxation on imports in Bangladesh included a combination of custom duties, sales taxes, and development surcharges. In the 1990s, a supplementary excise duty which can be considered as trade-neutral consumption tax, was introduced to replace regulatory duties and surcharges on imports. Furthermore, a uniform 15 per cent value-added tax (VAT) on both imports and domestically produced goods replaced the import discriminatory multiple rate sales tax. This has increased government revenue and has contributed to a reduction in the protection enjoyed by the domestic import-substituting industries. The liberalisation and rationalisation of tariff structures have caused the mean nominal protection for all tradables in the domestic economy to fall from 89 per cent in 1989 to about 28 per cent in 1999. Similarly, the import weighted mean level of nominal protection for manufactures has declined by about 27 percentage points (Table 1.3). Currently Bangladesh's nominal import protection level ranks among the lowest in South Asia (World Bank, 1999).

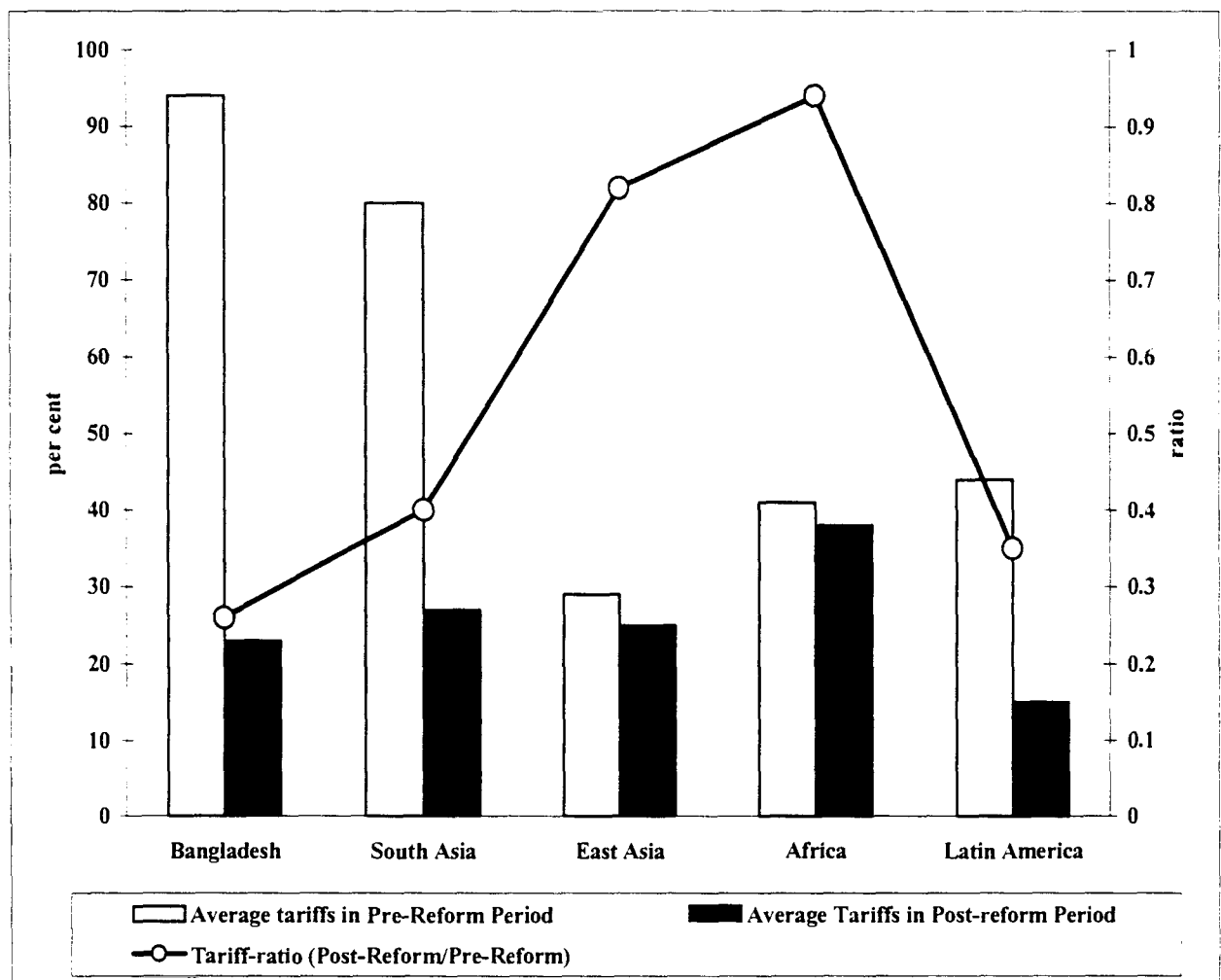
Table 1.3: Trends in Nominal Protection

	Pre-reform (1990-91)	Post-reform (1998-99)
Unweighted		
- agriculture	90.5	26.0
- manufactures	89.0	26.0
- all tradables	88.6	28.2
Import-Weighted		
- agriculture	20.9	10.1
- manufactures	51.8	23.8
- all tradables	71.9	20.3

Source: Compiled from World Bank (1996 and 1999).

In fact, Bangladesh is the country that has experienced one of the most rapid reduction in tariffs over the reform period as measured by the ratio of post-reform average tariffs to pre-reform rates among a set of world economies that have undertaken trade liberalisation measures (World Bank, 1999). This is illustrated in Figure 1.1, where the tariff rates in the pre- and post-reform periods are measured on the left vertical axis while the ratio of post-reform to pre-reform tariffs are scaled on the right vertical axis. It becomes obvious that only the Latin American countries have average post-reform tariff rates lower than Bangladesh. However, Bangladesh has witnessed the sharpest reduction in tariffs, as reflected in her lowest tariff ratio in Figure 1.1.

Figure 1.1: A Comparison of Tariff Liberalisation



Note: South Asia includes Bangladesh, India, Nepal, Pakistan and Sri Lanka. China, Indonesia, Malaysia, and South Korea are included in the East Asia sample. Latin America comprises Argentina, Brazil, Colombia, Chile, Costa Rica, Mexico, Peru, Uruguay, and Venezuela. Africa consists of Egypt, Ghana, Kenya, Madagascar, Nigeria and Tunisia.

Source: Based on data from World Bank (1999).

1.2.3. Liberalisation of the Exchange Rate Regime

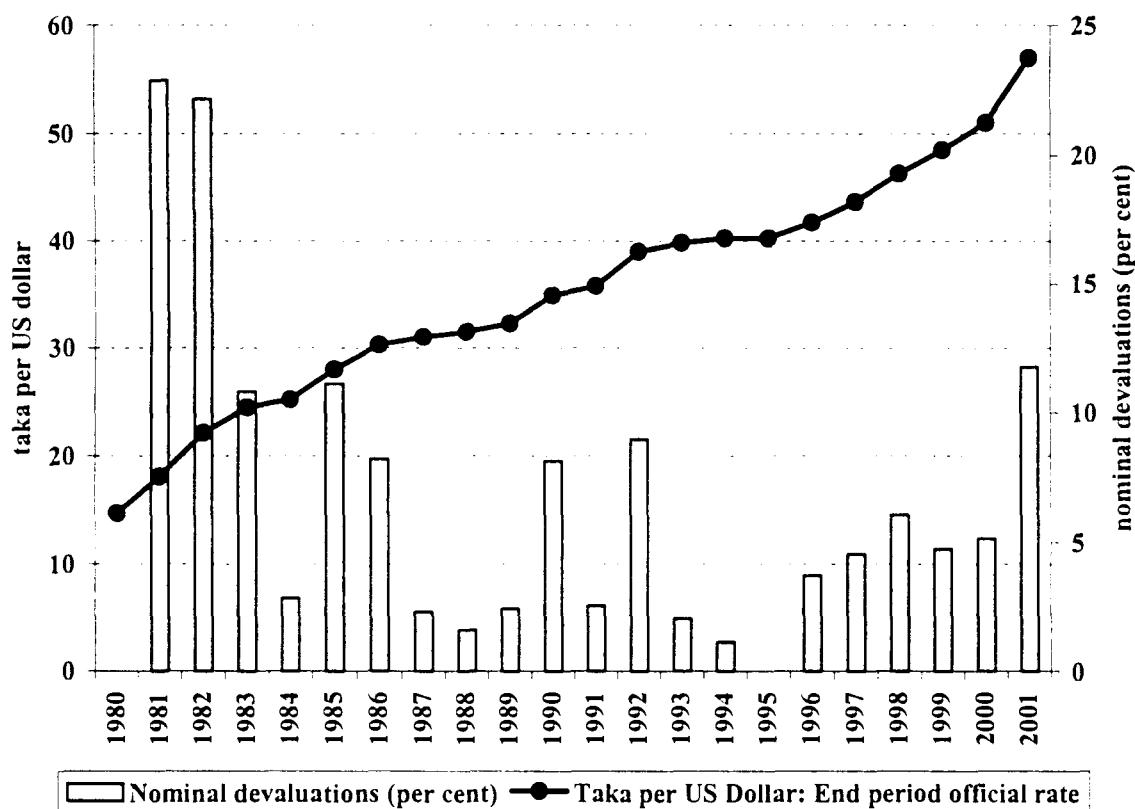
Reform of the exchange rate regime is central to any trade liberalisation policy. A country's exchange rate is usually overvalued under an import-substituting industrialisation strategy. This has a debilitating effect on exports and necessitates the imposition of QRs and high tariffs to maintain the overvalued rate and balance of payments equilibrium. Until the early 1980s, Bangladesh maintained an 'overvalued' and fixed exchange rate system in order to facilitate the inward-looking development strategy. The Taka was pegged to the Pound Sterling and the exchange rates with other currencies were determined by the rates between the Pound and respective currencies in London. In 1980 the fixed exchange rate regime was replaced by a 'managed' system of floating when the Taka was pegged to a basket of currencies of the country's major trade partners.² The intervention currency was changed from the Pound to the US Dollar and the exchange rate with other currencies was determined on the basis of the US Dollar closing rates in New York vis-à-vis different currencies. Since then regular nominal devaluations of the Taka in small amounts have been undertaken. Figure 1.2 shows that the nominal exchange rate in terms of Taka per US Dollar, measured on the left vertical axis, has increased steadily from 15 in 1980 to 57 in 2001. On the other hand, the rate of nominal devaluations, measured in the right vertical axis in Figure 1.2, for most years have been less than 20 per cent. This policy of slow but frequent adjustments of the nominal exchange rate is believed to have provided additional incentive to the exporters and exerted a downward pressure to the protection enjoyed by the domestic import competing industries.

Bangladesh had also maintained a dual exchange rate system for quite some time by administering the *Wage Earners' Scheme* (WES) in order to attract remittances of the Bangladeshis working abroad. The WES, which came into operation in 1978, offered the overseas Bangladeshis a rate (in terms of the Taka value of the US Dollar) higher than the official exchange rate for sending their remittances through the official channel. Later in 1986, under the Export Performance Benefit (XPB) scheme, exporters of non-traditional items were given some opportunities to derive benefits from the dual exchange rate system. Exporters

² The partners' weights for the pegged system were based on the bilateral foreign exchange transactions with Bangladesh.

covered by XPB received certificates that indicated specific entitlement rates applicable to the commodities in question, i.e., the proportion of export earnings in foreign currency that could be converted into local currency by using the WES exchange rate.³ With the initiation of the third phase of trade liberalisation and policy reforms, the WES and XPB came to an end with the unification of the two exchange rates in 1992.

Figure 1.2: Nominal Exchange Rate and Devaluations



Note: The rates of nominal devaluations are calculated using Bangladesh Bank data on the “end period official rate”.

In 1994, accepting the International Monetary Fund’s Article VIII obligations, Bangladesh committed to allow convertibility of the Taka in the current account and thus indicating a comprehensive liberalisation of the foreign exchange control regime. The step was aimed at linking the economy with international financial market and thereby facilitating international

³ The entitlement rate varied according to the domestic content (value added) of export items. Thus the total premium from a non-traditional export was determined by the entitlement rate, the difference between the official and WES rate and the value of exports (Stern *et al.*, 1988). The system of XPB was the single most important export incentive available to exporters during the late 1980s.

trade. Other important measures that were also undertaken include, *inter alia*, withdrawal of prior approval from the central bank for sale of foreign currency by the commercial banks, allowing exporters to retain a portion of their earned foreign exchange, withdrawal of restrictions on the borrowing capacity of foreign firms from the domestic banks and on non-residents' portfolio investment, establishment of dealers' control over fixing the selling and buying rates which were previously fixed by the Bangladesh Bank (Bayes *et al.*, 1995, and Hussain, *et al.*, 1997).

1.2.4. Monetary and Fiscal Policy Changes

During the 1970s, Bangladesh experienced a high annual average inflation rate of about 37 per cent. Increased cost of domestic goods for imported raw materials, rise in the salary bill of the government, growth of money supply to feed the construction and rehabilitation needs of the newly independent nation, rise in international oil price, and slow growth in production were the main reasons for the rapidly rising price level. On the fiscal side, government expenditures increased without analogous increases in tax or non-tax earnings. The resultant budget deficit was financed largely by money creation and by the availability of foreign aid (Ahmed, 2001). In spite of different structural adjustment measures taken during the 1980s, fiscal and monetary policies continued to be expansionary. Public expenditure kept on rising without much attempts to increase revenue collection thereby making the country overwhelmingly dependent on foreign aid for financing the development programmes. Things, however, changed dramatically with the beginning of the 1990s. A significant improvement in budgetary resource mobilisation took place as both tax and total revenue registered a sharp increase resulting in the rise of the contribution of domestic resources in Annual Development Programme (ADP) expenditures. The introduction of the value added tax (VAT) along with a range of tax reforms contributed to this positive development.⁴ A coherent and rather disciplined monetary and fiscal policy also helped achieve and maintain a very low rate of inflation through out the 1990s.

⁴ The increased effort by the government to mobilise resources from domestic sources can also be partly attributable to the reduced level of aid availability. In 1990 the official development assistance (ODA) to Bangladesh stood at more than US\$2,100 million, which declined sharply to reach US\$1,150 in 2000. While in the mid-1980s, foreign aid accounted for 40 per cent of gross domestic investment and about 30 per cent of imports, by the end of the 1990s both the comparable figures had come down to about 15 per cent.

1.2.5. Export Incentives

Another important element of trade policy reform has been the introduction of a set of generous support and promotional measures for exports. While import and exchange rate liberalisation were meant to correct the domestic incentive structure in the form of reduced protection for import-substituting sectors, export promotion schemes were undertaken to provide the exporters with an environment where the erstwhile bias against export-oriented investment could be reduced significantly. Important export incentive schemes available in Bangladesh include, amongst others, subsidised rate of interest on bank loans, duty free import of machinery and intermediate inputs, cash subsidy, and exemption from value-added and excise taxes. Table 1.4 summarises some of the most important export incentive schemes.

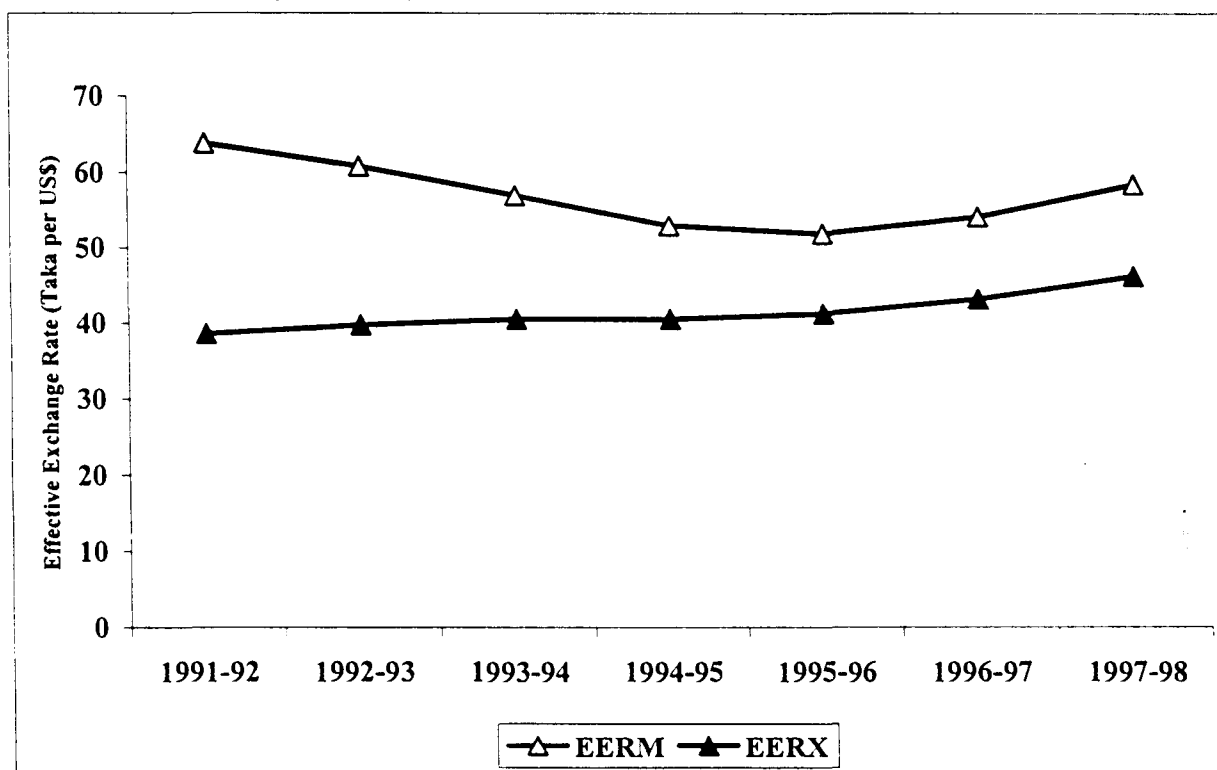
Table 1.4: Important Export-Incentive Schemes in Bangladesh

Scheme	Nature of Operation
Export Performance Benefit (XPB)	This scheme was in operation from mid-1970s to 1992. It allowed the exporters of non-traditional items to encash a certain proportion of their earnings (known as entitlements) at the higher exchange rate of WES. In 1992 with the unification of the exchange rate system, the XPB scheme ceased.
Bonded Warehouse	Exporters of manufactured goods are able to import raw materials and inputs without payment of duties and taxes. The raw materials and inputs are kept in the bonded warehouse. On the submission of evidence of production for exports, required amount of inputs is released from the warehouse.
Duty Drawback	Exporters of manufactured products are given a refund of customs duties and sales taxes paid on the imported raw materials that are used in the production of goods exported. Exporters can also obtain drawbacks on the value added tax on local inputs going into production.
Duty Free Import of Machinery	Import machinery without payment of any duties for production in the export sectors.
Back to Back Letter of Credits (L/Cs)	It allows the exporters to open L/Cs for the required import of raw materials against their export L/Cs in such sectors as RMG and leather goods.
Cash Subsidy	The scheme was introduced in 1986. This facility is available mainly to exporters of textiles and clothing who choose not to use bonded warehouse or duty drawback facilities. Currently, the cash subsidy is 25 per cent of free on board export value.
Interest Rate Subsidy	It allows the exporters to borrow from the banks at lower bands of interest rates of 8-10 per cent against 14-16 per cent of normal charge.
Income Tax Rebate	Exporters are given rebates on income tax. Recently this benefit has been increased. The advance income tax for the exporters has been reduced from 0.50 per cent of export receipts to 0.25 per cent.
Retention of Earnings in Foreign Currency	Exporters are now allowed to retain a portion of their export earnings in foreign currency. The entitlement varies in accordance with the local value addition in exportable. The maximum limit is 40 per cent of total earnings although for low value added products such as RMG the current ceiling is only at 7.5 per cent.
Special Facilities for Export Processing Zones (EPZs)	To promote exports, currently a number of EPZs are in operation. The export units located in EPZs enjoy various other incentives such as tax holiday for 10 years, duty free imports of spare parts, exemption from value added taxes and other duties.

Source: Bayes *et al.* (1995), Hussain *et al.* (1997) and Bakht (2000).

One basic objective of trade policy reforms has been to remove the anti-export bias in the domestic economy so that resources can be allocated between export and non-export sector in terms of their comparative advantage. One way of measuring the anti-export bias is to compute the effective exchange rate for exports (EERX) (i.e., nominal exchange rate adjusted for export incentives) and imports (EERM) (i.e., nominal exchange rate adjusted with protective trade interventions) and compare the two effective rates. World Bank (1999) finds that the ratio of EERM to EERX in Bangladesh has declined from 1.66 in 1992 to 1.26 in 1998, as shown in Figure 1.3. Therefore, Bangladesh has achieved some success in reducing the anti-export bias.

Figure 1.3: Declining Anti-Export Bias



Note: EERM refers to the nominal exchange rate adjusted for protected import taxes such as customs duty, supplementary duty and import discriminatory VAT. EERX gives nominal exchange rate after adjustment for the existing export promotion schemes such as, cash subsidy and interest rate subsidy.

Source: The figure is based on World Bank (1999).

1.3. Objectives of the Present Study

Although there is no denying the fact that trade and development strategies are intimately related, the issue of what policies are most appropriate for stimulating industrialisation and growth has generated a huge controversy. The collapse of the centrally planned economies together with the widely demonstrated malfunctioning of the import-substituting trade regimes tend to suggest that trade policy reform holds the key to economic success. Yet, in the academic and empirical literature the results of trade liberalisation are not settled at all and have continued to be a subject of vigorous scrutiny. Notwithstanding the existence of the debate concerning the choice of trade policy and its impact on economic performance ever since the emergence of the development economics, the related controversy was catapulted into prominence with the publication of *The East Asian Miracle* by the World Bank (1991).⁵ Since then a large number of empirical research works have been carried out to evaluate the role of trade policy reforms in economic growth.

How trade liberalization has influenced economic growth in Bangladesh has been a subject matter of great interest to researchers, academics and policy makers. This is definitely not an area lacking studies and analyses.⁶ However, most of the studies undertaken are descriptive in nature and very little has been done to test specific theories or propositions concerning the link between liberalisation and growth. Studies based on descriptive approaches do collect and analyse a large body of information about the nature of trade policy as well as the process of implementation of the reform measures, from which they seek to construct a plausible account of the extent to which trade reforms have been responsible for the observed changes in the variables or indicators of interest. However, the main disadvantage of this approach is its inability to test a theoretical model to validate the claims made empirically. Consequently, it is not possible to know whether the conjectures offered by descriptive studies are true in general or just coincidences or are specific to a particular sub-sample within a large sample. In contrast, the main attractive feature of the empirical approach is that it is possible to test statistically specific

⁵ Critical appraisals of *The East Asian Miracle* study can be found in Amsden (1992), Kwon (1992), Lall (1992) and Perkins (1992). Besides, Rodrik (1995) strongly argues that 'right' governmental interventions played the pivotal role in paving the way for some East Asian countries' success.

⁶ Two most important studies on the topic are Sobhan (ed) (1995) and World Bank (1999).

hypotheses about the nature of the relationship between liberalization and growth. Hence, the obtained results may be considered to be grounded in reality rather than in a theoretical construction. In other words, like the descriptive studies, empirical analysis is also intended to examine what actually happened. But while doing so the latter approach exploits theoretical frameworks explaining how controlling for other factors, trade policy affects the outcome. This theory is then estimated and tested using the data to assess the strength of the impact of trade-related policy variables independently of the effect of other economic variables.⁷

Therefore, in order to examine the relationship between trade liberalisation and growth, an empirical approach has been followed in this study. Three different but closely related issues have been chosen for empirical investigations, which are briefly mentioned below.

- First, we intend to analyse a general relationship between liberalisation and growth in the context of Bangladesh. It was discussed earlier that trade reform comprises liberalisation of quantitative restrictions, tariff barriers, and the exchange rate. The interaction of these factors as reflected in the ‘openness’ of the economy in question is hypothesised to exert an influence on aggregate growth. In the traditional neoclassical model output growth is, however, attributable to factors of production, namely capital and labour, and the exogenous total factor productivity growth. On the other hand, the relatively recent developments in growth theory emphasise the role of human capital as one of the most important factors and have also provided a convincing and rigorous conceptual framework for the analysis of the relationship between trade policies and economic growth (e.g., endogenous growth theory). Therefore, in order to isolate the effect of liberalisation it is essential to employ some kind of growth accounting framework to control for individual factors’ contribution to output growth and given them to examine the impact of liberalisation. The first empirical investigation in the present study estimates a number of growth models for Bangladesh including three different measures of liberalisation, as commonly used in the literature, to examine their statistical significance in various regressions. An attempt is also made to see whether the measures

⁷ Note that non-availability of data is the most important problem associated with empirical approaches. Discussions on the weaknesses and strengths of alternative approaches may be found in McCulloch *et al.* (2001).

of trade liberalisation are significantly correlated with the total factor productivity derived from the estimated growth equations.

- The second issue that we explore is the link between export and growth. The performance of export trade often obscures the relationship between liberalisation and growth. Taking into consideration of a robust export performance, Bangladesh is usually shown to have benefited substantially from trade reform measures.⁸ This assertion is based on the ‘export-led growth’ hypothesis, which implies that economic growth is directly linked to the success of the export sector and, more importantly, there is a causal effect of export performance on overall growth prospect of the economy. However, although the export sector has flourished alongside the liberalisation programmes, it is not clear whether the high trend growth rate of exports of the 1990s was a result of trade reforms or an outcome associated with the international trading environment. This is because the momentum in export trade has been overwhelmingly dominated by ready-made garments (RMG), the market of which in industrial countries is regulated under the Multi-fibre arrangements (MFA) quota, limiting competition and providing a ‘protected’ market for many developing countries including Bangladesh. Besides, given the fact of very low domestic value added (or, weak backward linkage) of the country’s principal export item, RMG’s ‘engine’ role of exports needs to be examined empirically. In this backdrop, the two main questions of empirical investigation are: (1) How are exports and economic growth related? and (2) Does liberalisation has any impact on exports and growth relationship?
- Finally, another issue that has become a subject of considerable controversy is the effect of exchange rate changes on economic growth. Exchange rate adjustments or nominal devaluations constitute one of the principal elements of trade policy reform and since the initiation of trade liberalisation programmes, Bangladesh has adopted a policy of frequent but usually small doses of devaluation at a time. Whenever the Taka is devalued, the need for enhancing exporters’ competitiveness is stressed as one of the most important reasons

⁸ In the 1990s, export performance has been quite robust with nominal exports in US dollars growing at 17 per cent per annum.

for justifying the action. It is also possible that by raising the domestic currency price of foreign exchange, devaluation increases the price of traded goods relative to non-traded ones inducing a reallocation of resources in favour of traded goods, which, in turn, contributes to the expansion of the traded sector in general, and exports in particular. This leads export-led growth proponents to claim that such downward adjustments of the exchange rate is beneficial to economic growth. In contrast to these arguments, there are concerns that the indirect costs of devaluation can actually outweigh its benefits. Devaluations could restore external balance mainly by reducing demand for imports rather than by expanding the domestic traded sector and could also generate an inflationary pressure through increased prices of imports. In addition, if production of non-traded goods rely on imports, the effect of devaluation might be contractionary. In the third empirical research, we intend to examine whether the net effect of nominal exchange rate adjustments on aggregate output has been positive or negative.

It is quite natural to expect that any study examining the impact of trade liberalisation will also deal with the issues related to poverty and inequality. The link between trade liberalisation and poverty and inequality is a complicated one and theoretical constructs are being developed only recently (Winters 2000). Besides, the basis of any empirical research is data availability and in Bangladesh there is not sufficient data to examine such an issue more rigorously under a suitable analytical framework. Therefore, rather than leaving such an important issue completely unaddressed, the present study describes the channels through which liberalisation could affect poverty and inequality, problems related to the empirical analysis of the issue, and some trends in poverty and inequality in Bangladesh based on secondary information.

It is expected that the present study will be useful in providing a better understanding of the impact of trade liberalisation on economic growth in Bangladesh. Although the selected issues occupy a central position in the macro policy discourse in Bangladesh, discussions surrounding these are usually uninformed in nature mainly due to lack of empirical evidence. The applied approach to research undertaken in the present study is likely to serve the purpose of bridging the theoretical constructs, deemed necessary for policy evaluation, with empirical evidence and thus is expected to contribute to filling the existing research gap.

1.4. Organisation of the Study

After the introduction in Chapter 1, three chapters which contain the empirical investigations are placed. Chapter 2 examines the relationship between trade liberalisation and economic growth; Chapter 3 investigates as to how exports and growth are related in Bangladesh and what impact trade liberalisation has on this relationship; and Chapter 4 provides an analysis of the effects of exchange rate changes on output. While a short descriptive note on trade liberalisation and poverty is provided in Chapter 5, some concluding observations are given in Chapter 6.

Chapter 2

Trade Liberalisation and Growth

2.1. Introduction

It was mentioned in Chapter 1 that in the face of severe macroeconomic imbalances of the 1980s, the policy of reforms for stabilization and structural adjustment was introduced in Bangladesh. By any standard, these measures have substantially liberalised the country's trade and industrial regime and, at the same time, outward-orientation of the economy has increased significantly.¹ It is also true that the 1990s, which is usually considered as the post reform period, has witnessed an average growth rate that is higher than the previous decade.² While the superior growth performance could be a result of liberalisation, empirical verification of this would require more than a mere association of high growth rate with the post-liberalisation period. In this chapter, therefore, we intend to study the relationship between aggregate output and liberalisation using a theoretical framework so that controlling for other factors contributing to growth, the effect of liberalisation can be captured. The attempted exercise is useful as the relationship between liberalisation and growth is controversial both in terms of theoretical constructs and results derived from a large number of applied research works. It will also help evaluate the role of liberalisation in promoting economic growth in a least developed country like Bangladesh.

The present chapter is organised as follows. Section 2.2 provides a brief review of both the theoretical and empirical literature; while Section 2.3 outlines the theoretical framework for the empirical exercise. Section 2.4 introduces the indicators of liberalisation and explains the sources of data on other variables that we use in our models. Section 2.5 elaborates the estimation strategy following which Section 2.6 provides estimation results. Finally, Section 2.6 concludes the chapter.

¹ The extent of liberalisation in Bangladesh in terms of removal of quantitative restrictions, rationalisation and diminution of import tariffs and opening-up of the exchange rate regime has been discussed in Chapter 1. The outward-orientation, as measured by the ratio of trade to GDP, in the Bangladesh economy has increased from as low as 17 per cent of the mid-1980s to about 33 per cent by the end of the 1990s. See Mujeri (2001).

² The annual average growth rate of GDP for the 1980s is estimated to be 3.74 per cent as against 4.78 per cent for the 1990s (Bhattachariya, 2002).

2.2. Trade Liberalisation and Growth: A Brief Review of the Literature³

2.2.1. Theoretical Arguments

In theory, there are arguments both in favour of protectionist and free trade regimes. The principal reason for protection and thus inward-looking strategy is the infant industry argument (e.g., Bardhan, 1970) that underlines the need for protecting firms at the beginning of their lifetime. Traditional trade models (Dornbusch, 1977; Rodriguez, 1974) also considered the possibility of an optimal level of protection for a country that could influence the terms of trade. It has also been shown that protection can raise income when there is no full employment (Brecher, 1974 and 1992, as cited in Vamvakidis, 2002). Theories by the structuralists (Singer, 1950, and Prebisch, 1950) provided justification for a protectionist policy by considering the division of world into a 'centre', the developed countries, and a 'periphery', the developing world, where trade acted as a source of impoverishment in the latter and as a source of enrichment in the former. According to these theories, trade brings growth for the industrialised countries with little or no gain at all for the developing countries. Some studies (e.g., Ocampo and Taylor, 1998) have also expressed their concerns on the ground that in return to the 'modest' benefit of liberalisation, a country may have to pay a higher price in terms of slow productivity growth, worsening income distribution, and likely de-industrialization. Again, to some people although import liberalisation strategy is less attractive (Deraniyagala and Fine, 2001; Heilleiner 1994), they opt for export expansion to generate positive influence on growth. Often, properly done 'selective protection' is considered more efficient than complete trade liberalisation (Lall, 1990; Redding, 1999).

In contrast, the 'gains from trade' theory is rooted in comparative advantage as seen in the Heckscher-Ohlin-Samuelson theory and in the theory of *vent for surplus*. As far as these theories are concerned, benefits from trade are rather static and not dynamic, i.e., there are no further implications for higher economic growth or higher investment in the process of trade.

³ There is a huge literature on this subject and in this brief review, we limit ourselves to only a few of them. For further reading, interested readers are referred to Barro and Sala-i-Martin (1995), Edwards (1998, 1992), Rodrik and Rodriguez (1999), Sachs and Warner (1995) and references therein.

While, the above static theories are well established text-book models, the failure of import-substitution regimes gave an impetus to the revival of a new orthodoxy of trade liberalisation in the late 1970s with trade seen as an 'engine of growth' with emphasis on dynamic arguments associated with pro-trade policies. Thus, while Krueger (1974) identifies costs of administration and costs associated with 'rent-seeking' activities affecting growth potentials, Bhagwati (1990) argues that a liberal trade strategy is beneficial to developing countries because it would bring efficiency in resource allocation, eliminate directly unproductive profit seeking and rent seeking activities, encourage foreign investment, and stimulate dynamic positive effects on the domestic economy. The proponents of trade as an engine of growth also recognises the benefits of a larger international market, which enable the industry to gain scale effects through large-scale production, to achieve higher export productivity as a result of international competitive pressures, and to exploit different forms of externalities (Balassa, 1984; Bhagwati, 1990; Kruger, 1998). In addition, better access to imports makes new inputs, new technologies and ideas, and new management techniques available to local producers (Esfahani, 1991; and Feenstra *et al.*, 1997). With emphasis on these positive effects of liberalisation, it has been argued that "trade liberalisation undertaken from a period of declining growth rates or even falling real GDP can normally lead to a period of growth above the rates previously realized" (Krueger, 1998; p. 1521).

The dynamic gains from trade is also one of the central features of the 'new' growth theories, often known as the 'endogenous' growth theories, pioneered by Romer (1986) and Lucas (1988). Endogenous growth theory has provided a convincing and rigorous conceptual framework for the analysis of the relationship between trade policies and economic growth. In the new growth models, it is possible to establish long-run relationships between trade orientation and economic growth in a number of ways. Import liberalisation is expected to promote technology transfer through the import of advanced capital goods. Growing export receipts and higher inflows of foreign capital enhance the import of technologically superior capital goods. In addition, open economies may be benefited from technological spillovers stimulated by trade, which again motivate growth. Coe and Helpman (1995) noted that a country's total factor productivity depended not only on domestic R&D capital but also on foreign R&D capital. They find that foreign R&D has beneficial effects on domestic productivity and these are stronger the more

open an economy is to foreign trade. Among others, Grossman and Helpman (1991) , Barro and Sala-i-Martin (1995), Romer (1992), and Edwards (1998) have argued that countries that are more open to the rest of the world have a greater capacity to absorb the technological advancement of the world. Also, the opening up of an economy is likely to speed up the rate of economic growth by leading to larger economies of scale in production due to the positive spillover effects emanating from technological developments in industrial countries.

2.2.2. Empirical Evidence

Numerous studies have examined the relationship between different measures of openness and economic growth and we do not intend to cover all of them. Mostly, the studies examining the relationship between liberalisation and growth construct some measure of trade openness and then examine its statistical relation to growth across a large number of countries. In general, the findings of the relatively recent studies led to a growing confidence that openness was good for growth. Among these, most prominent ones include Dollar (1992), Edwards (1992), Sachs and Warner (1995), and Greenaway *et al.* (1998). Dollar (1992) constructs two separate indices based on real exchange rate (RER) distortion and RER variability to capture the degree of outward-orientation. He then regresses these two indices on per capita GDP growth for the period 1976-1985 for 95 developing countries to discover a statistically significant relationship between growth and outward orientation and thus concludes that outward-oriented developing economies grow more rapidly than the inward-oriented economies. On the other hand, Edwards (1992) constructs two basic trade policy indicators of *openness* (the way in which trade policy restricts imports) and *intervention* (the extent to which commercial policy distorts trade). Using a data-set for a cross-section of 30 developing countries, trade orientation indicators are found to have the expected signs and to register statistical significance.⁴

In one of the most cited studies, Sachs and Warner (1995) use a dummy variable to designate the openness position, which takes the value zero if the economy was closed according to any of the

⁴ He also applies some other alternative indicators such as, average black market premium, coefficient of the variation in the black market premium, index of relative price distortion, average import tariff, average non-tariff barrier coverage, World Development Report (1983) index of trade distortion, index of effective rates of protection, and World Bank index (1987) on outward orientation and claims that the results support his original findings.

following criteria: (1) it had average tariff rates higher than 40 per cent, (2) its non-tariff barriers covered on average more than 40 per cent of imports, (3) it had a socialist economic system, (4) it had a state monopoly of major exports, and finally, (5) its black market premium exceeded 20 per cent during either the decade of the 1970s or the decade of the 1980s. The economy was considered to be 'open' if it did not have any of the above-mentioned five criteria. Cross-country regressions run by Sachs and Warner result in a high and robust coefficient for the 'openness' dummy implying a high degree of impact of openness on economic growth.⁵

The results of the panel analysis of liberalisation and growth using the 'before'/'after' dummy variable method by Greenaway *et al.* (1998) show that liberalisation and other reform programmes are associated with rapid improvement in the current account of the balance of payments and growth rate of real exports. But overall growth-enhancing effects of liberalisation are unlikely to be instantaneous as it is found that there is a negative (although not significant) effect on growth in the first year after liberalisation followed by a positive (but again not significant) impact in year two and larger and significant positive impact on year three ('J-curve' type effect).

The apparently favourable effects of trade liberalisation as demonstrated in the aforementioned studies have recently been strongly and convincingly criticised by Rodriguez and Rodrik (1999) who found that Dollar's two indices of outward-orientation, Sachs and Warner dummies to capture openness, and Edwards' measures of openness and intervention indicators were inappropriate and misleading. Rodriguez and Rodrik also provide evidence that the measures of openness used in various studies provide anything but 'robust' and consistent results and the econometrics used in the regression analyses is weak and flawed. This contention is also echoed in Harrison and Hanson (1999) who found that Sachs-Warner measure failed to establish a robust link between more open trade policies and long-run economic growth.

Amongst the more recent studies, Frankel and Romer (1999) provide some strong evidence in favour of the relationship between trade and growth. They investigate whether the correlation

⁵ In Sachs and Warner (1995) experiments "open economies grow, on average, by 2.45 percent more than the closed economies, with a highly statistically significant effect" (p. 47).

between openness and growth is because openness causes growth, or because countries that grow faster tend to open up at the same time. Controlling for the component of the openness due to such country characteristics as populations, land areas, and geographic distance that cannot be influenced by economic growth, they find that an increase of one percentage point in the openness ratio increases both the level of income and subsequent growth by around 0.5 per cent. But the authors acknowledge that the trade effect cannot be estimated with 'great precision', and is significant only 'marginally'. Due to the statistical indifference between the estimates of geographic component of trade from the estimates based on overall trade, they conclude that "... although the results bolster the case for the benefits of trade, they do not provide decisive evidence for it" (Frankel and Romer, 1999; p. 395).

The cross-country growth regression framework is often confronted with the problem of the 'fragility' of the parameters (i.e., not being able to maintain correct sign and significance) with respect to the inclusion of a set of potential variables that might be useful in explaining the variation in the dependent variable but not included in the original regression. In such an attempt, Levine and Renelt (1992) use Leamer's 'Extreme Bound Analysis' technique to test the sensitivity of results from cross-country growth models by adding a set of potential variables, which include trade-ratio, into the regression. The authors find an indirect positive impact on growth coming from international trade as they identify a robust positive correlation between growth and the share of investment in GDP and between the investment share and the ratio of trade to GDP. Therefore, trade is found to affect growth indirectly through investment.

One important problem associated with the empirical analysis of the relationship between trade liberalisation and growth is the use of cross-country regression models. In these studies, it is implicitly assumed that institutional characteristics, technology, and socio-economic environment across countries remain constant. However, these factors are likely to vary tremendously from one country to another and appropriate indicators are rarely available to control for them. If these factors have any influence on growth, cross-country regression results might yield doubtful inferences. Also, cross-country econometric studies are vulnerable to parameter instability as the estimated parameters might be sensitive to the choice of countries included in the sample. As a matter of fact, the connection between trade policy and growth is

most likely to be case specific, which implies that country specific time series analysis would be a more suitable framework to study the relationship.⁶

2.2.3. Studies on Bangladesh

There are not many studies investigating the relationship between liberalisation and economic growth in Bangladesh. In fact, we could locate only two studies in this regard, viz., Ahmed (2001) and Siddiki (2002). The study by Ahmed (2001) looks at the effects of trade liberalisation on industrial growth (and not aggregate output growth) using a framework of endogenous growth model. Ahmed reports a positive relationship between an index of industrial production and some measures of liberalisation. On the other hand, Siddiki (2002) examines the joint effect of trade and financial liberalisation on the overall economic growth of Bangladesh with annual data for 1975-95. Financial liberalisation is proxied by the supply of broad money as percentage of GDP while trade liberalisation by the ratio of trade to GDP. Siddiki finds positive effects of both types of liberalisation.

However, there are two important limitations associated with both the studies. First, although the long-run relationship between output and factors of production is specified on the level of the variables, i.e., the output is a function of the stocks of capital and labour, both Ahmed and Siddiki use investment-GDP ratio in their regressions. The investment-GDP ratio is a flow variable and being completely different from the stock of capital cannot represent the latter. The second problem is related to the data used in the empirical estimation. The time series data on industrial production and output used respectively by Ahmed and Siddiki correspond to the old national income accounting system. Recently, the Bangladesh Bureau of Statistics (BBS) has revised the national income estimates by incorporating extensive methodological and data improvements (BBS, 2000 and 2001) and widening the coverage. This revision has resulted in an increase in Bangladesh's GDP (in current prices) by 26–43 per cent. Therefore, if the new national income estimate is to be a true reflection of Bangladesh's economy, the previous

⁶ Such studies, however, are not numerous. Ghatak *et al.* (1995) is a study that concentrates on Turkey and examines the relationship between openness and economic growth. On the other hand, Greenaway and Sapsford (1994a) analyses the effect of liberalisation on the relationship between exports and economic growth for 14 individual developing countries. There are, however, numerous studies focussing on the relationship between exports and growth irrespective of liberalisation.

empirical research using the old estimates of GDP must have encountered the problem of measurement errors, which might have affected the reported results.

2.3. Analytical Framework

A simple way to evaluate the difference between the growth performance in the pre- and post-liberalisation periods is to compute the trend or average growth rates in the two periods and to test whether there is any significant difference between them. This test can be done with a simple regression:

$$\ln Y_t = a_1 + a_2 D + b_1 T + b_2 (DT) + u \quad (2.1)$$

where, \ln represents natural logarithm, Y is a measure of output, T is the time trend, D is the dummy variable with, say, 0 for pre- and 1 for post-liberalisation periods.

$$\text{So that, } E(\ln Y | D = 0) = a_1 + b_1 T \quad (2.2)$$

$$E(\ln Y | D = 1) = (a_1 + a_2) + (b_1 + b_2) T \quad (2.3)$$

Therefore, (2.2) and (2.3) are the growth equations respectively for pre- and post-liberalisation periods, with b_1 and $(b_1 + b_2)$ being the corresponding growth rates. The statistical significance of a_2 and b_2 in (2.1) implies that the post-liberalisation trend growth equation is different from that of the previous period.⁷

The simple dummy variable approach, as outlined above, captures only the differential rates of growth between the two periods. It does not say anything about the sources of growth i.e., whether the growth generated is due to factor accumulation only or due to total factor productivity (TFP) growth. More importantly, increased rate of growth in the post-liberalisation period can arise independent of reform or liberalisation measures and an equation like (2.1) cannot determine whether the superior growth performance is attributable to liberalisation.

⁷ However, the statistical significance of b_2 alone in equation (2.3) should indicate a higher growth rate for the post liberalisation period.

Therefore, equation (2.1) merely implies whether the growth of output associated with the post-reform regime is significantly different from that of the pre-reform period. One crucial problem in the implementation of equation (2.1) is that it requires specification of one particular point in time that separates the post-reform era from the pre-liberalisation period. In reality, there may not exist any such particular year marking such a drastic policy shift and thus the choice of such a break point depends on the subjective judgment of the researchers.

It follows from the above that we need to use some kind of growth accounting or production function framework to control for the relevant factors contributing to output growth and then examine the effects of trade liberalisation. Central to the growth accounting framework is the decomposition of output growth into its various sources, which has long occupied a prominent place in the field of macroeconomics. The usual neoclassical model of Solow (1956) attributes growth to three different factors, viz. physical capital accumulation, labour force growth, and total factor productivity (TFP) growth.⁸ The TFP growth is considered as the effect of exogenous technological progress, which can also be reflected in increasing productive efficiency. According to the model, the steady state growth solely depends on exogenous population growth and exogenous technical progress and these factors will converge to its steady state level due to the property of diminishing returns to capital.⁹ Using the Cobb-Douglas production function, the traditional neoclassical growth model can be specified as:

$$Y_t = A_t K_t^\alpha L_t^{1-\alpha} \quad (2.4)$$

where, Y is a measure of real output, A is total factor productivity, K is the stock of capital, and L is total employment. Taking logs and totally differentiating both sides yields:

$$\hat{y}_t = \hat{a}_t + \alpha \hat{k}_t + \beta \hat{l}_t \quad (2.5)$$

⁸ Often, this model is called as Solow-Swan model to acknowledge the contribution made by Swan in analysing the process of economic growth and capital accumulation (Swan, 1956).

⁹ Given that the marginal product of capital decreases as a country accumulates it, the neoclassical model predicts that poor countries should gradually converge toward richer countries.

where the lowercase variables with a ‘hat’ correspond to the growth rate of uppercase variables. As it follows from equation (2.5), the growth rate of output is decomposed into the growth of TFP, and a weighted average of the growth rates of physical capital and labour.

A slightly modified version of the Solow model, known as the augmented Solow model, extends the argument of the production function by including a human capital (H) variable into the model and is given in equation (2.6). The Solow-Swan and its augmented version have similar properties in the steady state and both assume constant returns to scale, as it appears from (2.4) and (2.6).¹⁰

$$Y_t = A_t K_t^\alpha H_t^\beta L_t^{1-\alpha-\beta} \quad (2.6)$$

Of late, the above theoretical neoclassical models have been challenged by what has come to be more popularly known as the endogenous growth theory (Lucas, 1988; Romer 1986; and Grossman and Helpman, 1991). In the new growth theory, the role of such endogenous factors as human capital stock and R&D activities are regarded as the main drivers of economic growth (Aghion and Howitt, 1999). In contrast to the assumption of exogenous TFP growth of the traditional growth models, endogenous growth theorists argue that this component of the growth itself can be the result of ‘learning-by-doing’ occurring between physical and human capital. This leads to increasing returns to scale in production technology in endogenous growth models ensuing the possibility of obtaining sustained growth in the long-run.¹¹ Therefore, the most distinctive difference between the neoclassical and endogenous growth theories is that while the former assumes constant returns to scale, the latter is based on increasing returns to scale.

The endogenous growth model that has received most attention is due to Lucas (1988). In this model, human capital is the ‘engine’ of growth. Production of output depends on the physical capital stock, the ‘effective work force’ rather than the ordinary physical labour.¹²

¹⁰ The steady state properties of the models can be found in Hwang (1998).

¹¹ It follows from the endogenous growth theory that income convergence among countries may not occur.

¹² The illustration of the Lucas model is based on Hwang (1998).

$$Y_t = A_t K_t^\beta (u q_t L_t)^{1-\beta} \quad (2.7)$$

where, A represents the level of technology, uq_tL_t , is a measure of effective labour force such that L is the number of workers, u stands for the fraction of working hours spent on production of goods, and q denotes average quality of workers. If h_a is to be the average human capital of the labour force, the production function in the competitive equilibrium will be as follows:

$$Y_t = A_t K_t^\beta (u h_t L_t)^{1-\beta} h_a^\gamma = A_t K_t^\beta (u L_t)^{1-\beta} h_a^{1+\gamma-\beta} \quad (2.8)$$

The term h_a^γ in (2.8) is the externalities from the average human capital.¹³ These externalities increase the degree of homogeneity of the production function to $(2 + \gamma - \beta) > (2 - \beta) > 1$. In contrast to the exogenous productivity model of Solow and Swan, the basic argument in the Lucas model is that non-diminishing returns characterize the production of knowledge technology, which, in turn, ensures sustained growth by the accumulation of knowledge and skills. In fact, the possibility of sustained growth depends on whether the externality effect, γ , is positive or not.

While the theoretical Lucas model provides a useful framework for understanding how an economy can achieve sustained growth, the application of the model is very data demanding. Especially, the data on average quality of labour, effective labour force and the average human capital are notoriously difficult to obtain for most developing and least developed countries. In the empirical literature, this problem is usually overcome by emphasizing on the main difference associated with the returns to scale in production between the augmented Solow and Lucas models. As we have seen above, both models incorporate a term on human capital but the simple neoclassical models postulate a constant returns to scale in production while the endogenous growth theory hypothesizes increasing returns. Thus in estimating such an equation as (2.6), the finding of the sum of the parameters corresponding to L , K , and H greater than unity is regarded as a support for the endogenous growth theory (e.g., see Beddies, 1999; Ghatak, *et al.*, 1995; Ghura, 1997; and Hwang, 1998).

In order to verify the link between trade liberalisation and economic growth, the above models can be extended further to include some measure of trade liberalisation. This means, apart from

¹³ The model assumes that all workers have the same skill level ($h_t = h_a$) in equilibrium.

the factors already included in above growth models, trade liberalisation measure itself could exert significant favourable influence on economic growth. Therefore, our empirical investigation will be based on the following equation:

$$Y_t = A_t K_t^\alpha H_t^\beta L_t^\theta \Gamma_t^\varphi \quad (2.9)$$

where Y, K, H, and L are as defined above and Γ is some measure of trade liberalisation. Taking logarithmic transformation and adding a stochastic error terms, the estimating equation from equation (2.9) can be written as:

$$\ln Y_t = \psi + \alpha \ln K_t + \beta \ln H_t + \theta \ln L_t + \varphi \ln \Gamma_t + \varepsilon_t \quad (2.10)$$

In equation (2.10), \ln represents natural logarithmic transformation of the variables, $\ln A$ is denoted by ψ , and the stochastic error by ε . A positive and significant coefficient on $\ln \Gamma$ will support the hypothesis that trade liberalisation has a positive effect on overall economic growth performance controlling for other factors of production. The specification in (2.10) is comparable to a number of similar empirical studies (e.g., Ahmed, 2001; Dutta and Ahmed, 2001; Greenaway and Sapsford, 1994a; Hwang, 1998; Onafowora and Owoye, 1998; and Siddiki, 2002).

2.4. Measures of Trade Liberalisation and Data on Other variables

2.4.1. Indicators of Trade Liberalisation

The empirical specification in equation (2.10) will require some measure of trade liberalisation. Clarifying the precise meaning of liberalisation is, however, far from a trivial matter. There is a wide array of policy instruments that are used to restrict trade ranging from the traditional means of import licensing, tariffs, quantitative restrictions, foreign exchange rationing to the most recent apparatus involving the enforcement of technical standards, putting in force the rules of origin requirements, recourse to anti-dumping, and similar other measures. Given these multiple dimensions of trade restricting measures, it is difficult to obtain an indicator that can be considered as the best measure of openness and trade liberalisation (Andriamananjara and Nash,

1997).¹⁴ In empirical research works, therefore, different investigators have used different measures – a summary of which, due to McCulloch, *et al.* (2002), is given in Table 2.1.

Table 2.1: Measures of Trade Liberalisation

Serial Number	Measure	Definition
I	Trade dependency ratio	The ratio of exports and imports to GDP
II	Growth rate of exports	The growth rate of exports over the specified period
III	Tariff averages	A simple or trade-weighted average of tariff levels
IV	Collected tariff ratios	The ratio of tariff revenues to imports
V	Coverage of Quantitative Restrictions	The percentage of goods covered by quantitative restrictions
VI	Black market premium	The black market premium for foreign exchange, a proxy for the overall degree of external sector distortions
VII	Heritage Foundation index	An index of trade policy that classifies countries into five categories according to the level of tariffs and other (perceived) distortions
VIII	IMF index of trade restrictiveness	A composite index of restrictions on a scale of 0 to 10
IX	Trade bias index	The extent to which policy increases the ratio of importable goods' prices relative to exportable goods' prices compared to the same ratio in world markets.
X	The World Bank's outward-orientation index	An index that classifies countries into four categories depending on their perceived degree of openness
XI	Sachs and Warner index	A composite index that uses several trade-related indicators: tariffs, quota coverage, black market premia, social organization and the existence of export marketing boards
XII	Leamer's openness index	An index that estimates the difference between the actual trade flows and those that would be expected from a theoretical cross-country trade model

Source: McCulloch, *et al.* (2002), p.14.

It needs to be mentioned that many of the measures summarized in Table 2.1 are suitable only for the studies that use cross-section (i.e., cross-country) regression models. For example, the measures reported in serial numbers VII, VIII, X, XI, and XII have been prepared exclusively for making inter-country comparison. In the case of country specific studies, one needs to have the information at least on a particular liberalisation measure on a continuous time series basis and, in this respect, subject to the availability of the data for every year, only the dependency ratio, export growth rate, tariff averages, collected tariff ratio, coverage of quantitative restrictions, black market premium, and trade bias index (i.e., measures defined in I, II, III, IV, V, VI, and

¹⁴ Most often “openness” and “liberalisation” are used synonymously. This is because liberalisation measures are thought to make a country more open.

IX) might be suitable. Since liberalisation is meant to reduce the anti export bias by increasing the ratio of the prices of exportables relative those of importables, of all the measures trade bias index can potentially constitute the most powerful indicator of trade liberalisation. Such an indicator requires the data on effective exchange rates for exports and imports. For Bangladesh, however, there is no consistent estimate of anti-export bias for a sufficiently long period of time. Although World Bank (1999) constructs a series of the ratio of effective exchange rate for imports to exports for the 1990s (1992-98) and Rahman (1994) provides the estimates of the 'trade policy bias' for 1974-89 using a similar definition, the methodologies employed in preparing these two series are different and hence not comparable.

While the data on black market premium for every year and sufficiently long time series of simple tariff averages are not available for Bangladesh, it can be argued that growth rate of exports and coverage of quantitative restrictions are very unlikely to be meaningful indicators.¹⁵ This is because despite the on-going liberalisation measures, it is unrealistic to expect that growth rate of exports will increase continuously.¹⁶ Similarly, after a certain point import coverage under quantitative restrictions will be unable to reflect further liberalisation.¹⁷

The above discussions leave us to use the trade dependency ratio as a measure of liberalisation. This simple measure is particularly useful as, with liberalisation, the rate of expansion of the

¹⁵ However, even when data are available, black market premium and simple tariff averages as measures of trade liberalisation have deficiencies. While an excess demand for foreign currency can be reflected in black market premium, it has been argued that the demand for imports outside of official channels is only one source of excess demand for foreign exchange (Andriamananjara and Nash, 1997). Factors such as capital flight can result in a high premium especially when the capital account is not open, even in an economy with a relatively open current account with few barriers. In the case of simple tariff averages there are several problems, as noted in Milner and Morrissey (1997). First, often there exists a large number of scheduled tariffs but many of them are actually redundant. Second, secondary tariffs such as supplementary duty and development surcharge are excluded making simple averages unrealistic and misleading. Third, many imports will not attract the scheduled rate either because the importer is entitled to exemptions or the source country is in a preferential trading arrangement.

¹⁶ If anything meaningful, one can only examine whether the annual average growth of exports in the post-reform period is higher than that of the pre-reform time.

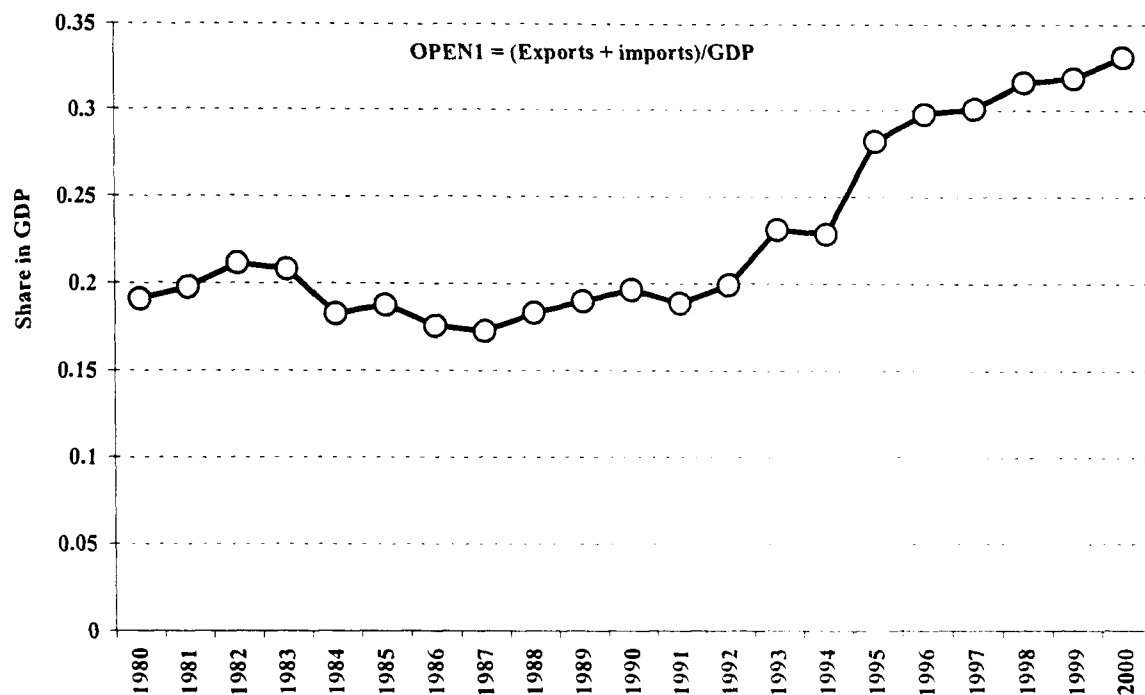
¹⁷ Note that, at a certain point in time inter-country comparison on the basis of the proportion of imports under quantitative restrictions may be useful to evaluate the restrictiveness of trade policies across countries. However, the evolution of a country's trade policy or orientation cannot be gauged adequately by the use of the information on quantitative restrictions alone. Anderson and Neary, as mentioned in Andriamananjara and Nash (1997, p.5) "have recently developed a "trade restrictiveness index", which in principle incorporates the effects of both tariffs and NTBs [non-tariff barriers]. Because of this, it is arguably the most theoretically defensible of any single measure. However, in the absence of domestic price data, empirical application requires assumptions about the effects of NTBs, and the results are sensitive to what assumptions are made".

external sector is expected to be higher than that of the GDP.¹⁸ Figure 2.1 provides the trade-GDP ratio (OPEN1) for Bangladesh for the last two decades, which shows that while in the 1980s the ratio had been about 20 per cent, since 1991 the trade-orientation had increased rapidly to reach 33 per cent in 2000. In fact, Figure 2.1 matches well with the general perception about the pace and extent of trade liberalisation in Bangladesh.

In some empirical research, import penetration ratio, i.e., imports as percentage of GDP rather than the trade-orientation ratio has been used as an indicator of liberalisation. In the context of an individual country, this measure can be useful since liberalisation has a direct impact on the import of goods into the domestic economy. However, country experiences show that the extent and pace of liberalisation differs between commodities. While preferences are given to the imports of capital goods and raw materials, restrictions on consumers' goods are either stringently maintained or are relaxed only slowly. Therefore, import penetration of consumers' goods may also constitute a good proxy for real liberalisation. For Bangladesh, the data on imports of consumers' goods are available thereby enabling us to construct a second measure of trade liberalisation. Figure 2.2 gives the ratio of imports of consumers' goods to GDP (OPEN2) for Bangladesh. It is observed that in the early 1980s imports of consumers' goods accounted for as low as 2 per cent of GDP, which by the end of the 1990s had risen to 6 per cent.

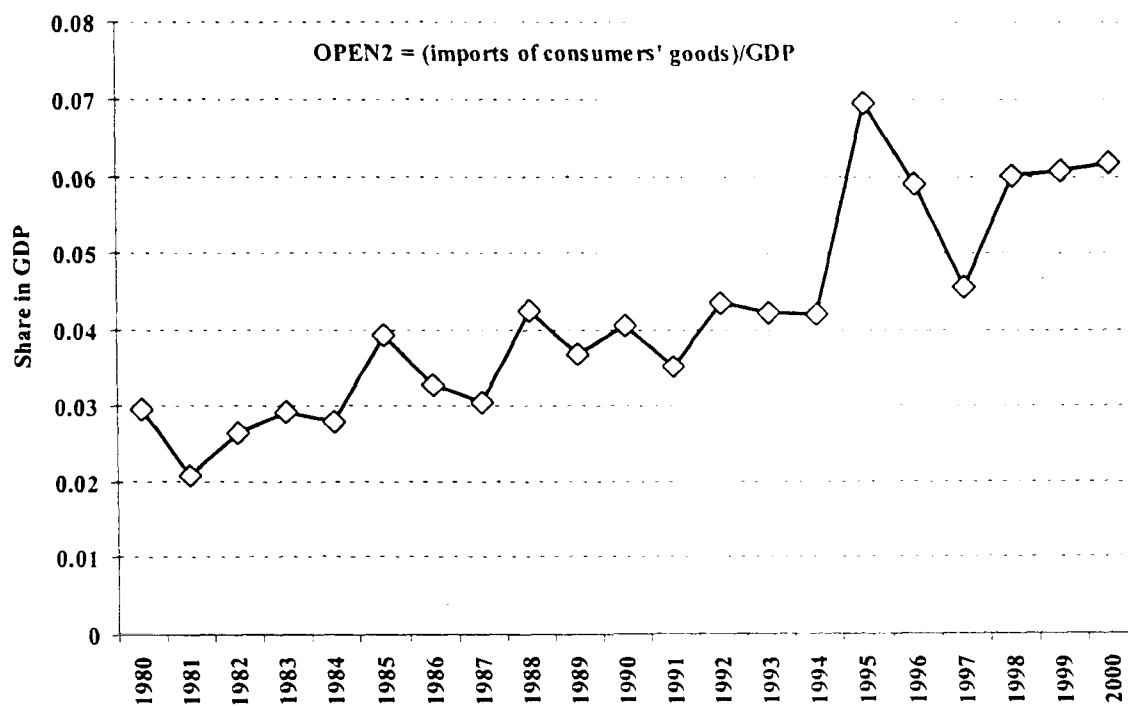
¹⁸ One should be careful in using trade-GDP or export-GDP ratio to evaluate the relative openness of any cross section of countries. For example, trade typically occupies a much larger share of GDP for small countries than for large countries. Thus, mere size may make a small country open in practice, even though it may apply numerous policy distortions to trading activities. To overcome this problem, many researchers first try to explain the cross-country export-propensity or trade-GDP ratio with country-specific characteristics such as population, population density, geographical location, etc. and then the difference between the actual and predicted value for each country is considered as the measure of relative openness. Gylfason (1999), therefore, prepares an index of relative openness on the basis of a simple cross-country relationship between export-propensity and population with the belief that large countries (in terms of population) will have a greater natural tendency to produce for the domestic market and hence is structurally less open than small economies. Leamer (1988) has gone further by constructing Heckscher-Ohlin-Vanek style factor endowment model to predict what would be a country's composition (not just volume) of trade without intervention, then using the average deviation of the actual from predicted values as a measure of openness or intervention (this is essentially the Leamer's openness index as shown in XII in Table 2.1 above). The problem with these approaches is that the results are only reliable to the extent that the models used to form the counterfactual incorporate all the relevant determinants of trade. Moreover, these measures only capture a country's deviation from the cross-country average level of trade restrictions. Thus, they can be thought of as relative, rather than absolute measures (Andriamananjara and Nash, 1997). The central message is that while in the case of cross-country comparison, the simple measure of openness either on the basis of the export-GDP or trade-GDP ratio can be problematic, for an individual country such measures can be useful in capturing one important effects of trade policy reforms.

Figure 2.1: Trade to GDP Ratio as a Measure of Trade Liberalisation



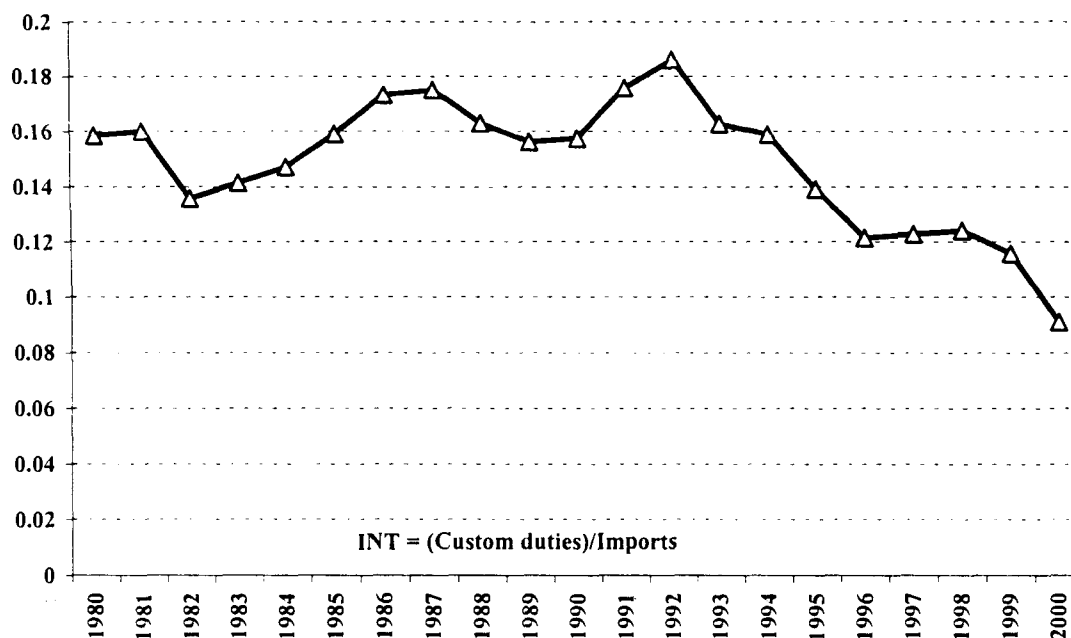
Source: Authors' estimate from BBS data (BBS 2000, 2001).

Figure 2.2: The Ratio of Imports of Consumers' Goods to GDP as a Measure of Trade Liberalisation



Source: Authors' estimates based on the data from BBS Annual Yearbook (various issues).

Figure 2.3: Implicit Nominal Tariff as a Measure of Trade Liberalisation



Source: Authors' estimate based on the data from NBR (2001).

Finally, as a third measure of trade liberalisation, the implicit nominal tariff (INT) rate can be used. This is defined as the ratio of total customs revenue divided by total value of imports. The implicit tariff measure is quite straightforward, overcomes the problem of simple tariff averages as discussed above and is considered to be a 'more reliable' measure of trade liberalisation (Milner and Morrissey, 1997). It is expected that as the trade liberalisation programmes become intensified, INT will fall.

Figure 2.3 provides the estimate of INT for Bangladesh. It appears that since 1992 there has been a significant reduction in INT. For most of the 1980s, the implicit tariff rate lay close to 16 per cent with some cyclical movements, but since 1992 it has fallen sharply. In 2000, the estimated INT stood at around 8 per cent, which is about half the corresponding rate of as late as in 1993. Hardly anyone could disagree that the INT measure as plotted in Figure 2.3 closely resemble the significant trade liberalising efforts of the 1990s.

2.4.2. Data on Other Variables

Apart from the indicators of trade liberalisation, data requirements for the empirical exercise can be assessed from equation (2.10), according to which information on real GDP, capital stock, labour, human capital will be required. The time series on real GDP is taken from the revised national income estimates by the BBS (2000 and 2001). This is given in millions of local currency (Taka) and in 1995-96 constant prices. Under the revised accounting system, the BBS provides comparable data for 1980–2000. Therefore, our sample will be limited to only 21 annual observations. The data on capital stock have been gathered from Rahman and Rahman (2002) and are given in 1995-96 prices.¹⁹

In the literature, there is some controversy regarding what should be used for labour. While total employment can be considered as good measure of labour involved in the process of overall production, no such data exist for Bangladesh for every year throughout the sample period.²⁰ The present study uses the data on labour force to proxy employment. Finally, the data on human capital are non-existent. Proxies such as enrolment ratio in primary and secondary educational institutions have been used by applied economists in empirical exercises (e.g., Ghatak *et al.*, 1997; and Riezman *et al.*, 1996). However, for Bangladesh there is no continuous time series data on enrolment in primary and secondary education. Therefore, we decided to use the adult literacy rate as a measure of human capital. We believe, for a least developed country such as Bangladesh, the literacy rate would be able to capture the basic trend in human capital formation.²¹ The data on labour force and adult literacy rate come from the World Development Indicators of the World Bank (2002).

¹⁹ It needs to be noted here that a large number of studies (e.g., Ahmed, 2001; Amirkhal-Khali and Dar, 1995; Ghatak *et al.*, 1997; Islam, 1998; Ram, 1987; Riezman, *et al.*, 1996; and Siddiki, 2002) erroneously make use of the investment-GDP ratio in the production function. A production function or output equation specified on the levels of the variables, as in equation (2.10), stipulates the relationship between output and capital stock and not between output and investment share in GDP.

²⁰ A large number of studies (e.g., Begum and Shamsuddin, 1998; Islam and Iftekharuzzaman, 1996; Medina-Smith, 2001; Ram, 1987; Sharma and Dhakal, 1994; and Van den Berg and Schmidt, 1994) have used population, which is certainly not a good measure of employment. Therefore, this proxy is not used in the present study.

²¹ Note that the use of enrolment ratio in various educational institutions might not truly represent human capital stock, as enrolment is more of a 'flow' and not a 'stock' concept. On the other hand, adult literacy is a stock variable.

2.5. Estimation Strategy

2.5.1. Time Series Properties of the Variables

Recent developments in econometrics put emphasis on the characteristics of the time series data. Central to this is the distinction between the stationary and non-stationary time series in contrast to the traditional practice of assuming all variables in the regression model are stationary. A time series is said to be stationary if its mean, variance and auto-covariance are independent of time. By now there is compelling evidence that many macroeconomic time series are non-stationary in nature and, as a consequence, the ordinary least squares (OLS) regressions using these data might produce not only inconsistent and inefficient estimates but also spurious results. In other words, one could obtain a highly significant correlation between variables although in reality there may not exist any such relationship.²² In order to avoid such problems of estimating non-sense relationship, the integrating properties of the variables should be examined carefully by testing for the existence of unit roots in variables under consideration.

The two most popular tests for unit roots, which we intend to use for the present study, are the Dickey Fuller (DF) and Augmented Dickey Fuller (ADF) tests. The DF test is based on equation (2.11) where Y is the variable under consideration, Δ is the first difference operator, subscript t denotes time period, T is the time trend and e is the error term. The null hypothesis for this test is that $(\psi - 1) = 0$ (i.e., Y_t is non-stationary) against the alternative of $(\psi - 1) < 0$ (i.e., Y_t is stationary). The 't' test on the estimated coefficient of Y_{t-1} provides the DF test for the presence of a unit root. The ADF test, on the other hand, is a modification of the DF test and involves augmenting equation (2.11) by lagged values of the dependent variables.²³ This is done to ensure that the error process in the estimating equation is residually uncorrelated.²⁴ More precisely, the ADF version of the test is based on equation (2.12). As in the case of the DF test, the t-ratio on $(\psi - 1)$ provides the ADF test statistic.

²² One interesting example of spurious regression is due to Hendry (1980) who found a very strong positive relationship between the inflation rate and the accumulated annual rainfall for the United Kingdom.

²³ Note that the DF and ADF tests are usually carried out with and without the time trend term (T) in the regression. If the variable is trended, the insertion of the term is required. However, if the variable is not trended, DF-ADF regressions can be applied without it.

²⁴ In the case of the annual data, incorporation of the first lag of the dependent variable most often overcomes the problem of residual correlation. Higher order of lags would be necessary for quarterly and other high frequency data.

$$\Delta Y_t = \tau + (\psi - 1)Y_{t-1} + \chi T + e_t \quad (2.11)$$

$$\Delta Y_t = \tau + (\psi - 1)Y_{t-1} + \chi T + \delta \Delta Y_{t-1} + e_t \quad (2.12)$$

In both the equations (2.11) and (2.12) the estimated t-ratios on $(\psi - 1)$ are non-standard requiring the computed test statistics to be compared with the corresponding critical values to infer about the stationarity of the variables.²⁵ The DF and ADF tests can, however, provide contrasting evidence and there appears to be a consensus in the literature that ADF test is preferable to DF. It is quite common to find that macroeconomic time series data are non-stationary on their levels but stationary on their first or higher order differences. Following Engle and Granger (1987), a time series is said to be integrated of order d [usually denoted as $\sim I(d)$] where d is the number of times the series needs to be differenced in order to become stationary.

It needs to be mentioned that in small sample the testing procedure for unit roots might be very complicated. Not only that the results emanating from different unit root test regressions can be inconclusive but also the critical values for such tests may prove to be very demanding. Apart from these, it is well known that the low power of the DF and ADF tests is an unavoidable fact as Harris (1995) points out that the most important problem faced when applying the unit root test is their probable poor size and power properties.²⁶ This is often reflected in the tendency to over-reject the null when it is true and underreject the null when it is false. In a small sample, the problem is likely to be even worse. Thus, in the case of small sample, Hall (1986) suggests the inspection of the autocorrelation function and correlogram as an important tool in determining whether the variables are stationary or not. The autocorrelation function for any variable at any lag k is defined by the ratio of covariance at lag k divided by the variance.²⁷ When the estimated autocorrelation coefficients at different lags are plotted against k , population correlogram is obtained.²⁸ For non-stationary variables, correlograms die down slowly giving rise to either a

²⁵ These critical values were first computed by Dickey and Fuller (1981). If the computed test statistics exceed the critical values, the null hypotheses underlying the DF-ADF tests are rejected. Computed t-ratios and the corresponding critical values are compared on their absolute levels.

²⁶ Engle and Granger (1987) also highlighted the low power of the DF and ADF tests.

²⁷ The autocorrelation coefficient like any ordinary correlation coefficient lies between -1 and $+1$.

²⁸ Note that in practice we only have a realisation of a stochastic process and therefore can only compute sample

autocorrelation function, which is defined as:
$$\frac{\sum (y_t - \bar{y})(y_{t+k} - \bar{y})}{\sum (y_t - \bar{y})^2}$$

secular declining or a constant trend in the graph of autocorrelation coefficients, while in the case of stationary variables they damp down almost instantly and then show random movement. For the present study, therefore, we shall employ the DF-ADF tests, autocorrelation coefficients and correlograms to determine the integrating properties of the variables.

2.5.2. Cointegration and Error Correction Modelling

2.5.2.1. The Engle Granger Procedure

Once it is determined that the variables in the model are non-stationary, the only way to infer about the long-run relationship is to employ some kind of cointegration technique. There are several cointegration methodologies in the literature – the simplest one being the Engle-Granger two step procedure. The basic idea behind the Engle-Granger technique is that if two variables say Y_t and X_t are both $\sim I(d)$, a linear combination of these two variables such that $V_t = X_t - \theta Y_t$, in general, will also be $\sim I(d)$. Engle and Granger, however, showed that in an exceptional case if the constant θ yields an outcome where $V_t \sim I(d-a)$ and $a > 0$, then X_t and Y_t will be cointegrated. Usually, the linear combination represented by the residuals from the OLS regression is tested for stationarity. Thus, if Y_t and X_t are both $\sim I(1)$, they will be cointegrated and have a valid long-run relationship if residuals from the OLS regression of X_t on Y_t is $\sim I(0)$. This is what is known as the first step of Engle-Granger procedure.

One important contribution of Engle and Granger (1987) was to find that if variables were cointegrated, there would have existed an error-correction model (ECM) of that cointegrating relationship. The ECM will then capture the short-run dynamics of the long-run behaviour, which is known as the second step of Engle-Granger procedure. The ECM is constructed by regressing the dependent variable in stationary form, onto its own lagged values and the current and lagged values of the stationary forms of the dependent variables, and the lagged error term from the cointegrating relationship. If we assume that both Y_t and X_t are $\sim I(1)$ such that ΔY_t and ΔX_t are $\sim I(0)$, the ECM can be represented as:

$$\Delta Y_t = \pi_0 + \sum_{i=0}^m \pi_{1i} \Delta X_t + \sum_{i=1}^n \pi_{2i} \Delta Y_t + \pi_3 \hat{u}_{t-1} + \varepsilon_t \quad (2.13)$$

Equation (2.13) gives a very general representation of the ECM. Since all variables in (2.13) are $\sim I(0)$, the problem of spurious regression is overcome. It is worth noting that the ECM is not a mere regression of the stationary variable rather it includes \hat{v}_{t-1} , the deviation from the steady-state long-run path, which basically contains the long-run information. Thus the ECM captures the short-run relationship taking into consideration the long-run information. A valid representation of the ECM will require $\theta > \pi_3 \geq -1$. The usual practice with the error correction modeling is to follow the “general to specific” methodology by constructing a general model in the beginning and subsequently reduce it to a parsimonious form after dropping all the insignificant variables step-by-step.

2.5.2.2. The Phillips-Hansen Fully Modified OLS

In estimating the equations as specified in Section 4, we can employ the Engle-Granger cointegration procedure to test for a valid long-run relationship. However, although this procedure can test for cointegration, it yields standard errors that do not provide the basis for valid inferences. In equations with more than two explanatory variables, this can be problematic in the sense that even if the variables are found to be cointegrated we cannot be certain whether any particular explanatory variable is significant or not.²⁹ We propose to handle the problem by using the Phillips-Hansen Fully Modified OLS (PHFMOLS) technique (Phillips and Hansen, 1990). The Phillips-Hansen method is an optimal single-equation technique, which is asymptotically equivalent to maximum likelihood procedure. It makes a semi-parametric correction to the OLS estimator to eliminate dependency of the nuisance parameters and provides standard errors that follow standard normal distribution asymptotically and thus are valid for drawing inferences. Due to this particular advantage, the use of PHFMOLS has become

²⁹ That is, for example, in a three variable, say Y, X and Z, regression model cointegration does not necessarily suggest statistically significant influence of both the explanatory variables, X and Z. It might be that only X is significant but not Z and vice-versa. Since the computed standard errors in the first step of the Engle-Granger procedure is not valid, correct statistical inference from the estimated model is not possible.

quite popular in international trade and macroeconomic modeling.³⁰ The PHFMOLS procedure can be described by the following.³¹

Consider the data generating mechanism for Y_t following the cointegration system:

$$Y_{1t} = \alpha_0 + \alpha_1 + \beta' Y_{2t} + u_{1t} = \lambda R_t + u_{1t} \quad (2.14)$$

$$\Delta Y_{2t} = u_{2t} \quad (2.15)$$

$$u_t = \begin{pmatrix} u_{1t} \\ u_{2t} \end{pmatrix} = \psi(L)\varepsilon_t, \quad E(\varepsilon_t \varepsilon_t') = PP' \quad (2.16)$$

where, Y_{1t} and Y_{2t} are scalar and mxt vector of $I(1)$ stochastic processes, $\lambda' = (\alpha_0 + \alpha_1 + \beta')$ and $R_t = (Y_{1t}, Y_{2t})$. We define:

$$\Omega = \psi(1)P, \quad \Sigma = \Omega\Omega' = \begin{pmatrix} \Sigma_{11} & \Sigma_{12}' \\ \Sigma_{21} & \Sigma_{22} \end{pmatrix} \quad (2.17)$$

Σ is the long-run covariance matrix of u_t . As mentioned earlier, the PHFMOLS estimator is an optimal single equation method based on the use of OLS on equation (2.14) with semi-parametric corrections for serial correlation and potential endogeneity of the right hand side variables.

Consider the OLS estimator of the cointegrating equation (2.14) by $\hat{\lambda} = (R_t' R_t)^{-1} R_t' Y_{1t}$, where R_t and Y_{1t} are respectively $T \times (m+2)$ and $T \times 1$ matrices of observations on R_t and Y_{1t} . Due to serial correlation in u_{1t} and endogeneity of Y_{1t} , $\hat{\lambda}$, in general, is consistent but biased. The FM procedure modifies the OLS estimator $\hat{\lambda}$ to correct for serial correlation and endogeneity bias. The FM estimator is given by:

³⁰ Amongst others, Athukorala and Riedel (1995) and (1996), Muscatelli, *et al.* (1994, 1995), Senhadji (1998) and Senhadji and Montenegro (1998) have used the Phillips-Hansen procedure to modeling trade for various countries, while Mallick (1999) has applied the procedure to macroeconometric modelling for India.

³¹ This is based on the illustrations in Senhadji (1998).

$$\hat{\lambda}^* = \begin{pmatrix} \hat{\alpha}_0^* \\ \hat{\alpha}_1^* \\ \hat{\beta}^* \end{pmatrix} = \begin{pmatrix} T & \sum_{t=1}^T Y_{2t}' & \sum_{t=1}^T t \\ \sum_{t=1}^T t & \sum_{t=1}^T t Y_{2t}' & \sum_{t=1}^T t^2 \\ \sum_{t=1}^T Y_{2t} & \sum_{t=1}^T Y_{2t} Y_{2t}' & \sum_{t=1}^T Y_{2t} t \end{pmatrix}^{-1} \begin{pmatrix} \sum_{t=1}^T \hat{Y}_{1t}^+ \\ \sum_{t=1}^T t Y_{1t}^+ \\ \sum_{t=1}^T Y_{2t} Y_{1t}^+ - T \hat{V}_T^+ \end{pmatrix} \quad (2.18)$$

$$\hat{Y}_{1t}^+ = Y_{1t} - \hat{\Sigma}_{21}' \hat{\Sigma}_{22}^{-1} \Delta Y_{2t} \quad (2.19)$$

$$\hat{\Sigma} = \begin{pmatrix} \hat{\Sigma}_{11} & \hat{\Sigma}_{21}' \\ \hat{\Sigma}_{21} & \hat{\Sigma}_{22} \end{pmatrix} = \hat{\Gamma}_0 + \sum_{\nu}^q \left(1 - \frac{\nu}{q+1} \right) \left(\hat{\Gamma}^{\nu} + (\hat{\Gamma}^{\nu})' \right) \quad (2.20)$$

$$\hat{\Gamma}_{\nu} = T^{-1} \sum_{t=\nu+1}^T \begin{pmatrix} \hat{u}_{1t} \hat{u}_{1t-\nu}' & \hat{u}_{1t} \hat{u}_{2t-\nu}' \\ \hat{u}_{1t-\nu} \hat{u}_{2t}' & \hat{u}_{2t} \hat{u}_{2t-\nu}' \end{pmatrix} = \begin{pmatrix} \hat{\Gamma}_{11}^{\nu} & \hat{\Gamma}_{12}^{\nu} \\ \hat{\Gamma}_{21}^{\nu} & \hat{\Gamma}_{22}^{\nu} \end{pmatrix} \quad (2.21)$$

$$\hat{V}_T^+ = \sum \left(1 - \frac{\nu}{q+1} \right) [(\hat{\Gamma}_{12}^{\nu})' + (\hat{\Gamma}_{22}^{\nu})'] \quad (2.22)$$

Where q is the bandwidth parameter in the Bartlett window used in the estimation of the long-run covariance matrix. The difference between the OLS and FM estimators is highlighted in the last vector of (2.18) where Y_{1t} is replaced by \hat{Y}_{1t}^+ (which corrects for the potential endogeneity of Y_{2t}) and the factor $T \hat{V}_T^+$ (which corrects for the potential autocorrelation of the error term). The FM estimator $\hat{\lambda}^*$ has the same asymptotic behaviour as the full information system maximum likelihood estimators.

2.5.2.3. Existence of a Long-run Relationship

2.5.2.3.1. Testing for Cointegration

From the above, our estimation strategy can be summarized as follows. First, the time series properties of the variables will be analysed and, in the case of equations containing non-stationary variables, PHFMOLS method will be used which would provide standard errors for valid inferences. The estimation by PHFMOLS itself does not guarantee cointegration needing one to check for residual stationarity. In the literature, the standard practice of testing for cointegration has been the use of ADF test, which is given in equation (2.23). Note that in

contrast to the regular ADF regressions, the test for residual does not include any intercept term.³²

$$\Delta \hat{v}_t = \rho \hat{v}_{t-1} + \kappa \Delta \hat{v}_{t-1} + \tau \quad (2.23)$$

The null hypothesis for the test is that $\rho=1$ (non-cointegration) against the alternative of $\rho<1$ (cointegration). Like the regular ADF test statistics the estimated standard errors in (2.23) are non-standard and hence they will have to be compared with the appropriate critical values as estimated by Engle and Granger (1987) and Mackinnon (1991).³³

Despite its widespread use, the low power of the ADF test is considered to be a serious shortcoming for cointegration test. Engle and Granger showed that when $\rho=0.9$ the ADF test for cointegration has about 28 per cent chance of not rejecting the null of no cointegration even when it is false.³⁴ In small sample, testing for cointegration is more troublesome as, apart from the low power, critical values for such tests become more demanding. One effective way of tackling this problem is to follow Hall (1986) and examine the autocorrelation coefficients and the resultant correlograms of the estimated error term from the static long-run equations.

2.5.2.4. Reason for Employing the Single Equation Estimation Technique

A problem with the Engle-Granger and PHFMOLS is that they ignore the possibility of multiple cointegrating vectors. This problem can be tackled by Johansen's (1988) Full Information Maximum Likelihood (FIML) procedure. However, there are two important problems associated with this approach. First of all, the results from the Johansen procedure can be very sensitive to the choice of lag-length (Hall, 1991; Banerjee *et al.* 1993). Although there are statistical tests for choosing the appropriate lag-lengths, in a small sample such tests may not be feasible. Moreover, severe problem of collinearity among the regressors may also arise when a considerable size of

³² This is because by definition the mean of the residual should be zero.

³³ Many econometric software routinely computes such critical values.

³⁴ Razzaque and Ahmed (2000) provide a detailed explanation with the help of a specific case when the ADF test on the residuals falls is thought to have fallen into the trap of its low power.

VAR is used (Athukorala and Riedel, 1996). Since in the present study we will be dealing with a small sample size (annual observations for 20 years), the Johansen procedure may not be an appropriate one. Therefore, we will have to rely on single equation procedures, such as those of Engle-Granger and PHFMOLS.

2.6. Estimation Results

2.6.1. Examining the Time Series Properties of the Variables

The estimation begins with the testing of variables for unit roots to determine whether they can be considered as a stationary or non-stationary process. Table 2.2 provides the results of DF-ADF tests on level and first difference of variables with and without the trend term, while Figure 2.4 presents the graphical plots and correlograms of all the variables. It is quite common to find that test results are inconclusive and, in such a case, graphical plots and correlograms might prove helpful in deciding about the integrating order of the relevant time series.

First, considering the aggregate output ($\ln Y$), it is found from Table 2.2 that while all DF and ADF tests on $\ln Y$ cannot reject the null hypothesis of non-stationarity, such tests on $\Delta \ln Y$ are inconclusive as DF tests reject the null hypothesis but ADF test cannot. In light of the fact that the ADF test is usually considered to be preferable to DF, without further testing one cannot be certain about the order of integration of $\ln Y$. The correlograms of $\ln Y$, as given in Figure 2.4, do not show any tendency of damping down while those on $\Delta \ln Y$ tail off on the first lag just like any stationary variable. While for $\ln Y$ the estimated autocorrelation coefficients were found to be individually statistically significant upto the second order of lag, no such coefficients were significant for $\Delta \ln Y$.³⁵ If a series is stationary, sample autocorrelation coefficients are approximately normally distributed with zero mean and standard error $1/\sqrt{n}$, where n is the sample size. Since we have a sample of 20 observations, it will imply a standard error of 0.2236. Now, following the properties of the standard normal distribution, the 95 per cent confidence interval for any of the sample autocorrelation coefficient will be $\pm 1.96(0.2236) = \pm 0.4382$. If all autocorrelation coefficients fall inside this interval, we cannot reject the null hypothesis that the

³⁵ Since we have a sample of 20 observations, the examination of autocorrelations coefficients upto the 5th lag order should be sufficient.

true autocorrelation coefficient is zero. It was found that up to the 4th lag order the null hypothesis could be rejected for $\ln Y$ but not for $\Delta \ln Y$ (Figure 2.5). Besides, one can test the joint hypothesis that all the autocorrelation coefficients are simultaneously equal to zero by employing the Box-Pierce and Ljung-Box statistics.³⁶ Both these statistics also provide the evidence that the joint hypothesis of all autocorrelation coefficients are simultaneously equal to zero could be rejected on the level of the variable, $\ln Y$, but not on its first difference, $\Delta \ln Y$.³⁷ Thus, probably it would not be inappropriate to conclude that $\ln NY$ is $\sim I(0)$.³⁸

Table 2.2: Results of the DF-ADF Unit Root Tests

Variables	Without Trend		With Trend	
	DF	ADF	DF	ADF
$\ln Y$	2.76	2.82	-0.67	-0.36
$\Delta \ln Y$	-3.87	-2.46	-4.82	-3.63
$\ln K$	15.21	1.58	1.56	0.23
$\Delta \ln K$	-0.92	-1.21	-1.65	-2.41
$\ln L$	3.84	1.65	-0.79	-1.30
$\Delta \ln L$	-1.80	-1.88	-2.48	-2.99
$\ln H$	-0.48	-0.54	-2.96	-3.44
$\Delta \ln H$	-4.71	-4.40	-4.55	-4.26
$\ln \text{OPEN1}$	0.33	0.33	-1.52	-1.40
$\Delta \ln \text{OPEN1}$	-3.99	-2.37	-4.84	-3.19
$\ln \text{OPEN2}$	-2.06	-1.30	-5.10	-4.52
$\Delta \ln \text{OPEN2}$	-6.54	-6.67	-6.37	-6.47
$\ln \text{INT}$	0.52	0.051	-0.29	-0.60
$\Delta \ln \text{INT}$	-2.56	-2.44	-3.60	-3.80

Note: The 95 per cent critical value for DF and ADF test statistics without the trend term is -3.02 . The comparable statistic for DF-ADF regressions with the trend term is -3.67 . The null hypothesis is that the variable under the test is non-stationary against stationary. An absolute value of the test statistic greater than the corresponding critical value would imply rejection of the null.

The two factors of production variables namely capital ($\ln K$) and labour ($\ln L$) appear to be extremely difficult in deciding about their order of integration. For both variables, none of the ADF test statistics can reject the non-stationary hypothesis, which means the variables are stationary neither on their levels nor on their first differences. The correlograms of $\ln K$ and $\ln L$

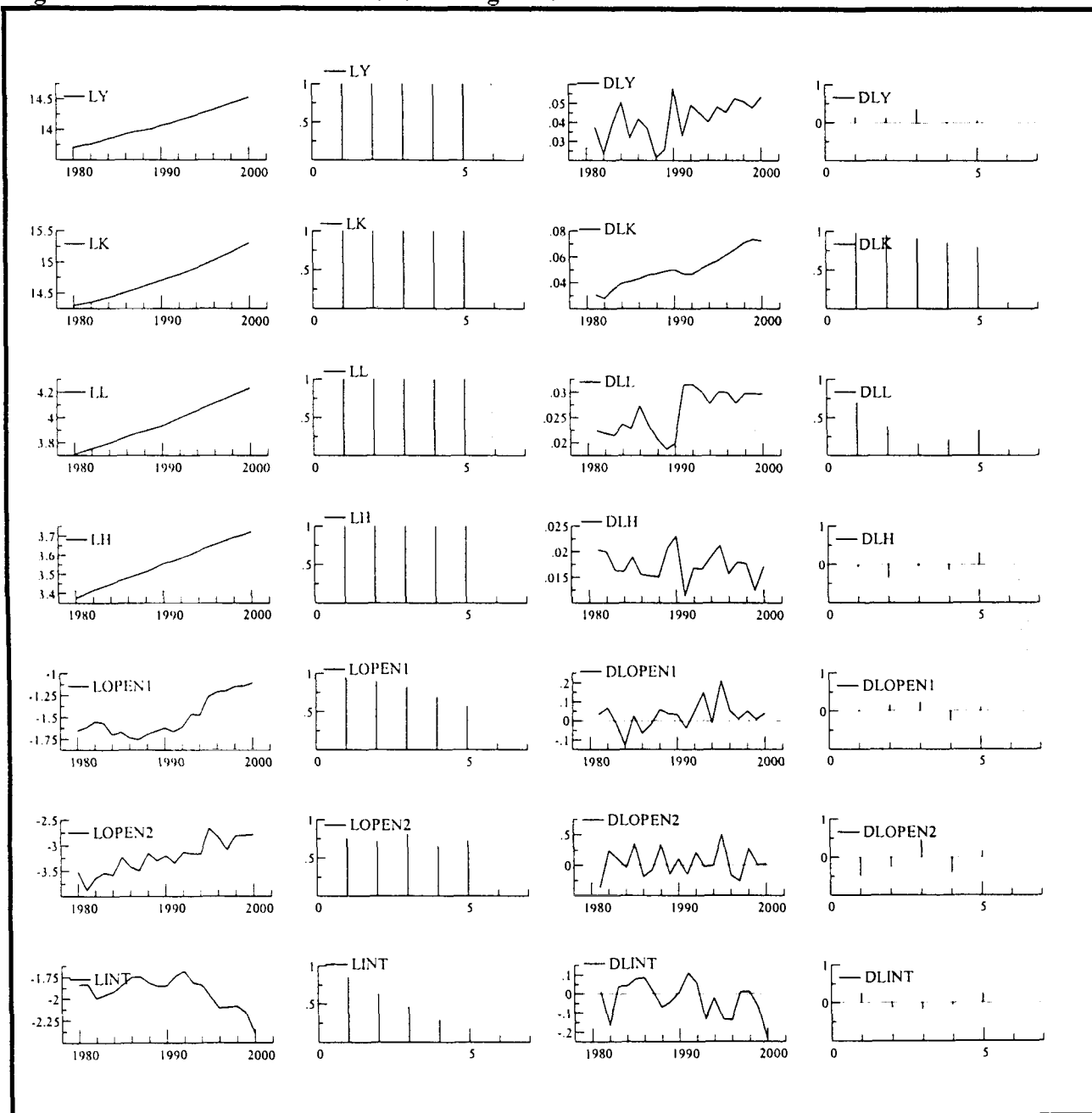
³⁶ The Box-Pierce Statistic (known as Q statistic) is given by $Q = n \sum_{k=1}^m \hat{\rho}_k^2$, where n is the sample size, m is the lag length and $\hat{\rho}$ is the sample autocorrelation coefficient. On the other hand, the Ljung-Box statistic (LB) is derived as: $LB = n(n+2) \sum_{k=1}^m \left(\frac{\hat{\rho}_k^2}{n-k} \right)$.

³⁷ Such a conclusion remains valid irrespective of the order of lag chosen.

³⁸ Note that $\Delta \ln Y$ is the growth of real GDP and it does not make sense to consider that the growth rate of GDP can be non-stationary over a long period of time.

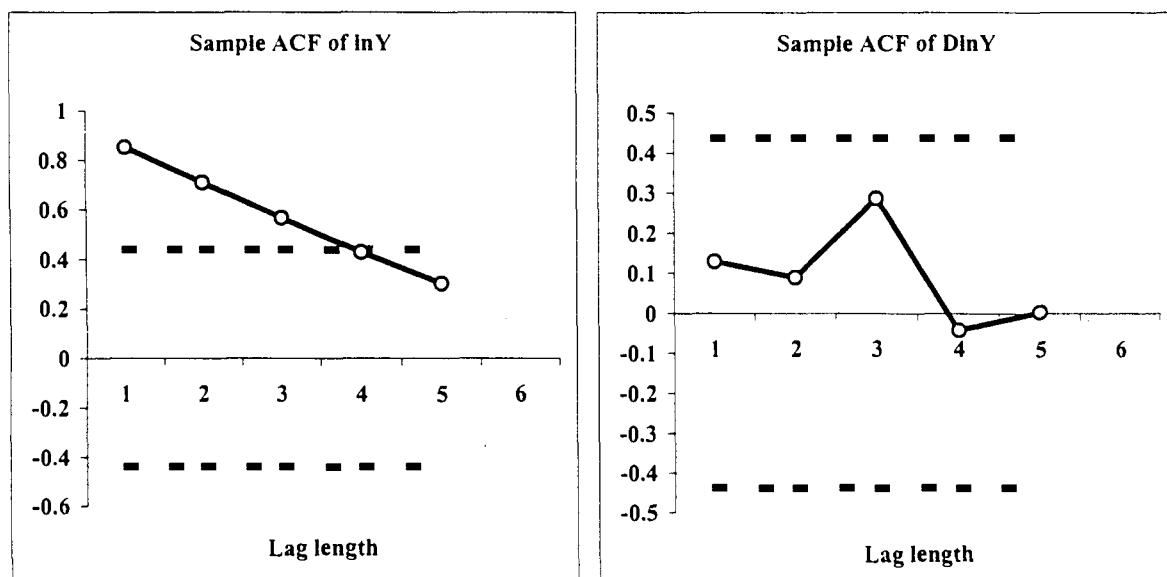
show the nature of movement associated with non-stationary variable but those of $\Delta \ln K$ and $\Delta \ln L$ do not depict pattern like stationary variables. We also experimented with the second order difference of $\ln K$ and $\ln L$ but the results of unit roots and correlograms remain almost unchanged. Therefore, the integrating order of these two variables cannot be determined.

Figure 2.4: Plot of Variables and Correlograms



Note: The graphs are produced by using PcFiml, version 9.10 (Doornik and Hendry, 1997).

Figure 2.5: Sample ACFs and Error-bars



We have unambiguous evidence to suggest that $\ln H$ is non-stationary on its level but stationary on its first differences. All DF-ADF tests cannot reject the unit-root hypothesis for $\ln H$, while the same tests for $\Delta \ln H$ can. These results are also supported by Figure 2.4, as the correlograms on $\Delta \ln H$ exhibit clear pattern of a stationary variable. Finally, the results of the unit root tests on the three measures of liberalisation are also inconclusive. The DF-ADF test statistics suggest the non-stationarity of $\ln \text{OPEN1}$ but no ADF test can reject the unit root for its first difference, $\Delta \ln \text{OPEN1}$. However, the correlograms of $\Delta \ln \text{OPEN1}$ behave just like a stationary variable and all sample ACFs were found to lie with the 95 per cent error bands. Based on these evidence, $\ln \text{OPEN}$ can be considered as an $\sim I(1)$ variable.

For $\ln \text{OPEN2}$ the problem is that the ADF test with the trend suggests its stationarity on the level, which is contradicted by the same test without the trend. The graphical plot of $\ln \text{OPEN2}$ is strongly trended justifying the inclusion of a trend in the ADF regression. However, the correlograms of the variable strongly depict a pattern associated with a non-stationary variable. On the other hand, the correlograms of $\Delta \ln \text{OPEN2}$ clearly indicate its non-stationarity – a fact supported by all DF and ADF tests. Therefore, it would be more appropriate to conclude $\ln \text{OPEN1} \sim I(1)$. Finally, taking into account of the correlograms and sample autocorrelation

coefficients, it was decided to treat $\ln INT$ as a variable, which contains a unit root on its level but not on its first difference.³⁹

2.6.2. Estimation of the Models

We first report the estimation results of the traditional neoclassical and the augmented Solow models without the measures of trade liberalisation. Since the models involve more than two time series and unit root tests indicated the non-stationarity of the level variables, in order to make valid inferences estimation is carried out by the Phillips-Hansen Fully Modified OLS method.⁴⁰ The first row in Table 2.3 provides the estimated simple neoclassical model, where output is specified as a function of capital stock and labour only. It is found that both the capital stock and labour are found to be statistically significant, as predicted by the theoretical model. The capital stock elasticity is estimated to be 0.21 and labour elasticity 1.15 thus suggesting increasing returns to scale in production. The restriction on the estimated model that the sum of the two coefficients on $\ln K$ and $\ln L$ was actually 1 returned a Wald statistic of 20.73 as against its critical value of 3.84 thereby rejecting the restriction.⁴¹ This implies that the fundamental assumption of constant returns to scale of the neo-classical model is not valid for Bangladesh.

Table 2.3: PHFMOLS Estimates of Growth Models

1. $\ln Y = 6.35^{***} + 0.21^{**} \ln K + 1.15^{***} \ln L$				
(s.e.)	(0.60)	(0.08)	(0.17)	
t-ratio	10.54	2.51	6.93	
ADF test statistic for residual (R1) stationarity: -3.87**				
2. $\ln Y = 5.92^{***} + 0.25^{**} \ln K + 0.96^{***} \ln L + 0.19 \ln H$				
(s.e.)	(0.74)	(0.09)	(0.27)	(0.22)
t-ratio	7.95	2.75	3.62	0.88
ADF test statistic for residual (R1) stationarity: -3.54				
3. $\ln Y = 3.35^{***} + 0.53^{***} \ln K + 0.83^{***} \ln H$				
(s.e.)	(0.25)	(0.05)	(0.16)	
t-ratio	13.47	9.29	4.97	
ADF test statistic for residual (R1) stationarity: -3.35				

Note: ** and *** are for statistical significance at the five and ten per cent level respectively.

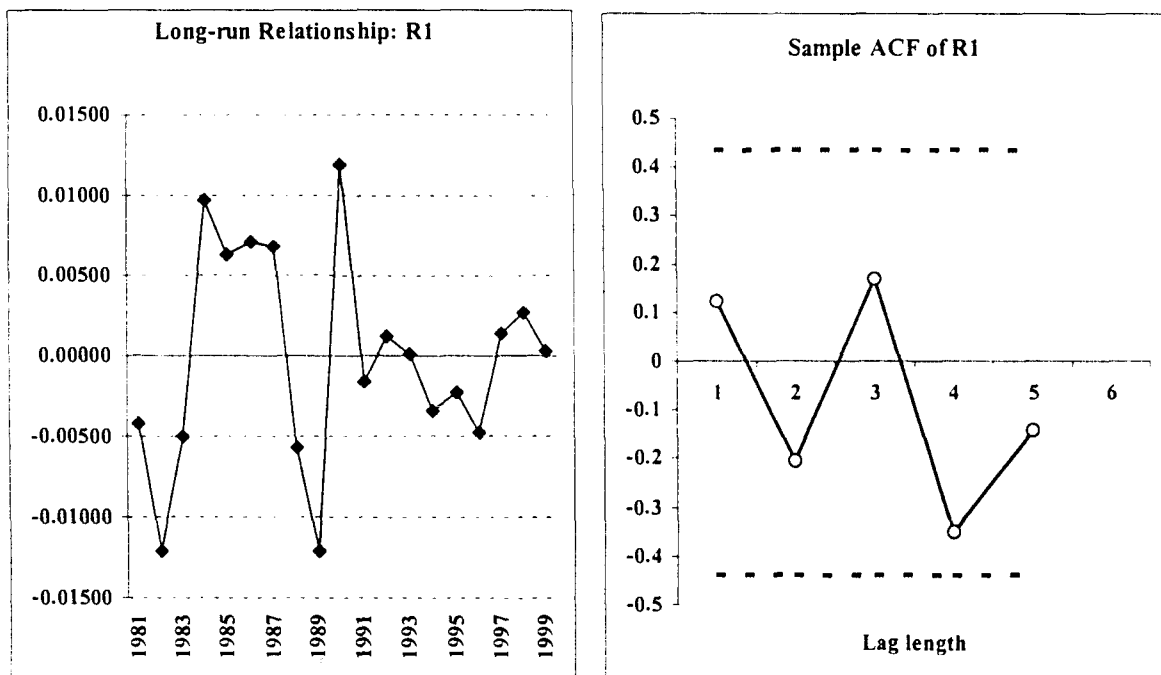
³⁹ All sample ACFs for $\Delta \ln INT$ fell within the 95 per cent error bands.

⁴⁰ In the case of an equation with just two variables estimation of the equation with the simple OLS technique and testing for the stationarity of residuals may be enough to verify the long-run relationship. However, when there are more than one explanatory variables it is important to determine whether the right hand side variables are individually statistically significant.

⁴¹ The Wald test statistic is chi-square distributed with the degrees of freedom being equal to the number of restriction, which in the present case is 1.

It is important to recall that unit root tests could not determine the order of integration of $\ln K$ and $\ln L$ but only suggested their non-stationarity. Since $\ln Y$ is considered as an $\sim I(1)$ variable, a valid cointegrating relationship in a regression of $\ln Y$ on $\ln K$ and $\ln L$ can be firmly established if the residuals from the estimated relationship appears to be stationary. In order to check for cointegration among the variables, the residuals from the estimated relationship (R1) was tested for stationarity. For this, the ADF test statistic was computed at -3.87 against its 95 per cent critical value of -3.74 . Since the test statistic is higher (absolutely) than the critical value, the null hypothesis of non-cointegration can be rejected. Figure 2.6 plots the estimated cointegrating relationship along with its sample ACFs. It is found that all sample ACFs upto the 6th lag length fall within the critical bounds supporting the ADF test result of cointegration.

Figure 2.6: Estimated Long-run Relationship: R1 and its Sample ACFs



The finding of cointegrating would imply the existence of a short-run dynamic equation, which is estimated according to the error-correction modeling procedure and is reported in the first row of Table 2.4.⁴² Having followed the ‘general-to-specific’ approach to model selection, the first lags of the first differenced variables along with the lagged dependent variable were also inserted

⁴² The estimated short-run error-correction models are in fact the representation of the second stage of the Engle-Granger procedure as discussed section 2.4 above.

into the model initially. Subsequently, all insignificant variables were dropped one-by-one to obtain the most parsimonious representation of the error-correction equation. In the short-run, the capital and labour elasticities are estimated to be 0.28 and 1.15 respectively with the former being significant at the 10 per cent while the latter at the 5 per cent error probability levels. The error-correction term (ECT), i.e., the lagged residuals from the long-run relationship, R_{t-1} , is correctly signed, highly significant, and lower than 1 (absolutely) thus confirming a valid representation of the error-correction model. The coefficient on the ECT suggests a rapid adjustment to the long-run steady state relationship from any short-run deviations as 88 per cent of the disequilibrium errors are corrected within one year.

Table 2.4: Estimated Short-run Models Corresponding to the Long-run equations

1.	$\Delta \ln Y =$	-0.003	$+ 0.28^*$	$\Delta \ln K +$	1.15^{**}	$\Delta \ln L -$	0.88^{***}	R_{t-1}
	(s.e.)	(0.01)	(0.16)		(0.50)		(0.27)	
	t-ratio	-0.30	1.77		2.30		-3.26	

Adjusted $R^2 = 0.55$; Serial Correlation $[\chi^2(1)] = 0.05$; Functional Form $[\chi^2(1)] = 0.008$
Normality $[\chi^2(2)] = 0.31$ Heteroscedasticity $[\chi^2(1)] = 2.45$

2.	$\Delta \ln Y =$	-0.001	$+ 0.32^{**}$	$\Delta \ln K +$	1.01^{**}	$\Delta \ln L -$	0.88^{***}	$R_{2,t-1}$
	(s.e.)	(0.01)	(0.15)		(0.48)		(0.26)	
	t-ratio	-0.11	1.99		2.11		-3.77	

Adjusted $R^2 = 0.56$; Serial Correlation $[\chi^2(1)] = 0.007$; Functional Form $[\chi^2(1)] = 0.41$
Normality $[\chi^2(2)] = 0.35$ Heteroscedasticity $[\chi^2(1)] = 3.38$.

3.	$\Delta \ln Y =$	0.014	$+ 0.53^{***}$	$\Delta \ln K -$	0.57^{**}	$R_{3,t-1}$
	(s.e.)	(0.007)	(0.14)		(0.21)	
	t-ratio	1.86	3.65		-2.65	

Adjusted $R^2 = 0.47$; Serial Correlation $[\chi^2(1)] = 0.085$; Functional Form $[\chi^2(1)] = 0.081$
Normality $[\chi^2(2)] = 1.32$ Heteroscedasticity $[\chi^2(1)] = 1.14$

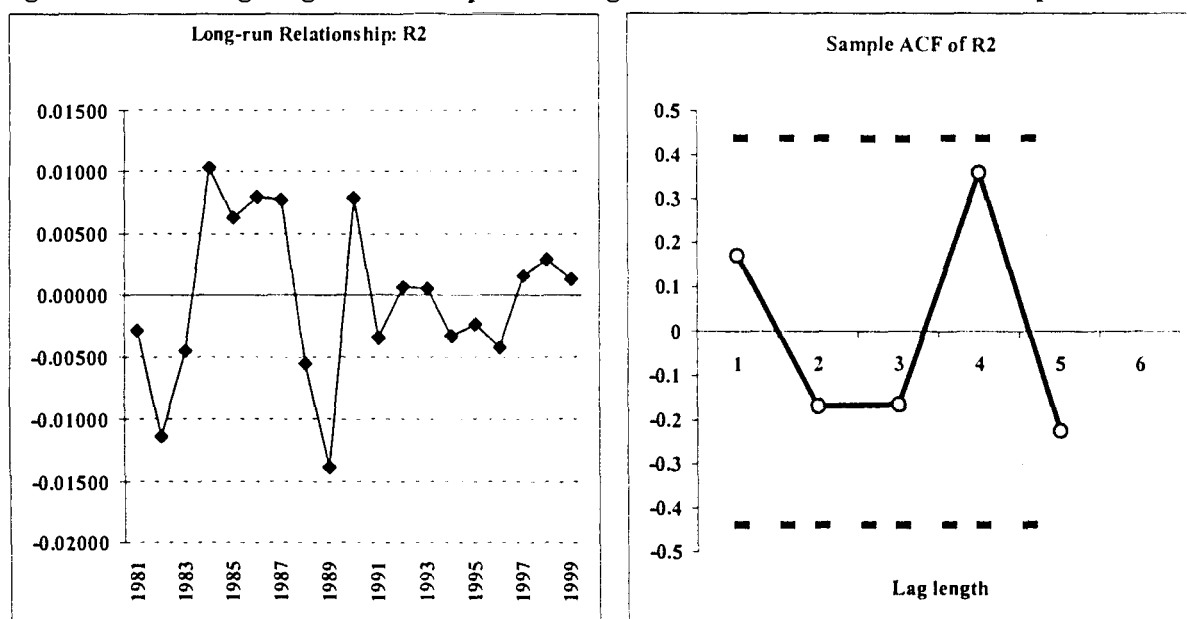
Note: The serial correlation test is based on Godfrey's (1978) LM test for serial correlation; Functional Form on Ramsey's (1969) RESET test; Heteroscedasticity on White's (1980) test; and Normality of residuals on Jarque-Bera (1987) test. The computed test statistics for serial correlation, functional form and heteroscedasticity are follow a chi-square distribution with one degree of freedom while normality test statistic follows a chi-square distribution with 2 degrees of freedom. Statistical significance at the one, five and ten per cent levels are denoted by respectively *** , ** , and * .

The short-run model can explain 55 per cent of the variation in the dependent variable. For diagnostics Godfrey's (1978) LM test for serial correlation, Ramsey's (1969) RESET test for functional form, White's (1980) test for heteroscedasticity and Jarque-Bera (1987) test for normality of errors are performed. The computed test statistics for serial correlation, functional form and heteroscedasticity follow a chi-square distribution with 1 degree of freedom, while the normality test statistic has a chi-square distribution with 2 degrees of freedom. Since the 95 per

cent critical values for $\chi^2(1)$ and $\chi^2(2)$ are 3.84 and 5.99 respectively, on the basis of the computed diagnostic test statistics we cannot reject any of the null hypotheses of no problem of serial correlation, no wrong functional form problem, normality of residuals and homoscedastic distribution of errors.

The second row in Table 2.3, i.e. equation 2, is the estimated augmented Solow model, which draws human capital ($\ln H$) as an additional argument into the traditional neoclassical production function. It is now seen that capital stock and labour remain significant but human capital ($\ln H$) fails to register any significant influence. The inclusion of human capital into the model changes the coefficients on $\ln K$ and $\ln L$ only slightly from those estimated in equation 1 and the model continues to reject the assumption of the constant return to scale.⁴³

Figure 2.7: Cointegrating Relationship in the Augmented Solow Model and its Sample ACFs



For the estimated augmented Solow model, we have some mixed evidence for cointegration. The ADF test on the residuals, $R2$, from the estimated equation 2 in Table 2.4 fails to reject the null hypothesis of non-stationarity or non-cointegration even at the ten per cent level.⁴⁴ On the one

⁴³ The restriction that the sum of the coefficients on capital stock, physical labour and human capital equals 1 yielded a Wald statistic of 19.97 as against the critical value of 3.84. Therefore, the restriction of constant return to scale is decisively rejected.

⁴⁴ The estimated ADF test statistic, as reported in Table 2.3, is -3.84 as against its 90 per cent critical value of -3.84 .

hand, the term human capital cannot add anything to the explanation of the variation of the dependent variable (as it turns out to be insignificant), its inclusion, on the other hand, raises the critical value for the cointegration test resulting in non-confirmation of a valid long-run relationship. However, the sample ACFs of R_2 were found to be individually statistically insignificant and all of them fell within the critical error bands as shown in the right panel of Figure of 2.6.⁴⁵ This, therefore, contradicts the result of the ADF test for cointegration.

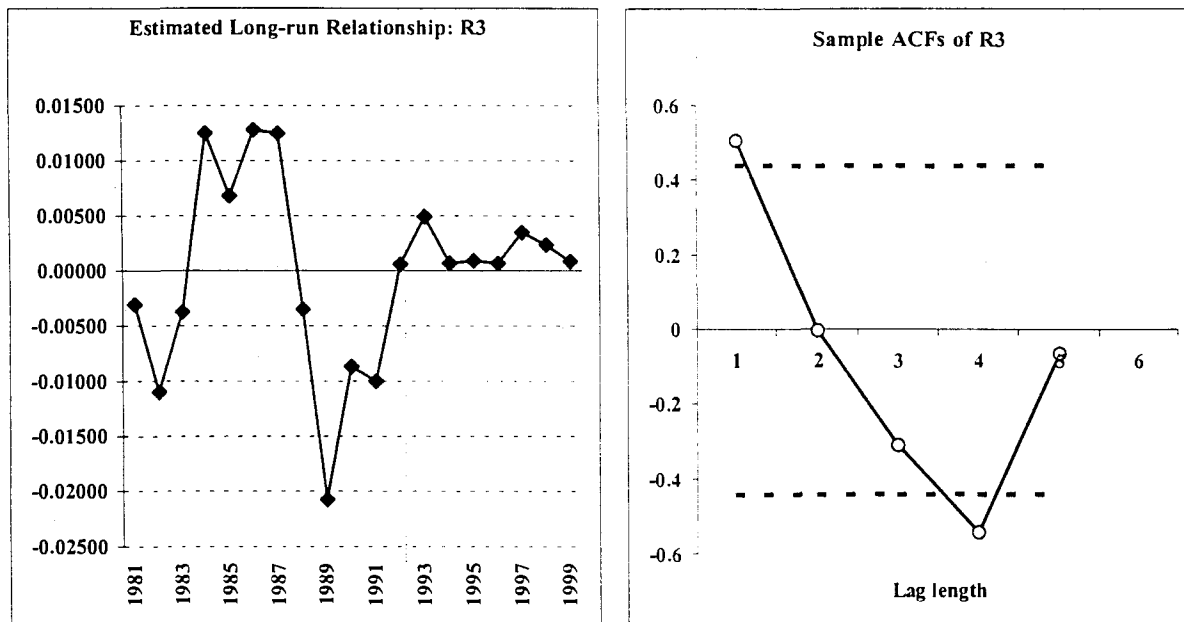
The short-run error-correction equation corresponding to the augmented Solow model is given in equation 2 in Table 2.4, where again the coefficient on $\Delta \ln H$ was not found to be significant and hence had been dropped. The ECT, R_2_{t-1} , remains highly significant, is correctly signed and shows convergence to the long-run equation. The well-behaved ECT tends to support a long-run cointegrating relationship for which there was only mixed evidence.

There is, however, some disagreement with regard to the specification of the aggregate output supply or production function in the context of Bangladesh. Rahman and Shilpi (1996) has argued that since Bangladesh is a labour surplus country, the constraint to the growth of aggregate output comes from factors other than labour that are limited in supply. Following this argument, if it is considered that Bangladesh has surplus labour but not human capital, the specification of the production function should be reformulated to a relationship between aggregate output and stocks of physical and human capital. The bottom row in Table 2.3 provides estimates of this reformulated relationship where it is found that both the physical and human capital stocks are significant at the one per cent level. Compared to the previous two cases, the size of the coefficient on $\ln K$ is now much higher, as the estimated elasticity is 0.53. The human capital elasticity, on the other hand, is 0.83. Once again the assumption of the constant return to scale is overwhelmingly rejected by the use of the Wald test for linear restriction that the sum of the coefficients on $\ln K$ and $\ln H$ is 1.⁴⁶ The significance of $\ln H$ together with the rejection of the constant return to scale seems to validate the endogenous growth theory for Bangladesh.

⁴⁵ Only the first five lag lengths are considered, as there are only 21 observations.

⁴⁶ The Wald test statistic was computed at 10.46 compared to its critical value of 3.84.

Figure 2.8: Plot of Long-run Relationship Represented by R3 and Its Sample ACFs



However, there is only a little evidence for cointegration in the estimated equation 3 in Table 2.3. The ADF test statistic for residual (R3) stationarity (-3.35) falls short of even the 90 per cent critical value of -3.45. In Figure 2.8, the long-run relationship represented by R3 is plotted along with its sample ACFs. It is obvious that at the first and fourth lag lengths, the sample autocorrelation coefficients exceed the 95 per cent critical bounds thereby suggesting that R3 may not be a stationary series.

Despite the lack of evidence for cointegration, the short-run error-correction model for equation 3 in Table 2.3 is estimated and its most parsimonious form is presented in the bottom row of Table 2.4. No significant short-run influence of human capital was observed and, therefore, the parsimonious model eliminated all the variables associated with $\Delta \ln H$. The short-run physical capital elasticity remained as high as its long-run counterpart and significant at the one per cent level. The error-correction term turns out to be correctly signed but the coefficient is much smaller and is significant at a lower level of error-probability level compared to those of the previous models. The lack of strong evidence of cointegration in the long-run equation might have resulted in relatively longer period for disequilibrium error correction. The diagnostic tests

do not report any problem with regard to serial correlation, wrong functional form, non-normal and heteroscedastic errors.

2.6.3. Measures of Trade Liberalisation in Growth Models

The above shows that the empirical estimations of the growth models for Bangladesh, on the whole, are quite satisfactory in the study. It will now be examined whether trade liberalisation has had any significant influence on the aggregate output in the long-run. As mentioned earlier, three measures of trade liberalisation will be used in the experiments, viz. (1) a simple measure of openness, OPEN1, defined as exports plus imports as percentage of GDP; (2) the share of imports of consumers' goods in GDP, OPEN2; and (3) implicit nominal tariff, INT, which is defined as customs duty as percentage of total imports. These three variables were found to be non-stationary on their levels but not on their first differences.

Table 2.5 summarizes the results involving different measures of trade liberalisation in the growth equations. The equations are estimated by the PHFMOLS procedure and hence this standard errors provide valid inferences. The columns 1-3 correspond to the estimation of the growth models with the capital stock and physical labour (along with the different liberalisation indicators) while columns 4-6 are similar estimates with human capital instead of labour.

Let us first consider the indicator OPEN1. According to Harrison (1996), the measure usually shows a significant positive association with economic growth even after controlling for other factors such as capital and labour. In sharp contrast, it is observed that the coefficients on $\ln\text{OPEN1}$ in both columns (1) and (4) in Table 2.5 are highly insignificant. As a matter of fact, the sign of the openness indicator in the growth model with labour is negative. Therefore, when trade-GDP ratio is considered to be a measure of trade liberalisation, no significant long-run association between output and liberalisation is observed. The ADF test statistics for cointegration in columns 1 and 4 fail, as the insignificance of OPEN1 does not contribute to the explanation of the variation in the dependent variable but increases the critical value for ADF test statistics.⁴⁷ One possibility is that no significant effect (or, small t-ratio) of openness is

⁴⁷ However, the examination of the sample ACFs seemed to suggest stationarity of the residual in column 1 but not in column 4.

noticed because of weak evidence of cointegration and had the variables been robustly cointegrated a significant influence would have been observed. Such a possibility, however, can be ruled out as the problem with the integrated variables is that they might show up high t-ratios and thus significant relationship whereas in reality there exists no such effect. It is usually not a problem with the integrated variables that they might give low t-ratios but otherwise they are significant. Since the t-ratios on the liberalisation indicator are very small, it is more likely that output is hardly influenced by it.

Table 2.5: Trade Liberalisation Measures in Growth Models

	1		2		3		4		5		6	
	Coeff (s.e.)	t-ratio	Coeff (s.e.)	t-ratio	Coeff (s.e.)	t-ratio	Coeff (s.e.)	t-ratio	Coeff (s.e.)	t-ratio	Coeff (s.e.)	t-ratio
Constant	6.08 ^{***} (1.61)	3.78	6.35 ^{***} (0.61)	10.5	6.23 ^{***} (0.69)	9.02	3.53 ^{***} (0.43)	8.20	3.40 ^{***} (0.28)	12.14	3.31 ^{***} (0.39)	8.48
lnK	0.23 ^{**} (0.08)	2.88	0.22 ^{**} (0.09)	2.44	0.23 ^{**} (0.09)	2.55	0.50 ^{***} (0.07)	7.13	0.53 ^{***} (0.05)	10.6	0.53 ^{***} (0.08)	6.62
lnL	1.13 ^{***} (0.15)	7.53	1.15 ^{***} (0.18)	6.39	1.12 ^{***} (0.18)	6.22	-	-	-	-	-	-
lnH	-	-	-	-	-	-	0.90 ^{***} (0.19)	4.73	0.80 ^{***} (0.19)	4.21	0.84 ^{***} (0.22)	3.82
lnOPEN1	-0.014 (0.012)	1.23	-	-	-	-	0.008 (0.02)	0.4	-	-	-	-
lnOPEN2	-	-	0.008 (0.01)	0.8	-	-	-	-	0.005 (0.01)	0.5	-	-
lnINT	-	-	-	-	0.006 (0.01)	0.06	-	-	-	-	-0.001 (0.02)	0.05
ADF test Statistics	-3.55		-3.89 [*]		-3.83 [*]		-3.22		-3.22		-3.17	

Note: Statistical significance at the one, five and 10 per cent levels are indicated respectively by ^{***}, ^{**}, ^{*}.

Columns 2 and 4 use OPEN2 as a measure of liberalisation in the growth equations. In both cases, the coefficient on lnOPEN2 is very small and not significantly different from zero. Therefore, like the trade-GDP ratio, the share of imports of consumers' goods in GDP fails to exert any significant influence on output. Finally, in columns 3 and 6, the implicit nominal tariff rate, lnINT, as our last measure of liberalisation is used. But again it fails to register statistical significance and in the model with human capital takes a negative sign. Therefore, the results reported in Table 2.5 show that the measures of trade liberalisation do not have any significant influence on the aggregate production in the long-run.

Although the hypothesis related to the effect of liberalisation on output is postulated over the long-run, the relationship was also explored in the short-run. This required estimation of the error-correction models corresponding to the respective long-run equations in Table 2.5.

However, like the long-run models in no case did we find any significant effect of liberalisation measures on output growth.⁴⁸

One could point out the potential endogeneity problem associated with the indicators of trade liberalisation in the equations, which arguably might have made the results biased. There is no denying that the output or GDP growth could lead to increased exports and imports and thereby could influence such indicators as OPEN1 and OPEN2. Consequently, the question is whether our results are free from the problem of endogeneity bias. When the time series data are integrated and any of the regressors is endogenous, the OLS estimator is asymptotically biased. This calls for instrumental variable (IV) approaches to estimation.⁴⁹ Although IV estimates are better than those of the OLS, it cannot provide asymptotically efficient estimators. The PHFMOLS method has been especially developed to tackle this problem and to provide asymptotically efficient estimates in the presence of endogeneity in the regressors. The semi-parametric corrections, based on transformations involving the long-run variance and covariance of the residuals as shown in Section 2.4 above, used in the fully modified (FM) estimator deal with the endogeneity of the regressor and potential serial correlation in the residuals. Since the results presented in Table 2.5 were derived by the procedure of PHFMOLS, the potential problem of endogeneity problem has already been dealt with.

Yet in another way the potential 'biasedness' of the results were checked. It is to be noted that the endogeneity problem can be eliminated, if the problematic variable is used on its lag in the estimating equations.⁵⁰ Our experiments showed that the coefficients on liberalisation indicators remained insignificant when the growth equations were estimated using their first lags.⁵¹ Therefore, it can be concluded that the estimated results are not subject to the endogeneity problem.

⁴⁸ These results are not reported in this study but are available from the authors on request.

⁴⁹ According to Engle and Granger (1987), the OLS estimators are biased if the explanatory variables are not weakly exogenous. Only if they are weakly exogenous, the problem of endogeneity bias can be assumed away. A simple way to check the weak exogeneity of any explanatory variable, X_t , is to construct an error-correction model for X_t , and to test the statistical significance of the error-correction term using the traditional t-test. If the t-test is significant, X_t cannot be treated as weakly exogenous.

⁵⁰ This means considering the relationship between a dependent variable, Y_t and an explanatory variable, X_t , the use of X_{t-1} makes X predetermined in the model. That is, in no way Y_t can influence X_{t-1} , which essentially eliminates the endogeneity problem in a statistical sense.

⁵¹ These results are not reported in the text but are available from the authors on request.

2.6.4. Growth in the Pre- and Post- Liberalisation Periods

In light of the failure of the trade liberalisation indicators to exert any significant influence on output, it might be interesting to ask whether the growth of aggregate output in the post-liberalisation regime has been significantly different from that of pre-liberalisation period. As discussed earlier, this kind of before-after comparison requires specification of a break point that separates the two regimes. Therefore, we need to divide the sample between pre- and post-liberalisation periods. In Chapter 1 of this study, it was mentioned that the trade liberalisation in Bangladesh was carried out in three phases, viz. 1982-85, 1986-91 and 1992-onwards. However, there is a general recognition that the most important and significant liberalisation measures were undertaken in the third phase.⁵² Having considered this, the period of 1980-91 can be treated as the pre-liberalisation period while the rest as post-liberalisation period. Once the break point is known, equation (2.1) can be estimated to obtain the trend growth rates for the two periods.

Table 2.6: Trend Growth Rates for the Pre- and Post-Liberalisation Periods

The estimated equation:

$$\ln Y = 13.66^{***} + 0.0362^{***} T - 0.152^{***} \text{LIBDUM} + 0.0121^{***} \text{DT}$$

(s.e.)	(0.004)	(0.0006)	(0.015)	(0.001)
t-ratio	2892.8	58.97	-10.07	11.72

The trend growth equation for the pre-liberalisation period: $\ln Y = 13.66 + 0.0362 T$

The trend growth equation for the post-liberalisation period: $\ln Y = 13.51 + 0.0483 T$

Note: \ln represents natural logarithm, Y is real GDP, T is the time trend, LIBDUM is the dummy variable with 0 for pre- and 1 for post-liberalisation periods, and $\text{DT} = \text{LIBDUM} * T$. Statistical significance at the one per cent level is denoted by ***.

Table 2.6 provides a simple equation to estimate the trend growth of real GDP in the pre- and post-liberalisation periods. As the variables LIBDUM and DT are significant, the estimated relationship suggests that the trend growth equations for the two periods will be significantly different both in terms of the intercept and the slope coefficient, which are given separately in the bottom row of Table 2.6. It is found that the trend growth rate for the pre-liberalisation period is 3.6 per cent while the comparable figure for the latter period is 4.8 per cent. Thus the trend growth rate in the post-liberalisation period is 1.2 percentage points higher. However, it must be

⁵² For example in an study (CPD 1995, p.243) it is observed “[I]n terms of the intensity of trade liberalisation, however, the third phase is considered relatively more activist than the earlier ones”.

emphasized that given the nature of the analysis (i.e., a before-after approach) it would be erroneous to conclude that liberalisation measures have resulted in a higher growth rate. In fact, the best way to interpret the result is that the post-liberalisation period has been associated with a higher growth rate; however, it is not known whether the trade liberalisation measures or other completely different factors have contributed to this improved growth performance.⁵³

2.6.5. Total Factor Productivity in the Pre and Post-Liberalisation Periods

So far our results have found that the measures of liberalisation are not correlated with the growth of output, nevertheless, the post-liberalisation period is found to be associated with a relatively superior growth rate. As discussed above, the usual growth accounting method attributes the sources of growth to physical capital accumulation, labour force growth and total factor productivity (TFP) growth. Of these, for any country the TFP is particularly important and plays a crucial role, as its growth can ensure expansion of the overall economy even in the absence of accumulation of factors of production.⁵⁴ It has been argued that trade liberalisation resulting in increased openness has a significant and robust positive effect on total factor productivity (Miller and Upadhyay, 2000).⁵⁵ The last two empirical issues that we explore in this chapter are whether the TFP is positively influenced by the measures of trade liberalisation and whether the growth of TFP has been significantly different in the post-liberalisation period than that of the previous regime.

The TFP growth is usually treated as the residual part of economic growth (Hwang, 1998) and from an empirical view point it is given by the estimated constant – the deterministic component of TFP – plus the error term – the stochastic component of TFP that results from estimating the production function (e.g., see Beddies, 1999). In order to estimate the TFP for Bangladesh, equations 1 and 3 (where output is explained by capital and human capital) in Table 2.3 will be used. Precisely, the estimates of TFP can be written as:

⁵³ In contrast, if it were found that one of the measures of trade liberalisation was positively and significantly associated with real GDP, we could have concluded that liberalisation had beneficial impact on output.

⁵⁴ There is an interesting debate about the role of TFP in the East Asian economy. Despite the popular belief about the high productivity growth of the East Asian economy, Young (1994, 1995) and Park and Kwon (1995) have argued that these countries did not achieve any extraordinarily high TFP growth. If this were true, the East Asian growth performance could be attributable merely to the rapid accumulation of factors of production.

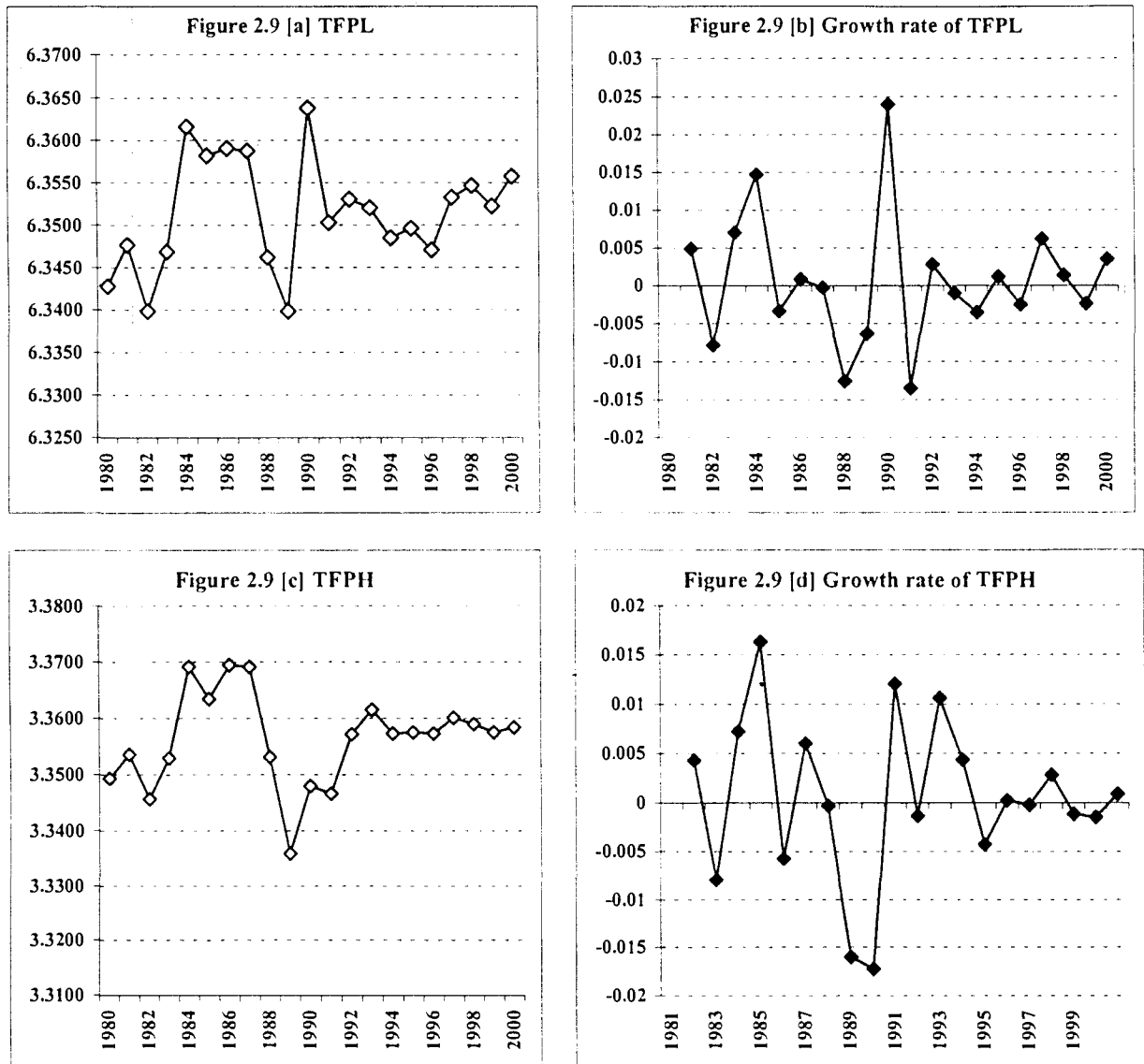
⁵⁵ Miller and Upadhyay (2000) states, “[L]arger trade implies greater openness that facilitates the economy’s adoption of more efficient techniques of production, leading to faster growth of total factor productivity and, hence, real per capita income.

$$TFPL = \ln Y - \alpha K - \beta L$$

$$TFPH = \ln Y - \alpha' K - \delta H$$

Therefore, TFPL is the measure of TFP when output is specified as a function of capital and labour and TFPH corresponds to the equation where output is determined by physical capital and human capital. Figure 2.9 provides the resultant TFPs and their growth rates.

Figure 2.9: Estimated TFPs and Their Growth Rates



The left panel in Table 2.7 gives the bi-variate relationship between the indicators of trade liberalisation and TFPL and the right panel between the indicators and TFPH. It is observed that

in every regression the coefficient associated with the liberalisation measure is invariably small and fails to become statistically significant at the conventional levels.⁵⁶ Therefore, in no case is there any evidence of significant influence of liberalisation measures on TFP. It needs to be mentioned here that the t-ratios on the explanatory variables are so small that testing for cointegration in the estimated equations are actually meaningless.⁵⁷

Table 2.7: Relationship between TFP and measures of trade liberalisation

1. TFPL = 6.35 ^{***} + 0.00137 lnOPEN1 (s.e.) (0.009) (0.006) t-ratio 692.35 0.22	4. TFPH = 3.36 ^{***} + 0.0054 lnOPEN1 (s.e.) (0.012) (0.007) t-ratio 279.20 0.69
2. TFPL = 6.36 ^{***} + 0.0021 lnOPEN2 (s.e.) (0.014) (0.0045) t-ratio 440.73 0.47	5. TFPH = 3.36 ^{***} + 0.0022 lnOPEN2 (s.e.) (0.018) (0.0057) t-ratio 181.11 0.39
3. TFPL = 6.34 ^{***} - 0.0056 lnINT (s.e.) (0.015) (0.007) t-ratio 421.48 -0.72	6. TFPH = 3.34 ^{***} - 0.005 lnINT (s.e.) (0.02) (0.01) t-ratio 165.2 -0.49

Note: Estimates are based on the PHFMOLS procedure. ^{***} implies significance at the one per cent level.

Finally, an attempt was made to examine whether TFPs for the post-liberalisation period was significantly different from that of the pre-liberalisation period employing a similar equation as in Table 2.6. The estimated equations for TFPL and TFPH did not reveal any significant trend growth rate, as the coefficient on T in both regressions was not significantly different from zero. The intercept and slope dummies, LIBDUM and DT, also failed to register statistical significance thus rejecting the possibility of a structural break resulting in significantly higher TFP for the post-liberalisation period.⁵⁸ These results are corroborated by the fact that in Figures 2.9[a] and 2.9[c] clearly rising trends in TFPL and TFPH are not discernible.

⁵⁶ Note that although insignificant OPEN1 and OPEN2 are found to be positively associated with TFPs but the sign of lnINT on both occasions is negative.

⁵⁷ Nevertheless, the tests for cointegration between the two series of TFP and trade liberalisation indicators were carried out explicitly. In Section 2.4, the rationale for using a single equation estimation technique (such as the PHFMOLS) and the inappropriateness of Johansen procedure in short sample was discussed. However, a sample of 21 observations might be just enough to test for cointegration between two variables with the Johansen procedure. The trace and maximal eigenvalue tests, following the Johansen procedure, failed to reject the null of no cointegrating vector thereby supporting the results presented in Table 2.7. The tests were implemented using both 1 and 2 lag lengths in the Johansen vector autoregression and the results were not sensitive to the choice of lag lengths. These results are available from the authors on request.

⁵⁸ These results are not reported here but are available with the authors.

2.7. Concluding Observations

In both theory and empirical analysis, the relationship between openness and growth remains unsettled. In this study, we have used the recently revised BBS estimates of national income to investigate the relationship between trade liberalisation and growth in Bangladesh. The analytical framework used in the study augments the neo-classical and endogenous growth models to incorporate some measures of trade liberalisation. Based on available information, three different measures of trade liberalisation, viz. trade-GDP ratio, the ratio of imports of consumers' goods to GDP and implicit nominal tariff rate, were constructed for inclusion in the growth model. The estimation strategy explicitly considered the time series properties of the variables. Due to the presence of non-stationary time series, cointegration technique was used to validate the long-run relationship and, in order to draw valid inferences, the Phillips-Hansen Fully Modified OLS method of estimation was used.

In contrast to the assumption of the neoclassical growth model, our results reveal increasing returns to scale in the production of aggregate output, which, therefore, tends to suggest the relevance of an endogenous growth model for Bangladesh. In the models used in the study, capital and labour elasticities are found to be statistically significant at the conventional levels. However, when human capital is included in the model along with labour, the former could not register statistical significance. In regressions without labour, the coefficients on human capital come out significant but the evidence of cointegration is somewhat weak.

The most striking feature of the results is that in no regression the effects of trade liberalisation indicators are found significant. This finding holds both for the long-run as well as short-run models. Nevertheless, it is found that the trend growth rate associated with the post-liberalisation period (4.8 per cent) is higher than that of the pre-liberalisation regime (3.6 per cent). Since the constructed indicators of liberalisation failed to put forth any significant influence on output, it could not be ascertained whether the superior growth performance is attributable to trade liberalisation. The results also suggest that the measures of liberalisation do not have any significant influence on the total factor productivity, which remains statistically unchanged in the post-liberalisation period. That is, the relatively high growth rate associated with the post-liberalisation regime is not due to a higher TFP growth but is attributable to mere accumulation

of factors of production. All this would imply that the significantly higher growth in the post-liberalisation period might have been the result of an interaction between the inherent aggregate production function for the economy exhibiting increasing returns to scale in production and accumulation of factors of production at a faster rate.

We need, however, to acknowledge two potential shortcomings that might have been associated with the study. First, it might be possible that the constructed indicators of trade liberalisation do not adequately capture the extent of liberalisation in Bangladesh. In fact, an appropriate measure of liberalisation may be much more involved than the ones used in the study. However, as discussed earlier, data constraint did not permit us to construct more suitable measures of liberalisation. Having acknowledged the problem, it needs to be mentioned that, in numerous studies, simple measures such as the openness ratio (i.e., trade-GDP ratio) has been shown to have significantly contributed to the growth of output, which in the case Bangladesh, as we have seen, apparently do not have any such effect. Furthermore, the graphical plots of such liberalisation measures as trade-GDP ratio and implicit nominal tariff used in this study greatly matches the general perception about the evolution of trade policy regime in Bangladesh. Yet, the statistical association between these measures and output is highly insignificant.

Finally, is the small sample size of the study responsible for the results especially when the data for the most protectionist trade regime of the 1970s (from 1973 to 1979) are not taken into account? This is a genuine concern but the relevant data consistent with the revised estimates of GDP for the 1970s are not available.⁵⁹ Notwithstanding the problem, it is not a convincing argument that a true (if there is any) association between liberalisation and output cannot be captured only because of the short sample. Trade liberalisation in Bangladesh started off in the 1980s and got a remarkable momentum in the 1990s and, therefore, its effect on output should have been reflected in the data for the past two decades.

⁵⁹ Given the information at hand, the construction of such data for the aforementioned period is not feasible.

Chapter 3

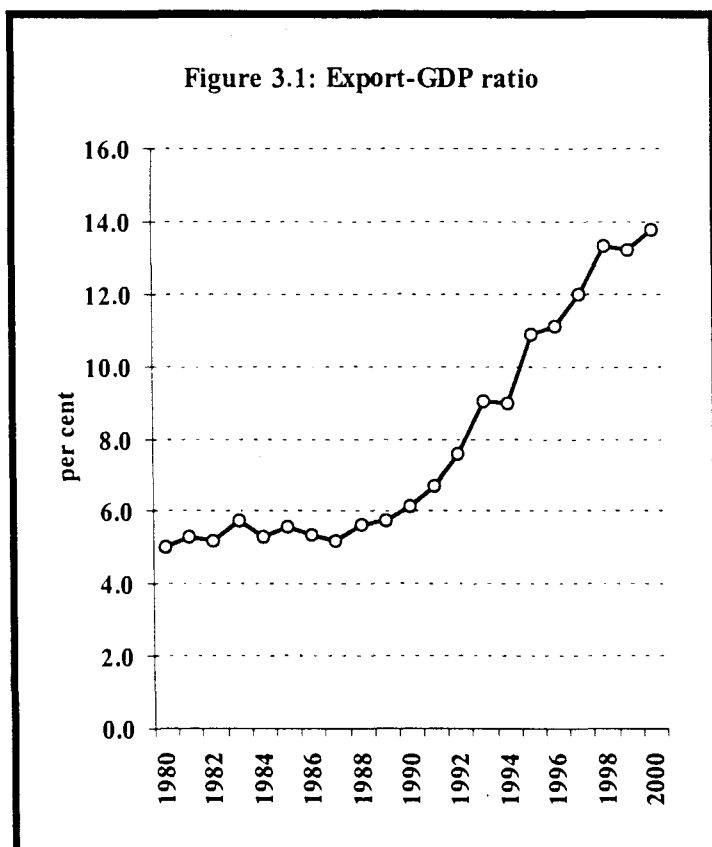
Export-Growth Nexus and Trade Liberalisation

3.1. Introduction

In Chapter 1, it was mentioned that the trade reform measures in Bangladesh marked a policy shift from an inward-looking import-substitution to an export-promotion strategy. The basic objective behind the policy reversal was to transform the productive structure of the economy in such a way that export growth would be accelerated, thereby paving the way for a sustained overall growth (Rashid and Rahman, 1998). The strategy essentially lies at the heart of the so-called 'export-led growth' (ELG) paradigm that postulates exports to be an 'engine' of economic growth.

Although a small export-orientation and slower growth in the export sector of a country with a big domestic market may not be a major impediment to its overall economic growth as long as the non-export sectors flourish, a robust performance of the export sector is often considered central to the acceleration of the growth process (Gylfason, 1999). For any low-income country, a greater magnitude of export-orientation is thought to have several advantages. First, since export is directed to the world market, low purchasing power of domestic consumers cannot act as a hindrance to the exploitation of economies of scale in production. Second, export activities require a relatively non-distortionary policy environment, which promotes efficiency and discourages unproductive rent-seeking activities. Moreover, if exports grow in line with the static comparative advantage of the economy, any reallocation of resources from the non-export to the export sector increases the total factor productivity, which, in turn, raises GDP (Begum and Shamsuddin, 1998). It is also argued that the export sector generates positive externalities on non-export sectors through more efficient management styles, skill accumulation by labour, and improved production techniques (Feder, 1983; Ghatak *et al.*, 1997). Apart from these, the expansion of export activities facilitates the import of capital goods and encourages technology transfer. For these reasons, a strategy of export-led growth is supposed to achieve both the objectives of greater export-orientation in the economy and overall economic growth.

As pointed out earlier, a country can grow even if only the non-export sectors flourish, as such ELG strategy is not necessarily called for. However, when a country deliberately chooses the ELG doctrine, it indicates that economic growth is directly linked to the success of the export sector and, more importantly, there is a causal effect of export performance on the overall growth prospect of the economy.



One salient feature of post-trade reform period in Bangladesh has been the rising trend of exports. As a matter of fact, if we juxtapose liberalisation programmes and export performance, Bangladesh can be considered as a country that have been successful in energising exports. In 1980, the country's total exports stood at US\$ 913 million, which rose to US\$ 1,865 million by 1990. Compared to this, the pace of export expansion in the 1990s had been much faster as in 2000 export accruals reached US\$ 6,589 million, a rise of 253 per cent over 1990. In

fact, the decade of the 1990s witnessed nominal exports (in US dollars) growing at a rate of 17 per cent per annum. As a result, the export-GDP ratio registered a significant rise from less than 6 per cent in the late-1980s to about 14 per cent in 2000.

The above suggests that the Bangladesh economy has become more export-oriented during the post-liberalisation period and it then follows from the ELG hypothesis that the robust performance of the export sector have driven the overall economic growth of the economy. The basic objective of this chapter is to address two questions: (i) Are exports and growth related, and if so, how? and (ii) Does liberalisation have any impact on the export-growth nexus? The examination of the above issues is necessary to assess whether the export-promotion strategy is beneficial to the growth performance of Bangladesh or the policy shift

has been a mere imitation of the world-wide move towards such a paradigm.¹ To investigate the above issues, the revised national income data are used and, therefore, the empirical results should be preferable to similar past studies employing the old GDP estimates.² The chapter is organised as follows. Section 3.2 briefly reviews the general features and related shortcomings of the studies on export-growth relationship. While Section 3.3 sets out the methodology that is used to overcome the limitations of these studies, the estimation results of the present study are presented in Section 3.4. Finally, Section 3.5 concludes the chapter.

3.2. Empirical Testing of Export-Growth Relationship

The link between export and growth has been studied extensively resulting in the emergence of a voluminous literature. In a recent study, Giles and Williams (2000) provide a comprehensive survey of more than one hundred and fifty published articles on the subject.³ For our purpose, some general features of the literature are emphasised.

Broadly speaking, the applied research on the subject can be divided into two groups: (1) studies using the cross-country data; and (2) studies based on time series data. Most of the earlier studies have used cross-country data to explore the association between export and growth. While Balassa (1978), Kavoussi (1984), and Michalek (1977) used a simple rank correlation coefficient to test the hypothesis, others used the ordinary least squares (OLS) regression method (e.g., Balassa, 1978 and 1984; Ram, 1985; and Tyler, 1981). The cross-country studies, in general, find a close relationship between the growth of exports and overall economic activity, measured either by GDP or GNP. However, one important limitation of these studies is that they assume a common economic structure and production technology across different countries, which is not likely to be true. Besides, the direction of causal relationship in cross-country studies is not clear.

¹ As Love (1995, p.11) puts it “[I]n essence, one might try to judge whether the shift in thinking and in policy is one of substance or is part of cyclical process which will in time be followed by a shift to another ‘fashionable’ paradigm”.

² Studies that have examined the issue of export-growth link in the context of Bangladesh include Begum and Shamsuddin (1998), Islam and Iftekharuzzaman (1996), and Islam (1998). All the studies used the old national income estimates resulting in unreliable empirical results. Also, none of the studies examined the impact of trade liberalisation on the export-growth link.

³ Other useful surveys can be found in Ahmad and Kwan (1991), Edwards (1993), Ghartey (1993), Greenaway and Sapsford (1994a and 1994b), Jung and Marshall (1985), Love (1994), Medina-Smith (2001), and Shun and Sun (1998).

In recent times, an increasing number of such studies have relied on time series data. One advantage of such studies is that they explicitly test whether export causes economic growth by utilising the standard Granger (1969) and Sims (1972) causality tests. In contrast to cross-country studies, time series results are, however, far less conclusive. Thus, Bahmani-Oskooee and Alse (1993), Marin (1992), Medina-Smith (2001), Salvatore and Hatcher (1991), Sengupta and Espana (1994), and Thornton (1996) find support for the ELG postulate for a number of countries, while Bahmani-Oskooee *et al.* (1991), Darrat (1987), Dutt and Ghosh (1996), Ghartey (1993), Greenaway and Sapsford (1994a), Jin and Yu (1996), Jung and Marshall (1985), Kunst and Marin (1989), and Riezman *et al.* (1996) provide little evidence in favour of the hypothesis for others.

As far as the model specification is concerned, three different approaches have been followed. First, most studies have employed a simple two-variable relationship between growth of exports (\dot{X}) and output (\dot{Y}), as shown in equation (3.1) below.⁴ Second, in some studies a production function type of framework has been used. This is done basically by including \dot{X} in a neo-classical production function that specifies a relationship between output growth and growth of factors, such as capital (\dot{K}) and labour (\dot{L}) (equation 3.2).⁵ Finally, following Feder (1983), some researchers have modelled the effects of exports on output explicitly as the sum of the ‘externality’ and ‘productivity differential’ effects. Feder’s analytical framework is based on a two-sector model that subdivides the economy into an export-oriented sector (X) and a non-export traditional sector (N). The model allows exports to influence output growth through two channels. Whilst the channel through the externality effect is specified by including current exports in the production function along with other factors of production such as capital (K) and labour (L), the productivity differential effects allow marginal products of both capital and labour to differ between the export and non-export sectors. Therefore, the specifications for aggregate output, non-export output and exports are given by:

⁴ In equations (1)-(3) u represents the stochastic error term. In few instances, the bivariate relationship in equation (1) is tested by including a third variable on a purely adhoc basis. For example, while Islam (1998) and Serletis (1992) used imports as the third variable, Dhawan and Biswal (1999) and Henriques and Sadorsky (1996) considered the terms of trade.

⁵ Ghatak *et al.* (1997) has augmented the model further, in line with the “new growth theory”, to incorporate a human capital (H) variable into the equation. Thus if we distinguish between physical (K) and human (H) capital a new equation can be written as: $\dot{Y} = d_1 + d_2 \dot{X} + d_3 \dot{K} + d_4 \dot{L} + d_5 \dot{H} + u_1$.

$$Y = N + X \quad (\text{A})$$

$$N = f(K_N, L_N, X) \quad (\text{B})$$

$$X = g(K_X, L_X) \quad (\text{C})$$

where, K_N , and L_N are capital and labour inputs in the non-export sector, and K_X and L_X are the same factors in the production of export goods. Total differentiation of equations (B) and (C) yields:

$$\dot{N} = f_K \dot{K}_N + f_L \dot{L}_N + f_X \dot{X} \quad (\text{D})$$

$$\dot{X} = g_K \dot{K}_X + g_L \dot{L}_X \quad (\text{E})$$

where, f_K, f_L , and g_K and g_L are marginal productivities with respect to the respective factors of production in the non-export and export sectors; f_X represents the marginal externality effect of X and N . Since by definition $\dot{Y} = \dot{N} + \dot{X}$, assuming that productivity of each input in the export sector differs from that of the non-export sector by a factor γ so that $g_i = (1+\gamma) f_i$ and substituting equations (D) and (E) into \dot{Y} one can obtain:

$$\dot{Y} = f_K \dot{K}_N + f_L \dot{L}_N + f_X \dot{X} + (1+\gamma) f_K \dot{K}_X + (1+\gamma) f_L \dot{L}_X \quad (\text{F})$$

$$\text{or, } \dot{Y} = f_K (\dot{K}_N + \dot{K}_X) + f_L (\dot{L}_N + \dot{L}_X) + f_X \dot{X} + \gamma (f_K \dot{K}_X + f_L \dot{L}_X) \quad (\text{G})$$

Defining $\dot{K} = \dot{K}_N + \dot{K}_X \equiv \dot{K}$ and $\dot{L} = \dot{L}_N + \dot{L}_X \equiv \dot{L}$ and using the productivity differential effects into (E) provides the basic Federian equation:

$$\dot{Y} = f_K \dot{K} + f_L \dot{L} + (\gamma / (1+\gamma) + f_X) \dot{X} \quad (\text{H})$$

With some manipulation in (H), the Feder model gives rise to an estimation equation of the form as outlined in equation (3.3) below.⁶

$$\dot{Y} = a_1 + a_2 \dot{X} + u_1 \quad (3.1)$$

$$\dot{Y} = b_1 + b_2 \dot{X} + b_3 \dot{K} + b_4 \dot{L} + u_2 \quad (3.2)$$

$$\dot{Y} = c_1 + c_2 \dot{K} + c_3 \dot{L} + c_4 \left(\frac{X \dot{X}}{Y} \right) + u_3 \quad (3.3)$$

⁶ The detailed derivation of equation (3) can be found in Feder (1983) and Begum and Shamsuddin (1998).

Now, if the 'true' model is equation (3.2), the estimation of equation (3.1) will lead to biased and inefficient estimation due to the exclusion of some relevant variables. Yet, the studies concentrating on a simple bivariate relationship between X and Y are quite common (e.g., Bahmani-Oskooee and Alse, 1993; Bahmani-Oskooee, *et al.*, 1991; Darrat, 1987; Dutt and Ghosh, 1996; and Xu, 1996).

Another serious problem, duly emphasised by Greenaway and Sapsford (1994a), associated with the above specifications is that exports, via the national income accounting identity, are themselves component of output. To remedy this problem, it is necessary to separate the 'economic influence' of exports on output from that incorporated in the growth accounting relationship. Therefore, it is essential to net out the export element from the output growth variable before estimating the models.

Apart from the aforementioned problems, one crucial limitation of the specifications in (3.1)-(3.3) is that none of them permits to test whether there is any valid long-run relationship among the variables in the models. By its very nature, the export-GDP nexus, as postulated in the ELG hypothesis, is supposed to hold in the long run. However, when variables are based on their rates of growth (and often on first differences) the long-run relationship is totally wiped out (Charemza and Deadman, 1992; Harris, 1995; and Hendry, 1995 and 1999).⁷ Thus most studies seeking to examine the export-output relationship in the long-run, have ended up with modelling pure short-run behaviour, about which economic theories are generally silent.⁸ Indeed, it is possible to find no significant association between any two variables in the short-run, while such a relationship may well exist in the long-run. Amongst others, Begum and Shamsuddin (1998), Greenaway and Sapsford (1994a), Jung and Marshall (1985), Darrat (1987) and Riezman *et al.* (1996) fail to recognise that there is simply no way to infer about the long-run relationship and, as such, the validity of the ELG hypothesis from the kind of model that they estimate.

⁷ This is despite the fact that many economic time series are non-stationary and transformation in terms of growth rates or first differences make them stationary, for which the OLS regressions are valid. However, regression on growth rates can not tell anything about the long-run equilibrium behaviour of the model. The ideal way to deal with the problem is to employ some kind of cointegration technique, and not, using Hendry's (1999, p.357) terminology, "blanket differencing".

⁸ This point is highlighted in Ghatak *et al.* (1997) as the authors note "Thus, the previous results do not necessarily imply that there exists a 'genuine' relationship between the long-run development of exports and output (either GDP or GNP), as they may arise from a purely short-run relationship" (p.214).

Yet another problem is related to the testing of causality using time series data. The usual practice has been to follow either Granger (1969) or Sims (1972) procedure. However, with the appearance of more sophisticated time series techniques, the traditional procedures may not be valid for testing causality. In fact, if the time series data are non-stationary on their levels and cointegrated, the traditional causality tests might provide misleading results. Therefore, it is indispensable to consider the time series properties of the variables under consideration and test for cointegration before undertaking the causality test. In this regard, Granger (1988) provides a revised formulation of his earlier causality testing framework when the variables in the model are cointegrated. Considering model (3.1), if the variables are not cointegrated, the usual Granger test, as given in equation (3.1'), will remain valid. In equation (3.1') whether X causes Y will be determined by the significance of τ_{1i} 's. However, if X and Y are cointegrated, the causality test specification must be augmented to include the error-correction term as shown in equation (3.1'') (Granger, 1988). By including the error-correction term, equation (3.1'') introduces an additional channel through which causality can be detected. That is, from equation (3.1''), X causes Y if either of λ_{1i} 's are jointly significant or λ_3 is significant or both of them are significant. One key result Granger (1988) derives is that if the variables are cointegrated, there must be at least one direction of causality (i.e., either from X to Y or from Y to X).

$$\Delta \ln Y_t = \tau_0 + \sum_{i=1}^m \tau_{1i} \Delta \ln X_t + \sum_{i=1}^n \tau_{2i} \Delta \ln Y_t + \xi_t \quad (3.1')$$

$$\Delta \ln Y_t = \lambda_0 + \sum_{i=1}^m \lambda_{1i} \Delta \ln X_t + \sum_{i=1}^n \lambda_{2i} \Delta \ln Y_t + \lambda_3 \hat{v}_{t-1} + \zeta_t \quad (3.1'')$$

There are two studies, viz., Begum and Shamsuddin (1998) and Islam and Iftekharuzzaman (1996) that attempt to explore the relationship between exports and economic growth especially for Bangladesh. Both these studies, however, suffer from the same limitations as mentioned above and also provide contrasting evidence. Begum and Shamsuddin estimated an empirical model derived from the theoretical framework provided by Feder (1983), as expressed in equation (3.3), to show positive externality effects of exports on GDP. On the other hand, Islam and Iftekharuzzaman augmented the same model by including the government sector to find that the growth of exports did not have any significant influence on output. As the estimating equation in both studies is based on growth rates of variables, it is

apparent that none of them examines the long-run relationship but concentrates on pure short-run association between exports and economic growth. Begum and Shamsuddin also do not check for the integrating properties of variables in their model and consequently it is not known whether the inferences drawn from their estimation results are valid. The issue of netting out economic influence of exports from growth accounting relationship has been totally overlooked in both the studies. Only the former study carries out the Granger test to infer about the bivariate causal relationship between exports and GDP. However, since the cointegrating properties of the variables are not considered, the causality equation might have been mis-specified. In fact, causality testing procedure of Begum and Shamsuddin is only valid, if there were no long-run relationship between exports and GDP. On the other hand, if there is no such long-run relationship, the positive externality effects of exports on output found in the study cannot provide any support for ELG hypothesis in Bangladesh. Another problem with the study of Begum and Shamsuddin is that they used data for both pre- and post-liberation period of Bangladesh, as their sample covered annual observations for 1962-1992. This is rather an unusual practice for any study concentrating on Bangladesh.⁹ Besides, 1970-71 and 1971-72 are the years when the liberation war was fought, as a result of which all normal economic activities were suspended at least for some parts of these two years. Because of this, official publications of Bangladesh usually do not report data for these years.¹⁰ More importantly, the time series data on output used in both the studies correspond to the old national income accounting system, which has been subjected to significant methodological revision and extended coverage. Therefore, as pointed out in Chapter 2, if the new national income estimates are a more appropriate measure of Bangladesh's GDP, the previous empirical research using the old estimates must have encountered the problem of measurement errors. Considering the importance of the issue and having observed that the previous studies are subject to a number of major shortcomings, the present study examines the export-output relationship for Bangladesh within a more adequate framework.

⁹ For example, the other study by Islam and Iftekharuzzaman (1996) used the data for post-liberation period only although they had to work with a very small sample of 19 years.

¹⁰ One could also question the use of dummy variables in the estimating equation by Begum and Shamsuddin on grounds of "abnormal years", which is defined as "periods of war, natural calamity and political instability". Events such as natural calamity and political instability are not uncommon in Bangladesh and hence an explanation for periods to be considered as atypical is needed. Since the authors do not specify the periods for which the dummies are used, it is not possible to extend a support on their judgement about "abnormal years".

3.3. Model Specification and Data

As stressed earlier, if the relationship between exports and output is to be tested over the long-run, it is necessary to formulate models that measure the long-run association. Besides, exclusion of relevant variables from the model and the issue of national income accounting identity relationship between exports and GDP should also be borne in mind. In the present study, we formulate a number of models, the estimation of which will testify whether the relationship between exports and output is sensitive to the choice of specification. Equations (4a)-(6b) set out all such specifications.¹¹

$$\ln Y_t = \alpha_0^1 + \alpha_1^1 \ln X_t + \upsilon_{t1} \quad (3.4a)$$

$$\ln NXY_t = \beta_0^1 + \beta_1^1 \ln X_t + \upsilon_{t2} \quad (3.4b)$$

$$\ln Y_t = \alpha_0^2 + \alpha_1^2 \ln X_t + \alpha_2^2 \ln K_t + \alpha_3^2 \ln L_t + \upsilon_{t3} \quad (3.5a)$$

$$\ln NXY_t = \beta_0^2 + \beta_1^2 \ln X_t + \beta_2^2 \ln K_t + \beta_3^2 \ln L_t + \upsilon_{t4} \quad (3.5b)$$

$$\ln Y_t = \alpha_0^3 + \alpha_1^3 \ln X_t + \alpha_2^3 \ln K_t + \alpha_3^3 \ln L_t + \alpha_4^3 \ln H_t + \upsilon_{t5} \quad (3.6a)$$

$$\ln NXY_t = \beta_0^3 + \beta_1^3 \ln X_t + \beta_2^3 \ln K_t + \beta_3^3 \ln L_t + \beta_4^3 \ln H_t + \upsilon_{t6} \quad (3.6b)$$

All models are in log-linear form, which is very common in empirical work (e.g. Ghatak, *et al.*, 1997 and Medina-Smith, 2001). One advantage of this specification is that first differencing of the variables gives the rates of growth. Unlike the models in (3.1)-(3.3), our specified formulations are on the level of the variables. As it is shown below, these models are capable of capturing the long-run relationship. Equation (3.4a) gives the simplest static bivariate relationship between Y and X , while (3.5a) specifies the relationship by including capital (K) and labour (L). Equation (3.6a) augments the specification further to include human capital (H), which is compatible with the new growth theory (Ghatak, *et al.*, 1997; Ram, 1987; and Seehey; 1990). In order to tackle the problem of “accounting effect” of X on Y , equations (3.4b), (3.5b) and (3.6b) have non-export output (NXY) on the left hand side. While the specified models show the relationship between export and output, a dummy variable will be used to capture the effect of trade liberalisation in the estimated equations.

¹¹ υ is the stochastic error term in equations (4a)-(6b). We will assume that the explanatory variables are weakly exogenous in these equations. This is because the value of each explanatory variable is believed to be determined outside the system and thus, independent of the error term (Ghatak, *et al.*, 1997).

The new national income estimates on Bangladesh's GDP in 1995-96 constant prices (BBS 2001) will be used as a measure of Y . The revised data are available only since 1980 thus forcing us to use a short-sample of 1980-2000.¹² Exports in 1995-96 constant prices from the same source (i.e., BBS, 2001) will be considered as X . The non-export GDP, NXY , is approximated by subtracting X from Y . For K , L , H we use the data on capital stock, labour force, and adult literacy rate – the sources of these data and justification for their use have been elaborated in Chapter 2.

3.4. Estimation Results

3.4.1. Simple Graphical Presentation of Exports and Growth

Before going into the econometric estimates, it might be worthwhile to consider two simple graphical representations of the export-growth relationship. First, in Figure 3.2 year-wise growth rates of GDP and exports are presented. A close look at the Figure reveals no clear relationship between the growth rates for the 1980s but a co-movement of the two variables in the same direction for the following decade. For example, while export growth rate falls in 1984 followed by a rise in 1985 before falling again in 1986, the corresponding movements in the GDP growth rates have been completely opposite. In contrast, in the 1990s no single instance of opposite movement in export and GDP growth rate is noticed. What is, however, most striking about the 1990s is that even very high rates of growth of exports are associated with only slight changes in GDP growth. Thus, there is very little difference between the impact of as high as 30 percent rise (as in 1995) and just about 5 per cent change (as in 1999) in exports on overall GDP. Figure 3.3 provides the scatter of GDP and export growth rates. The line of best fit obtained through the scatter shows a positive relationship although the R^2 value is quite low. The estimated equation shows that on an average a one-percentage point rise in export growth rate is associated with a rise of GDP growth rate of 0.05 percentage point.

¹² Quarterly data are also not available.

Figure 3.2: Graphs of Exports and GDP Growth Rates

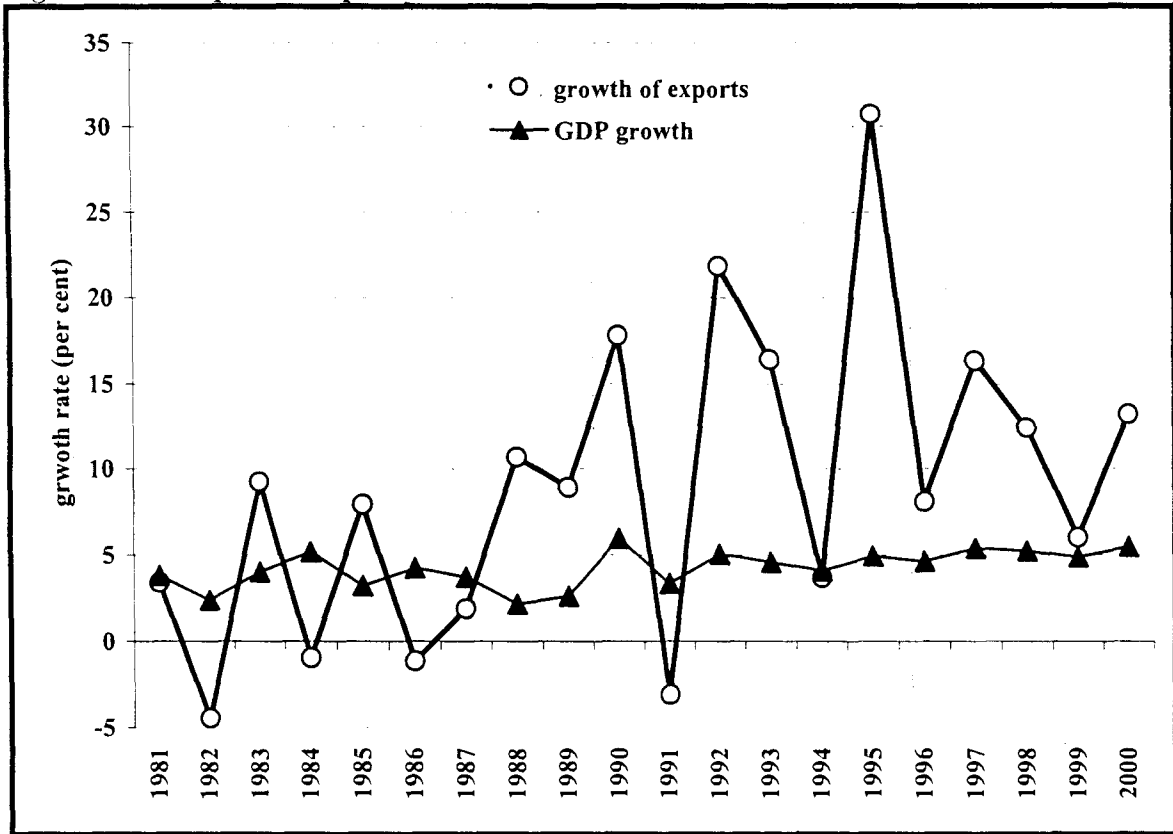
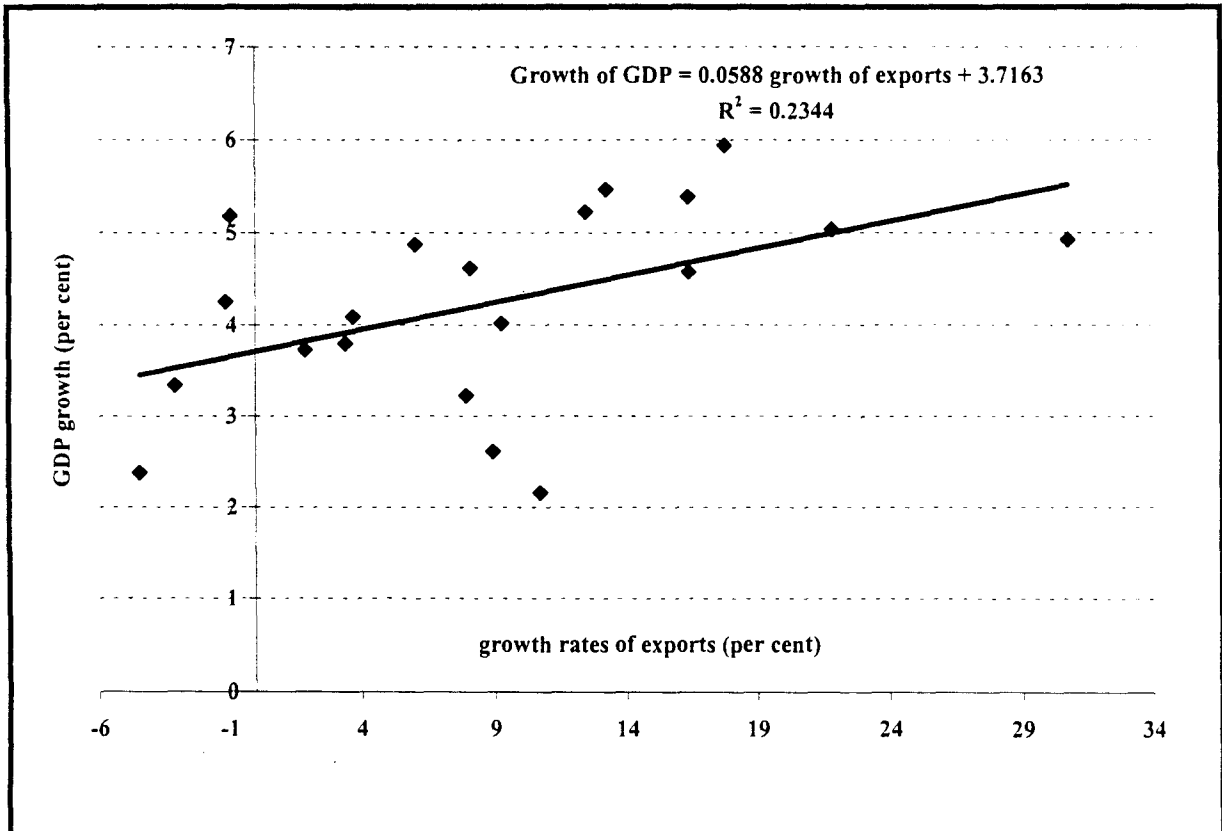


Figure 3.3: Scatter of Growth of Exports and GDP



3.4.2. Unit Root Test of Variables

As discussed in Chapter 2, in order to avoid the problem of spurious regressions, testing of variables for unit roots should precede the econometric estimation of the models. If variables possess integrating properties, one should employ cointegration techniques to obtain a valid long-run relationship. To determine whether the variables can be considered either as $I(1)$ or $I(0)$ series, Table 3.1 summarises the results of the DF and ADF regression test statistics while Figure 3.4 provides the graphical plots of level and first differenced variables along with their correlograms. It needs to be mentioned here that the integrating properties of $\ln Y$, $\ln K$, $\ln L$, $\ln H$ were examined in Chapter 2 where $\ln Y$ and $\ln H$ were considered to be $\sim I(1)$ but the order of integration for $\ln K$ and $\ln L$ could not be determined. Therefore, it would be sufficient to test the unit roots for $\ln X$ and $\ln NXY$ in this case.

Table 3.1: Results of the DF-ADF Unit Root Tests

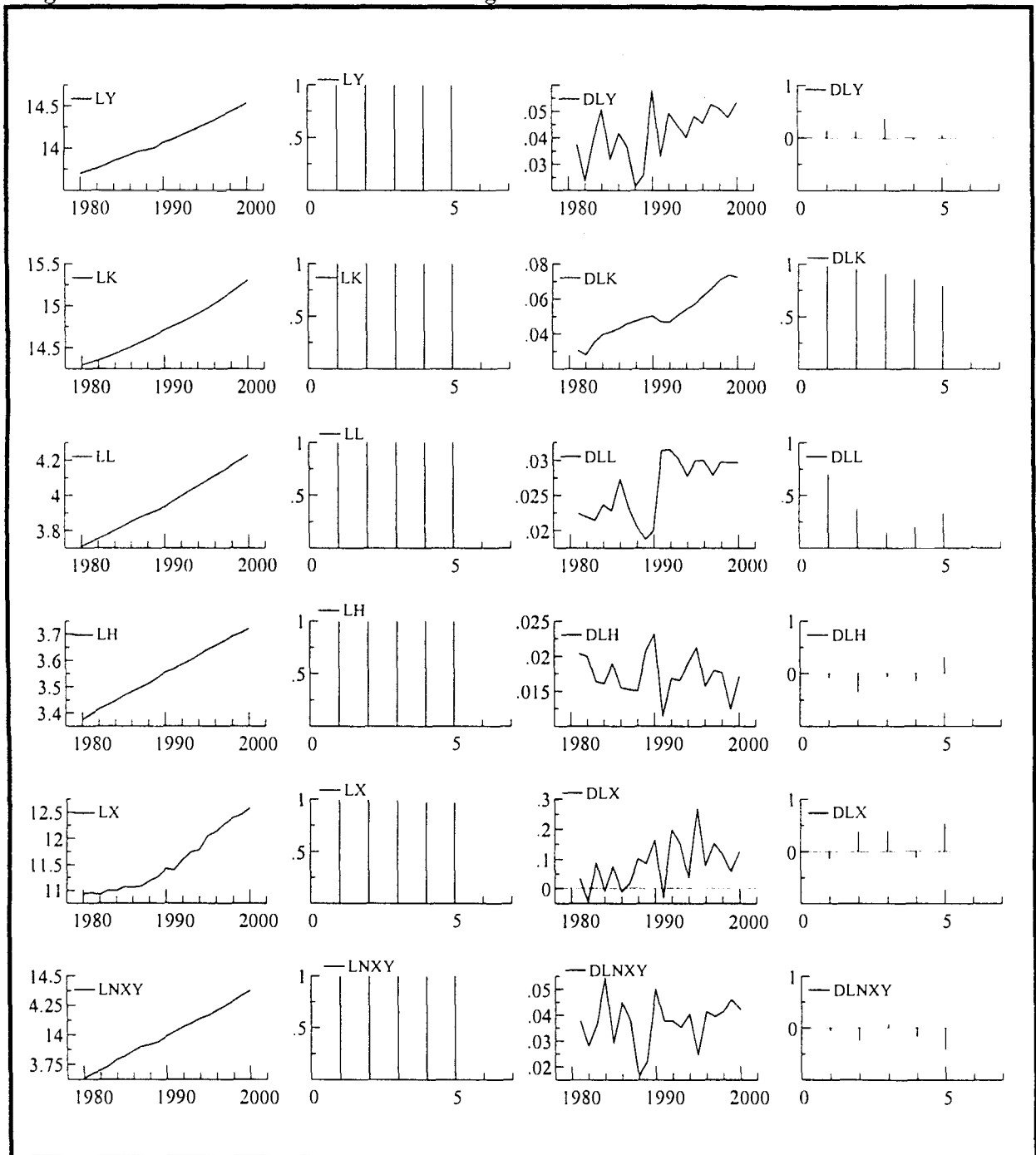
Variables	Without Trend		With Trend	
	DF	ADF	DF	ADF
$\ln Y$	2.75	2.82	-0.67	-0.36
$\Delta \ln Y$	-3.81	-2.46	-4.82	-3.63
$\ln K$	15.21	1.58	1.56	0.23
$\Delta \ln K$	-0.92	-1.21	-1.65	-2.41
$\ln L$	3.84	1.65	-0.79	-1.30
$\Delta \ln L$	-1.80	-1.88	-2.48	-2.99
$\ln X$	1.61	2.30	-2.19	-2.21
$\Delta \ln X$	-5.22	-2.48	-6.71	-3.33
$\ln H$	-0.48	-0.54	-2.96	-3.44
$\Delta \ln H$	-4.71	-4.40	-4.55	-4.26
$\ln NXY$	0.75	0.79	-1.87	-2.06
$\Delta \ln NXY$	-4.30	-3.63	-4.23	-3.61

Note: The 95 per cent critical value for DF and ADF test statistics without the trend term is -3.02 . The comparable statistic for DF-ADF regressions with the trend term is -3.67 . The null hypothesis is that the variable under the test is non-stationary against stationary. An absolute value of the test statistic greater than the corresponding critical value would imply rejection of the null.

For $\ln X$, as Table 3.1 shows, the DF and ADF tests both with and without the trend cannot reject the null of unit root or non-stationarity. And on the first difference of $\ln X$, $\Delta \ln X$, while the DF tests can reject the null, but none of the ADF tests can. Since the ADF test is preferable to DF, the results of the unit root test should be considered as inconclusive. The first difference of $\ln X$ picks up a larger variance in the mid-1990s showing some high growth of exports. This might have resulted in the failure of the ADF test in a relatively small sample that have only 20 observations. Second difference of $\ln X$ was also tested for unit root and again none of the ADF tests could reject the non-stationarity hypothesis. Thus it seems that ADF tests cannot determine the integrating order on $\ln X$. The correlograms of $\Delta \ln X$,

however, depicts a pattern, which is comparable to that of a stationary variable. Moreover, the examination of individual sample ACFs of $\Delta \ln X$ failed to become statistically significant and, as shown in Figure 3.5 [a], all of them fell within the 95 per cent confidence interval defined for any stationary variable with 20 observations. Based on this evidence, $\Delta \ln X$ can be considered as an $\sim I(0)$ variable, or $\ln X$ is $\sim I(1)$.

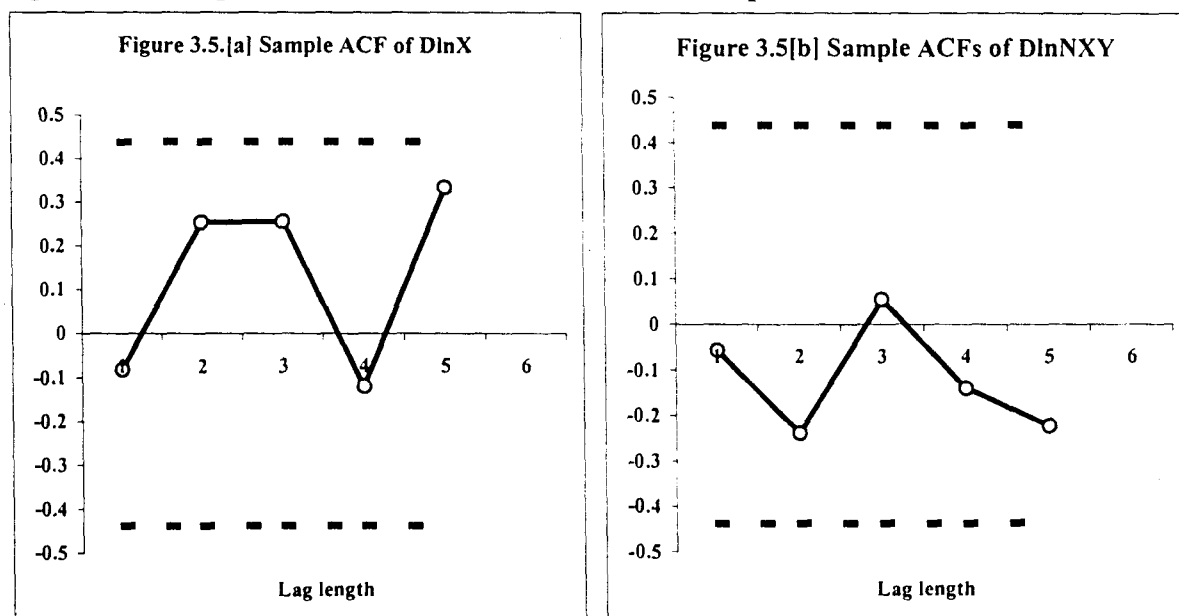
Figure 3.4: Plot of Variables and Correlograms



Note: The graphs are produced by using PcFiml, version 9.10 (Doornik and Hendry, 1997).

For non-export GDP, $\ln NX Y$, all the DF and ADF tests suggest its non-stationarity on levels but for $\Delta \ln NX Y$ the result of ADF test with the trend, contradicts the same test without the trend. Figure 3.4 shows that the first difference of $\ln NX Y$ is not trended and, therefore, considering the ADF test without the trend it can be concluded that $\ln NX Y$ is $\sim I(1)$. The statistical insignificance of individual sample ACFs of $\Delta \ln NX Y$ and, as Figure 3.5[b] shows, and their falling well within the 95 per cent confidence interval for a stationary variable with similar number of observations further support its non-stationarity.

Figure 3.5: Sample ACFs of $\Delta \ln X$ and $\Delta \ln NX Y$ and 95 per cent Error Bands



3.4.3. Estimating the Bivariate Relationship

Equations (4a) and (4b) postulate static bi-variate long-run relationship between export and GDP and export and non-export GDP, respectively. For these two equations, finding cointegration between the variables would be sufficient to infer about the long-run relationship. We first compute the first step of Engle-Granger procedure – the results of which are reported in Table 3.2.

Table 3.2: Estimation of the Bi-variate Relationships

Long-run static regression	Adjusted R^2	DW Statistics ¹	Computed ADF Statistics for Residual	Critical Value for ADF test ²
(4a): $\ln Y = 9.03 + 0.44 \ln X$	0.96	0.35	-2.33	-3.34
(4b): $\ln NX Y = 9.59 + 0.38 \ln X$	0.94	0.33	-2.26	-3.34

Note: ¹DW stands for Durbin-Watson. ²These critical values correspond to the 95 per cent level of confidence interval and are taken from Davidson and McKinnon (1993), p.722.

The estimates in Table 3.2 are super-consistent and the estimated standard errors are not reported since they do not provide valid inferences.¹³ The sign of the coefficient of $\ln X$ in both regressions is positive, which is indicative of a positive association between X and Y and X and NXY . The estimated results show that a one per cent increase in exports is associated with 0.44 and 0.38 per cent increase in Y and NXY , respectively. However, these associations are true if and only if the variables in the estimated equations are cointegrated. In this respect, what is worrying is the fact that the estimated Durbin-Watson statistics in the two estimated equations are smaller than the respective adjusted R^2 values, which is usually considered as a symptom of spurious regression. The ADF tests for residual stationarity confirmed the suspicion of not having found cointegrating relationship as it is reported in Table 3.2 that on both occasions the computed ADF statistic falls far below the critical value. Hence, the null hypothesis of non-stationarity of residual (or non-cointegration) cannot be rejected at the 95 per cent level and the results can be interpreted as not supportive of valid long-run relationships between X and Y and between X and NXY .¹⁴ The residuals representing the long-run cointegrating vectors in equations (4a) and 4(b), R1 and R2, respectively, along with their corresponding correlograms are shown in Figure 3.4, which clearly exhibit their non-stationary.

Table 3.3: Bivariate Relationship in the Short-run

$\Delta \ln Y = 0.03 + 0.08^{**} \Delta \ln X - 0.06 R1_{t-1}$	$\Delta \ln NXY = 0.04 - 0.008 \Delta \ln X - 0.042 R2_{t-1}$
(s.e.) (0.003) (0.029) (0.04)	(s.e.) (0.003) (0.03) (0.04)
t-ratio 11.09 2.79 -1.40	t-ratio 11.67 -0.28 -1.04
Diagnostic Tests	
Adjusted $R^2 = 0.23$	Adjusted $R^2 = 0.08$
Serial Correlation $[\chi^2(1)] = 0.02$	Serial Correlation $[\chi^2(1)] = 0.03$
Functional Form $[\chi^2(1)] = 0.05$	Functional Form $[\chi^2(1)] = 3.59$
Normality $[\chi^2(2)] = 1.14$	Normality $[\chi^2(2)] = 0.53$
Heteroscedasticity $[\chi^2(1)] = 1.18$	Heteroscedasticity $[\chi^2(1)] = 0.05$

Note: ** indicates statistical significance at the five per cent level. For diagnostics Godfrey's (1978) LM test for serial correlation, Ramsey's (1969) RESET test for functional form, White's (1980) test for heteroscedasticity and Jarque-Bera (1987) test for normality of errors are performed. The 95 per cent critical values for $\chi^2(1)$ and $\chi^2(2)$ are 3.84 and 5.99 respectively, which are being used to test the null hypothesis of no problem of serial correlation, functional form, non-normality of errors and heteroscedasticity.

Although there is no evidence of cointegration, Table 3.3 reports the short-run error-correction models corresponding to equations (4a) and 4(b). In the short-run, export is found to be positively and significantly influencing output only in the *GDP* equation (left panel in

¹³ The application of OLS to $I(1)$ variables yields super-consistent estimates, i.e., they converge on their true values at a faster rate than it would be the case if all stationary variables are used in regression (see e.g., Gujarati 1995; Harris 1995).

¹⁴ Even at the 90 per cent level the non-stationarity of residuals cannot be rejected.

Table 3.3); in the other model the sign of $\Delta \ln X$ is negative and the coefficient fails to be statistically significant. The error-correction terms in both models are highly insignificant, which also support the previous finding of no long-run relationship between X and Y and X and NXY . The short-run models do not report any problem concerning serial correlation, functional form, non-normality of residuals and heteroscedastic error variances.

3.4.4. Multivariate Relationship

One reason for not getting long-run relationship might be the exclusion of other relevant variables from the model. Therefore, we need to examine the export-growth relationship taking into consideration other variables that influence X and NXY and as specified in equation (3.5a), (3.5b), (3.6a) and (3.6b) above. The equations, as estimated in Table 3.2 contain two variables and, therefore, only a test for cointegration is enough to determine the long-run influence of exports on output not requiring to compute valid standard errors, which the OLS cannot provide in the presence of non-stationary variables. In contrast, in equations (3.5a)-(3.6b), where there are more than one explanatory variables only the evidence of cointegration is not sufficient to infer about the significant influence of X or any other variables.¹⁵ It is important to determine statistical significance of individual variables. Since OLS do not yield valid standard errors, the Phillips-Hansen Fully Modified OLS (PHFMOLS) technique (Phillips and Hansen, 1990) is used to make the correct inferences. Having estimated by the PHFMOLS procedure, residuals obtained from the long-run regressions are tested for stationarity to check for a valid long-run relationship.

Table 3.4 reports the results for equations (3.5a)-(3.6b) that were obtained using the PHFMOLS procedure. Since the PHFMOLS yields standard errors for valid inferences, they are also reported to see whether exports significantly influence output. Let us first consider the estimation of two neo-classical production functions, augmented by export i.e., equations (3.5a) and (3.5b). In both regressions, $\ln K$ and $\ln L$ turn out to be correctly signed and are statistically significant at least at the ten per cent level. However, it is the export variable that produces the perverse result by appearing with a negative sign. When the dependent variable is GDP ($\ln Y$), the coefficient of $\ln X$ is insignificant but in non-export GDP (NXY) equation the negative effect is highly significant, at less than one per cent level. In fact, a one per cent increase in exports is found to be associated with 0.1 per cent fall in non-export GDP. There

¹⁵ In an equation involving three variables, e.g., M, N and P it might be possible that the cointegration result is due to M and N only and the influence of P in the regression is not significant.

is evidence for cointegration in the estimated equations. The computed ADF statistic for residuals in equation (3.5a), R3, is -3.83 , which exceeds the critical value at the 90 per cent level. For equation (3.5b) the evidence for a valid long-run relationship is even stronger as the ADF test on the residuals, R4, returns a test statistic of -4.10 implying that the null of non-cointegration could be rejected even at the 95 per cent level. The graphs of R3 and R4 and their correlograms, as given in Figure 3.6, behave more like stationary variables than non-stationary ones thereby providing support to the ADF test results.

Table 3.4: Phillips-Hansen Estimation of Equations 5(a)-6(b)

Equation (3.5a):

$$\ln Y = 6.05^{***} + 0.25^{**} \ln K + 1.11^{***} \ln L - 0.01 \ln X$$

(s.e.)	(0.69)	(0.09)	(0.16)	(0.017)
t-ratio	8.65	2.62	6.63	-0.67

Unit Root Test for Residuals (R3) : ADF statistic = -3.83^*

Equation (3.5b):

$$\ln NXY = 6.96^{***} - 0.18^* \ln K + 1.42^{***} \ln L - 0.11^{***} \ln X$$

(s.e.)	(0.73)	(0.10)	(0.17)	(0.01)
t-ratio	9.46	1.80	8.04	-6.92

Unit Root Test for Residuals (R4) : ADF statistic = -4.10^{**}

Equation (3.6a):

$$\ln Y = 5.89^{***} + 0.26^{**} \ln K + 0.99^{***} \ln L + 0.15 \ln H - 0.004 \ln X$$

(s.e.)	(0.76)	(0.09)	(0.27)	(0.24)	(0.017)
t-ratio	7.70	2.65	3.58	0.63	-0.22

Unit Root Test for Residual (R5) : ADF statistic = -3.58

Equation (3.6b):

$$\ln NXY = 6.42^{***} + 0.196^{**} \ln K + 0.98^{**} \ln L + 0.53^{**} \ln H - 0.09^{***} \ln X$$

(s.e.)	(0.74)	(0.09)	(0.27)	(0.24)	(0.016)
t-ratio	8.60	2.07	3.64	2.20	-5.41

Unit Root Test for Residuals (R6) : ADF statistic = -4.26^{**}

Equation (3.6a)': After Deleting $\ln L$

$$\ln Y = 3.88^{***} + 0.45^{***} \ln K + 0.93^{***} \ln H + 0.025 \ln X$$

(s.e.)	(0.49)	(0.08)	(0.18)	(0.020)
t-ratio	7.86	5.28	5.08	1.25

Unit Root Test for Residuals (R7) : ADF Statistic = -3.48

Equation (3.6b)': After Deleting $\ln L$

$$\ln NXY = 4.50^{***} + 0.37^{***} \ln K + 1.31^{***} \ln H - 0.058^{***} \ln X$$

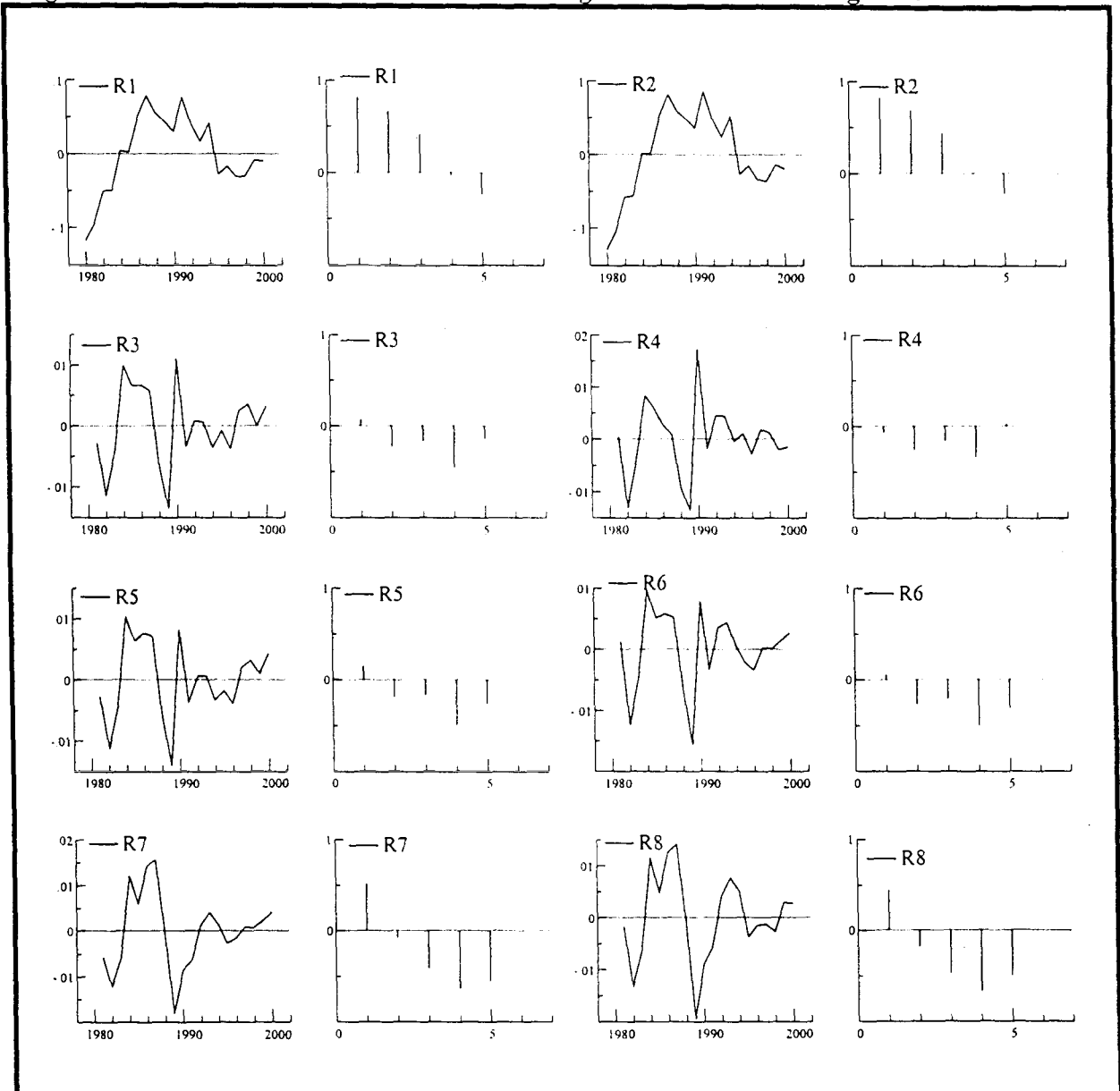
(s.e.)	(0.49)	(0.08)	(0.18)	(0.02)
t-ratio	9.14	4.40	7.23	-2.87

Unit Root Test for Residual: ADF Statistic = -3.77

Note: *** , ** , and * are for statistical significance at the one, five and ten per cent levels respectively. The 95 per cent critical values for the ADF test of unit root for residuals with 4 and 5 variables in the cointegrating regression are respectively -4.10 and -4.43 . Corresponding critical values at the 90 per cent level are -3.81 and -4.15 . These critical values are taken from Davidson and MacKinnon (1993), as given in p.722 and cited in Johnston and DiNardo (1997), p.265.

In equations (3.6a) and (3.6b), the neo-classical production function is extended further to include human capital (H). The influence of $\ln H$ fails to be significant and in terms of sign and significance of $\ln X$, equations (3.6a)-(3.6b) are not different from the previous equations (3.5a)-(3.5b). The ADF test statistic on the residuals from the model (3.6a), R5, could not reject even the 90 per cent critical value, while the same test statistic on R6, the residuals from model (3.6b), could reject at the 95 per cent level.¹⁶

Figure 3.6: Plot of Residuals from Various Regressions and Correlograms



Note: The graphs are produced by using PcFiml, version 9.10 (Doornik and Hendry, 1997).

¹⁶ We should be careful in concluding that R5 is not stationary. This is because in equations (6a) there are two variables which are highly insignificant. Dropping these two insignificant variables from the model will greatly reduce the critical value for ADF test. Therefore, on the one hand, $\ln H$ and $\ln X$ do not contribute much in explaining the variation in the dependent variable and, on the other, their inclusion in the model raises the critical value.

Finally, following the argument that in a labour surplus economy, L should not be included in the aggregate production function, equation (3.6a)' and (3.6b)' explain GDP and non-export GDP in terms of physical capital, human capital and exports only. With this, $\ln K$ and $\ln H$, in both regressions, become statistically significant at the one per cent level. The coefficient on $\ln X$ turns out to be positive in GDP equation (3.6a)' but it fails to be significant at the conventional levels. The influence of $\ln X$ in non-export GDP equation (3.6b)' continues to be negative and significant. It is observed that a one per cent rise in exports is associated with about 0.06 per cent fall in non-export GDP. The computed ADF test statistics on R7 and R8, the residuals obtained from (3.6a)' and (3.6b)', are lower than their critical values thus not supporting a conclusion in favour of cointegration. The correlograms of R7 and R8 also show large sample autocorrelation coefficients at the first, fourth and fifth lag orders and hence giving inconclusive results.

The short-run error-correction models corresponding to the long-run equations of Table 3.4 are given in Table 3.5. The reported error-correction models are parsimonious forms of general models where all insignificant variables have been deleted.¹⁷ It is evident from Table 3.5 that all error-correction terms are correctly signed and highly significant. Only on two occasions error-correction terms are greater than 1 (absolutely), however, in both cases the restriction that the actual coefficient was -1 could not be rejected at the 5 per cent level. Therefore, all the short-run models seem to support the long-run cointegrating relationship for all equations in Table 3.4. Turning to our variable of interest, it is observed that significant influence of export is only captured in the growth of non-export GDP equations. And, in every case, these are negative suggesting an inverse relationship between export growth and non-export output even in the short-run. On an average, a one per cent increase in export growth is associated with -0.05 – -0.085 per cent fall in non-export output growth. The estimated diagnostic test statistics indicate that in no instance do we have any problem related to serial correlation, non-normality of errors, functional form or heteroscedastic error variances.

¹⁷ The results would not have changed qualitatively had the insignificant export growth variables not been deleted from the model.

Table 3.5: Error-Correction Representation of the Estimated Equations in Table 3.4

Error-correction Model	Diagnostic Tests				
	\bar{R}^2	SC	FF	NOR	HET
<p>For Equation (5a): $\Delta \ln Y = -0.004 + 0.29 \Delta \ln K + 1.18 \Delta \ln L - 0.89 R_{3,t-1}$ (s.e.) (0.01) (0.16) (0.50) (0.27) t-ratio -0.39 1.81 2.35 -3.29</p>	0.55	1.55	0.10	0.26	3.04
<p>For Equation (5b): $\Delta \ln NXY = 0.08 + 2.02 \Delta \ln L - 0.085 \Delta \ln X - 1.12 R_{4,t-1}$ (s.e.) (0.014) (0.57) (0.028) (0.36) t-ratio 0.60 3.48 -3.05 -3.08</p>	0.38	0.007	0.17	0.93	1.25
<p>For Equation (6a): $\Delta \ln Y = -0.002 + 0.31 \Delta \ln K + 1.05 \Delta \ln L - 0.89 R_{5,t-1}$ (s.e.) (0.010) (0.16) (0.48) (0.26) t-ratio -0.18 1.96 2.17 -3.36</p>	0.56	0.30	0.43	0.30	3.43
<p>For Equation (6b): $\Delta \ln NXY = 0.02 + 1.53 \Delta \ln L - 0.074 \Delta \ln X - 1.08 R_{6,t-1}$ (s.e.) (0.011) (0.45) (0.023) (0.30) t-ratio 0.24 3.39 -2.97 -3.51</p>	0.45	0.002	0.01	0.81	0.01
<p>For Equation (6a)': $\Delta \ln Y = 0.014 + 0.52 \Delta \ln K - 0.59 R_{7,t-1}$ (s.e.) (0.007) (0.14) (0.21) t-ratio 1.95 3.67 -2.81</p>	0.49	0.20	0.001	1.16	1.50
<p>For Equation (6b)': $\Delta \ln NXY = 0.02 + 0.34 \Delta \ln K - 0.05 \Delta \ln X - 0.59 R_{8,t-1}$ (s.e.) (0.007) (0.15) (0.024) (0.208) t-ratio 3.08 2.14 -1.97 -2.86</p>	0.36	0.006	1.03	0.38	0.028

Note: SC stands for serial correlation, FF for functional form, NOR for Normality of errors, and HET for Heteroscedasticity. *, **, and *** are for significant at the one, five and ten per cent levels respectively.

Therefore, the general finding that emerges from Table 3.4 and Table 3.5 is that there is no evidence of exports influencing the GDP or non-export GDP positively. In static long-run regressions where growth accounting effect of exports in GDP is not separated, the effect of exports on output is at best insignificant. On the other hand, in all non-export GDP equations, export is found to be negatively influencing the output and these negative effects are highly significant. Similar effects of exports are also maintained in the short-run dynamic equations.

3.4.5. Estimating the Federian Equation to Determine Externality and Productivity Differential Effects of Exports

As mentioned above, following Feder (1983), the effect of exports on output is often modeled as externality plus a productivity differential effect. This results in estimating an equation of the form (3.3), where the coefficient on c_4 is interpreted as “the social marginal productivity gap between the export and the non-export sector relative to the private marginal productivity in the export sector” (Begum and Shamsuddin, p.101). Having estimated the equation for Bangladesh, Begum and Shamsuddin reported to have found significant externality and productivity differential effects. In this section, we make an attempt to verify the conclusion reached in Begum and Shamsuddin (1998).

The estimating equation in Feder (1983) involves all variables on their growth rates thus wiping out the long-run relationship. One way of rationalizing this modeling effort is to consider that the relevant variables are cointegrated on their levels and the short-run dynamics are given by the actual estimating equation in (3.3). In such a case, in order to include the long-run information into the model, it is important to extend equation (3.3) by including an error-correction term, which should essentially provide the information on the long-run cointegrating relationship. For the present study, since the long-run relationship in GDP and non-export GDP equations have already been estimated in equations (3.5a) and (3.5b) of Table 3.4, the relevant residuals can be inserted into Feder’s equation to establish the link between the short-run estimating equation and the corresponding long-run relationship among the variables.

Table 3.6 provides econometric estimates of a number alternative formulation of Feder’s equation. While equation 1 in Table 3.6 is the original estimating equation as in Feder (1983) and in Begum and Shamsuddin (1998), equation 2 is the modified version of the model incorporating the lagged error-correction term, $R3_{t-1}$, representing the long-run relationship

between $\ln Y$, $\ln K$, $\ln L$ and $\ln X$ as estimated in Table 3.4. Due to the problem posed by the national income identity relationship between exports and GDP, equations 3 and 4 have been estimated with non-export GDP being the dependent variable. In equation 4, $R_{4,t-1}$ gives similar long-run relationship as in $R_{3,t-1}$ but with respect to $\ln NXY$.

Table 3.6: Estimation of a Variety of Feder's Equations

1. Original Feder equation: dependent variable is $\Delta \ln Y$

$$\Delta \ln Y = 0.011 + 0.26 \Delta \ln K + 0.58 \Delta \ln L + 0.22 (X/Y) \Delta \ln X$$

(s.e.)	(0.013)	(0.22)	(0.59)	(0.34)
t-ratio	0.86	1.18	0.98	0.65

Adjusted $R^2 = 0.25$; Serial Correlation $[\chi^2(1)] = 1.77$; Functional Form $[\chi^2(1)] = 0.09$

Normality $[\chi^2(2)] = 1.21$ Heteroscedasticity $[\chi^2(1)] = 3.51$

2. Feder equation as an error-correction model: dependent variable is $\Delta \ln Y$

$$\Delta \ln Y = -0.006 + 0.33^{**} \Delta \ln K + 1.23^{**} \Delta \ln L - 0.15 (X/Y) \Delta \ln X - 0.95^{***} R_{3,t-1}$$

(s.e.)	(0.01)	(0.14)	(0.58)	(0.24)	(0.30)
t-ratio	-0.45	2.38	2.10	-0.61	-3.15

Adjusted $R^2 = 0.53$; Serial Correlation $[\chi^2(1)] = 0.003$; Functional Form $[\chi^2(1)] = 0.45$

Normality $[\chi^2(2)] = 0.48$ Heteroscedasticity $[\chi^2(1)] =$ Adjusted with White's (1980) procedure.

3. Original Feder equation with the dependent variable $\Delta \ln NXY$

$$\Delta \ln NXY = 0.015 + 0.275 \Delta \ln K + 0.54 \Delta \ln L - 0.67^{**} (X/Y) \Delta \ln X$$

(s.e.)	(0.012)	(0.21)	(0.56)	(0.32)
t-ratio	1.23	1.30	0.95	-2.06

Adjusted $R^2 = 0.14$; Serial Correlation $[\chi^2(1)] = 2.57$; Functional Form $[\chi^2(1)] = 3.04$

Normality $[\chi^2(2)] = 0.20$ Heteroscedasticity $[\chi^2(1)] = 0.56$

4. Feder equation as an error-correction model with the dependent variable $\Delta \ln NXY$

$$\Delta \ln NXY = -0.010 + 0.22 \Delta \ln K + 1.76^{**} \Delta \ln L - 1.07^{**} (X/Y) \Delta \ln X - 0.97^{***} R_{4,t-1}$$

(s.e.)	(0.014)	(0.18)	(0.64)	(0.30)	(0.33)
t-ratio	-0.75	1.20	2.77	-3.50	-2.89

Adjusted $R^2 = 0.43$; Serial Correlation $[\chi^2(1)] = 0.27$; Functional Form $[\chi^2(1)] = 2.77$

Normality $[\chi^2(2)] = 1.26$ Heteroscedasticity $[\chi^2(1)] = 0.24$

Note: Statistical significance at the one, five and ten per cent levels are denoted by respectively ^{***}, ^{**}, and ^{*}.

It is now obvious that in the original Federian formulation (equation 1 in Table 3.6), none of the explanatory variables including the weighted export growth variable turns out to be statistically significant. This is tantamount to finding that there is no significant productivity differential and externality effect as a result of the growth of exports. In equation 2 with the inclusion of the lagged residuals from the long-run relationship, capital and labour become statistically significant. $R_{3,t-1}$ also appears to be highly significant providing justification to the use of Feder's equation under an integrated framework of cointegration and error-correction modeling. However, it is our variables of interest, $\left(\frac{X}{Y}\right) \cdot \Delta \ln X$, that not only fails to become significant but also takes a negative sign. When the growth of non-export GDP ($\Delta \ln Y$) replaces simple GDP growth as the dependent variable in the original formulation,

only the weighted export growth variable appears to be statistically significant. However, the negative sign of the coefficient implies that growth of exports adversely affects the non-export output. Finally, the non-export growth equation specified within the framework of error-correction modeling strategy (equation 4 in Table 3.6) also provides significantly negative coefficient on $\left(\frac{X}{Y}\right) \cdot \Delta \ln X$ along with statistical significance of $R4_{t-1}$ and $\Delta \ln L$. It needs to be mentioned here that although the estimated models in Table 3.6 use labour and not human capital (H), we confirmed that the inclusion of the latter would not cause any qualitative change in the results reported.

3.4.6. Trade Liberalisation and Export-Growth Relationship

So far we have not considered the effect of trade liberalisation on the export-growth relationship. It might be that the relationship between exports and growth has undergone significant change, which is not captured in simple models that do not allow for structural breaks. In fact, one possible channel through which liberalisation is expected to influence the export growth relationship is through an alteration of one or more parameters of the model. This is to suggest that liberalisation might give rise to a situation where a given increase in exports has a greater influence upon the rate of economic growth than was previously the case. Therefore, it is important to check for parameter stability in the model. Our methodology for testing parameter stability is via the inclusion of intercept and slope-dummies on exports and other variables in the long-run regression equations for GDP and non-export GDP.

Table 3.7 reports the results of parameter stability test in both the models for GDP and non-export GDP. Columns denoted by (1) and (4) test whether only the intercept dummy (for trade liberalisation), LIBDUM, is significant, while in columns (2) and (5) the significance of both the intercept and slope-dummies on exports, X-DUM, is tested. Finally, columns (3) and (6) have intercept dummy as well as slope dummies associated all the explanatory variables, viz., K-DUM, L-DUM, and X-DUM. It is found that the variables LIBDUM and X-DUM are not significant when they appear alone or together (i.e., in columns 1, 2, 4, and 5). However, when the intercept and all three slope-dummies are inserted together (i.e., in column 3 and 6), all variables including LIBDUM and X-DUM turn out to be significant at the one per cent

level.¹⁸ The sign of the intercept dummy and X-DUM are, however, negative in both cases. The negative and statistically significant coefficients on X-DUM would particularly imply that the influence of trade liberalisation on the export-output relationship has been negative. Although the estimated equations as presented in Table 3.7 involves variables on their levels, similar effects of liberalisation were also tested in the error-correction models. However, there was no evidence of any statistically significant influence of liberalisation on the export-growth relationship even in the short-run models.¹⁹ Therefore, although the results may appear to be surprising, taken as a whole are fairly conclusive.

Table 3.7: Export-Output Relationship and Liberalisation

Variables	Dependent variable: lnY			Dependent variable: lnNXY		
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	6.76*** (0.90)	6.88*** (0.87)	14.14*** (2.02)	7.31*** (0.97)	7.49*** (0.88)	14.77*** (2.10)
lnK	0.14 (0.13)	0.14 (0.12)	-0.95*** (0.30)	0.128 (0.14)	0.09 (0.12)	-1.00*** (0.31)
lnL	1.30*** (0.22)	1.31*** (0.22)	2.94*** (0.46)	1.51*** (0.24)	1.49*** (0.22)	3.11*** (0.48)
lnX	0.008 (0.02)	-0.005 (0.03)	0.21*** (0.05)	-0.10*** (0.02)	-0.06 (0.03)	0.15*** (0.05)
LIBDUM	-0.011 (0.008)	-0.147 (0.18)	-9.14*** (2.23)	-0.004 (0.009)	0.25 (0.24)	-8.47*** (2.32)
K-DUM	-	-	1.41*** (0.31)	-	-	1.35*** (0.36)
L-DUM	-	-	-2.45*** (0.67)	-	-	-2.23*** (0.70)
X-DUM	-	0.012 (0.016)	-0.17*** (0.07)	-	-0.02 (0.016)	-0.22*** (0.07)

Note: All equations are estimated using the PHFMOLS procedure. LIBDUM is dummy variable with 0 for pre-liberalisation period of 1980-91 and 1 for the post-liberalisation period (1992-00). K-DUM, L-DUM and X-DUM are the slope dummies with respect to capital, labour and exports and are constructed as respectively, (LIBDUM × lnK), (LIBDUM × lnL) and (LIBDUM × lnX). Statistical significance at the one, five, and ten per cent levels are denoted respectively by ***, **, and *. '-' indicates non-inclusion of the variable in the estimation.

3.4.7. Export-Growth Causality and Trade Liberalisation

The export-led growth doctrine not only postulates a positive association between exports and output but also contends that growth of exports leads to output growth. In empirical literature, this hypothesis has been examined by employing the Granger causality-testing framework as outlined in section 3.2 above [equations (3.1') and (3.1'')]. Although, in the present study, we

¹⁸ We should, however, note that the models including the intercept and all the slope dummies might be problematic giving fewer degrees of freedom, as there are only 20 years' data. Working with fewer observations than the present study, Greenaway and Sapsford (1994a) used only the differential intercept and export slope dummies and excluded slope dummies associated with other variables in the model. Despite having a small sample, the present study experiments with a general model to show that the results are quite consistent.

¹⁹ These results can be made available upon request.

could not uncover a significant positive association between exports and output, an explicit attempt is made to see whether there exists any direction of causality from growth of exports to output and if trade liberalisation influences the causality relationship significantly.²⁰

To carry out the Granger test, equations like (3.1)' and (3.1)'' will be estimated. One important point in this regard is that there is evidence that causality tests are often sensitive to the choice of lag length (Gujarati, 1995). In the literature, there are a number of suggested procedures to determine the optimum lag lengths. Davidson and Mckinnon (1993), for example, advocate for starting with a large number of lags and then checking whether the fit of the model deteriorates significantly when the most insignificant ones are eliminated. On the other hand, Engle and Granger (1987) recommend beginning with fewer lags and then testing for added lags. Apart from these, some have used information criterion, such as, Akaike's minimum Final Prediction Errors in determining the optimum lag lengths (e.g., Hsiao, 1979 and 1981). For a small sample, the determination of appropriate lag order is, however, notoriously difficult. This is because overparameterisation of the model to specific general methodology or information criterion may result in substantial loss of degrees of freedom. Bearing this in mind, Ghatak *et al.* (1997) working with 35 observations for Malaysia restricted the lag length to 1. Since in the present study we have only 20 annual observations, it might not be inappropriate to consider just one lag length.

Table 3.8: Testing Causality from Growth of Exports to Growth of Output

Causality Experiments	Coefficients [t-ratio]			
	$\Delta \ln X_{t-1}$	LIBDUM	DX-DUM	EC term
1. $\Delta \ln Y$ on $\Delta \ln X$	0.023[0.65]	-	-	-
	0.005[0.16]	-0.107[-0.88]	0.01[0.99]	-
2. $\Delta \ln NXY$ on $\Delta \ln X$	0.03[1.20]	-	-	-
	0.028[0.85]	-0.085[-0.66]	0.007[0.67]	-
3. $\Delta \ln Y$ on $\Delta \ln K, \Delta \ln L, \Delta \ln X$	-0.012[-0.40]	-	-	-1.14** [-2.48]
	-0.003[-0.08]	-0.004[-0.20]	0.03[0.50]	-1.12* [-1.78]
4. $\Delta \ln NXY$ on $\Delta \ln K, \Delta \ln L, \Delta \ln X$	0.07[1.41]	-	-	-0.69[-1.29]
	0.04[0.73]	0.013[0.56]	-0.065[0.97]	-0.69[-0.95]

Note: DX-DUM is the slope dummy variable for $\Delta \ln X$ and is constructed as $LIBDUM \times \Delta \ln X$, where LIBDUM is the liberalisation dummy with 1980-91=0 and 1992-00=1. The error-correction, EC, term indicates the lagged residuals corresponding to the relevant long-run equation in Table 3.4. Figures within the parentheses, [], are t-ratios. ** and * are statistical significance at the five and ten per cent level respectively.

²⁰ Strictly speaking given two variables, m and n , the direction of causality may exist either from m to n or from n to m or both. Since the objective is to validate export-led growth hypothesis, we will test for the direction of causality from exports to output only.

Table 3.8 contains the results of the causality tests with regard to whether X causes Y and NXY and whether the intercept dummy and the slope dummy associated with growth of exports are significant in the causality model. Each causality experiment in Table 3.8 accompanies two regressions. In the first regression the intercept dummy, LIBDUM, and the export-growth slope dummy, DX-DUM, are excluded while in the second regression they are added. In the results, only the coefficients on $\Delta \ln X_{t-1}$, LIBDUM, DX-DUM, and error-correction terms are given, whenever they belong to the estimating equations, along with their t-ratios. The significance of $\Delta \ln X$ will be a direct evidence of causal influence from X to Y, while the significance of the error-correction term, when included, will imply the causality operating from the corresponding long-run relationship. Similarly, if LIBDUM and DX-DUM are found to be significant, it can be inferred that the causal relationships have been influenced by trade liberalisation.

Equations (1) and (2) in Table 3.8 implement the causality tests for simple bi-variate relationship between export and output growth and between export and non-export output growth. Since it was revealed earlier that $\ln X$ and $\ln Y$ and $\ln X$ and $\ln NXY$ are not cointegrated, causality regressions in 1 and 2 have been run without the error-correction term. In equations 1 and 2, the coefficients of $\Delta \ln X$ are not significant and neither are those associated with LIBDUM and DX-DUM. For the multivariate models of 3 and 4, as there were some evidence of cointegration, the causal experiment is carried out including the error-correction term that corresponds to the relevant long-run relationship. However, in neither do we find any significant coefficient on $\Delta \ln X$, LIBDUM or DX-DUM. Only in one instance, i.e., the causality experiment 3, the error-correction terms are found to be significant. However, since even in the long-run equation the effect of $\ln X$ on $\ln Y$ was found to be not significant, the significance of the EC terms in Table 3 is attributable to other variables such as, labour and capital, that cause the growth of output. Therefore, our results do not detect any significant causal relationship from exports to output and also there is no evidence to suggest that trade liberalisation has influenced the relationship.

3.5. Interpretation and Implications of the Results

The post-liberalisation regime in Bangladesh happens to be associated with a robust performance of the export sector and the export dynamism of the 1990s is considered to be one of the most successful achievements of trade reform measures. Since Bangladesh has embarked upon a strategy of export-led growth from an inward-looking trade and industrial regime, it is widely held that export success will drive economic growth in Bangladesh. In fact, a remarkable export performance of the past decade along with a relatively high growth rate of GDP in the post-liberalisation period seem to validate the export-led growth hypothesis for Bangladesh.²¹

In this chapter, the export-growth nexus in Bangladesh has been examined carefully. Given the shortcomings associated with a large number of existing empirical studies on this subject, appropriate models were specified and suitable estimation techniques were employed to overcome them. The basic objective has been to test for long-run relationships between export and output, to validate the positive externality effects of exports on non-export sector and to ascertain the causality relationship running from exports to output as envisaged in the export-led growth hypothesis. Since unit roots in time series can result in spurious relationship, the estimation strategy explicitly examined the integrating properties of the variables. Due to the presence of non-stationary time series, cointegration techniques were used to confirm the long-run relationship statistically and in order to draw valid inferences the Phillips-Hansen Fully Modified OLS method of estimation was employed.

When simple bi-variate long-run relationships between export and aggregate GDP and between exports and non-export GDP are examined, a positive coefficient on export is found in both equations. However, the estimated equations fail to represent valid cointegrating relationships. In multivariate analysis, the long-run effects of exports on GDP and non-export GDP are examined after controlling for such factors as labour, capital stock and human capital. At this, while in no regression any significant positive influence on GDP could be found, in most cases the coefficient on export is negative but not significant. On the other hand, quite extraordinarily, the results show a significant inverse long-run relationship

²¹ In Chapter 2 it was found that the post-liberalisation period of 1992-00 had been associated with a higher growth rate of GDP compared to that of pre-reform period of 1980-91.

between export and non-export GDP in every equation. It is rather worrying to observe that some of the estimated equations with a negative effect of export on non-export GDP provide quite strong evidence for cointegration (i.e., a valid long-run relationship among the variables).

As discussed earlier, the original empirical framework (Feder, 1983) illustrating the externality effects of export on output fails to distinguish between long-run and short-run relationship and concentrates on short-run effects. In this chapter, an attempt was made to integrate the short-run model into the long-run relationship exploiting the cointegration technique. Besides, the original Feder-type equations were also estimated. Nevertheless, the results remain unchanged: in the GDP growth equations there is no significant influence of exports while, in the short-run non-export GDP equations, the coefficient on export growth is negative and highly significant. Therefore, these results are at variance with Feder's theory and the empirical evidence regarding the positive externality effects of exports on GDP put forward by Begum and Shamsuddin (1998) in the context of Bangladesh.

The impact of trade liberalisation on the export-growth relationship was also examined. The results seem to suggest that in the post-liberalisation period, the effect of export on output has been weakened further. Finally, no evidence of causality running from export to output could be found to validate the export-led growth hypothesis for Bangladesh.

On the whole, the results are in no way encouraging to the proponents of the ELG hypothesis. It needs to be emphasised that this paper uses the revised GDP estimates, which extends its coverage to a number of sectors that were not accounted for previously resulting in some significant rise in the volume of domestic value added. Since the estimates of exports remain unchanged, the revised GDP data provide results in sharp contrast to the studies that have used the old GDP data. Nevertheless, if the revised data are to be considered as a better measure of Bangladesh's GDP, in light of the results of this study, there is a need for rethinking about the role of exports in promoting economic growth.

It might be striking to many observers that the effects of very high or low export growth rates on GDP have been minimal (as seen in Figure 3.2) despite the fact that the share of exports in GDP has increased substantially. However, it should be noted that the GDP is a measure of (gross) 'value added' while a significant proportion of exports are intermediate inputs that

does not comprise value added. And, it is the value added that contributes to GDP and not the sheer size or volume. While the liberalisation of trade regime has been accompanied by a robust performance of the RMG export, which has increased its share from as low as less than 2 per cent in the early 1980s to currently about three-fourths of total export receipts, most other important export items such as raw jute, jute goods, tea, leather and leather products, and frozen foods and shrimps have either stagnated or expanded at much slower rates.²² This has an important implication – the structural transformation in the export basket has been dominated by low-value added items as the backward linkages for RMG exports are much lower than all other major products. According to Dowlah (1999), in the 1990s Bangladesh imported about 85 per cent of the total fabric required for its exports of RMG as a result of which about 75 per cent of the industry's export earnings were used to import intermediate goods. Bayes *et al.* (1995) provide some estimates of total local value additions in various export items, which show that value addition for woven-RMG is only 30 per cent while the comparable figure for knit-RMG is 50 percent. All other export categories have value additions close to 100 per cent. Using the information, it can be calculated that between 1991 and 2000, total domestic valued added in exports as percentage of GDP has risen only modestly – from 4.4 per cent to 7.1 per cent. Therefore, once the net contribution to the domestic economy is considered, the spectacular performance of the 1990s is overshadowed by the export industry's continued overwhelming dependence on imported raw materials and intermediate inputs.

When the domestic valued added content of exports is so low, the finding of no significant effect of exports on output may not be surprising. This, however, does not help explain the significant negative effects of export on non-export GDP that were found in various regression equations. It might be possible that the process of trade liberalisation has resulted in reduced support for the non-export oriented firms thereby inducing the transfer of resources from high value-added import-competing sector to low value added export sector.

²² It is not, however, clear as to what extent the trade liberalisation helped flourish the RMG sector. The growth of RMG industry in Bangladesh has largely been a result of a 'managed' world trade regime in textiles and clothing operated through the "Multi-Fibre Arrangement" (MFA). Under the MFA, the textiles and clothing sector enjoys a very high level of protection in the developed countries, as exports from developing countries have been controlled by strict quantitative restrictions. Many international business firms, in particular those from the Asian newly industrialising economies (NIEs), facing binding quota restrictions in their own countries, relocated part of their production and trade to Bangladesh. The availability of cheap and easily trainable labour for clothing production facilitated this process further. Besides, Bangladesh has also provided a number of fiscal and financial incentives to help accelerate the growth of the export sector, which are believed to have contributed to the development of the sector.

How government resources are being used up in providing incentives to the low value added export sector also needs to be understood. If the support provided is at the cost of non-export sector, the opportunity costs of such resources might be greater than the social benefits of the incentive schemes.

To conclude, the revised GDP estimate poses a challenge to the export-led growth hypothesis for Bangladesh as the new national income accounting data seem to undermine the 'engine' role of exports in economic growth. Further research may be needed to verify whether the link between export and output is more complicated than the relationships specified in the present study.

Chapter 4

The Effect of Exchange Rate Changes on Output

4.1. Introduction

Devaluation of the domestic currency is an important component of the orthodox stabilisation programme leading to trade policy reforms. By raising the domestic currency price of foreign exchange, devaluation increases the price of traded goods relative to non-traded ones. This causes a reallocation of resources resulting in increased production of exports and items of import competing sectors.¹ Devaluation is also believed to contribute to the enhancement of external competitiveness of the country allowing exporters to cut their product prices in foreign currency in overseas markets. Increased competitiveness further stimulates production in the export sector. On the other hand, as a direct consequence of nominal devaluations, import prices go up which is likely to depress the demand for imports in the domestic economy. Increased exports and reduced imports are expected to improve the external trade balance of the country and many developing countries have relied upon devaluation to correct fundamental disequilibria in their balance of payments.² It is argued that by expanding the production of the traded sector in general, and exports in particular, devaluation should have an expansionary effect on the overall economy.

However, although nominal devaluations help achieve the goal of relative price adjustment along with an improvement in trade balance, they might do so at a high cost. There are concerns that indirect costs of devaluation can actually outweigh its benefits adversely affecting the overall output growth. This is what is known as the contractionary effect of devaluation.

¹ This is also known as expenditure-switching effect of devaluation.

² According to the economic theory, devaluation will improve the balance of payments if the Marshall-Lerner condition holds, i.e., the devaluing economy's demand for imports and demand for its exports are elastic. In fact, Marshall-Lerner condition specifies that the sum of both elasticities, in absolute term, must be greater than one.

There are a number of theoretical reasons for a contractionary effect of devaluation. First, devaluation increases the price of traded goods, which feeds into the general price level rendering a negative real balance effect. This, in turn, results in lower aggregate demand and output (Edwards, 1986). Second, the contractionary effect might also result from income distributional effect of devaluation. This point was first made by Diaz-Alezandro (1963) who argued that devaluation could lead to a redistribution of income from people with high marginal propensity to consumption to high propensity to save rendering a negative effect on the aggregate demand. Third, if the demand for imported goods is inelastic due to the dominance of capital and essential intermediate and consumers' goods in a country's import basket, then devaluation may be contractionary (Upadhaya and Upadhaya, 1999). Apart from these demand side channels, contractionary effects can also arise from the supply side (Edwards 1986, Upadhaya and Upadhaya 1999). The increased cost of imported inputs might affect production and output adversely. Thus, while Hanson (1983) emphasizes the importance of imported inputs even in the production of non-traded goods, Lizondo and Montiel (1989) maintain that reduced profits in the non-traded sector caused by increased costs of imported inputs (e.g., oil) lead to contraction in aggregate supply after devaluation. Besides, the real balance effect of devaluation might raise the interest rate thus reducing the demand for working capital by the firms. Krugman and Taylor (1978), using a Keynesian framework, have identified certain conditions under which devaluations are found to be contractionary, viz., (1) if initially imports exceed exports; (2) consumption propensity out of profits and wages are different; and (3) if government revenues are increased as a result of devaluation.

Empirical findings on the consequences of devaluations on output are mixed. While Gylfason and Schmid (1983), Connolly (1983) provided some support for expansionary devaluations, Gylfason and Radetzki (1985) and Atkins (2000) encountered with contractionary effects of devaluation. Some interesting results are reported in Edwards (1986) and Rhodd (1993) where the authors found negative short-run effects but, in the long-run, the output response to devaluation appeared to be positive. Finally, there are other studies that do not find any significant effect on devaluation (e.g., Bahmani-Oskooee, 1998 and Upadhyaya and Upadhyay 1999).

Like many other developing countries, devaluation has been a major component of trade policy instruments in Bangladesh. Since the initiation of trade liberalisation programmes in the early 1980s, the country has adopted a policy of frequent but small doses of devaluation at a time. Every time the government devalues the Taka, it emphasises on enhancing the competitiveness of exports as one of the most important reasons for justifying the action.³ However, in light of the above discussions, it is legitimate to ask what has been the net effect of exchange rate changes on Bangladesh's overall economic activity. As emphasized in various studies, it is not possible to generalise the experience of developing countries and consequently nothing can be inferred about Bangladesh in the absence of an empirical research. While the issue of devaluation attracts so much attention in Bangladesh, discussions surrounding it are usually uninformed in nature due to lack of an in-depth study. The present study contributes to the macro policy discourse in Bangladesh more effectively by carrying out an empirical investigation into the impact of devaluation on output.

The chapter is organized as follows: Section 4.2 provides the analytical framework specifying the output-exchange rate link. While Section 4.3 defines and constructs multilateral real exchange rate series for Bangladesh, Section 4.4 provides the empirical specification of the theoretical model and elaborates the sources of data. In Section 4.5, estimation results are presented followed by a summary of findings and some ensuing implications in Section 4.6.

4.2. Theoretical Framework

Edwards (1986), building on the analytical framework of Khan and Knight (1981) for analysing the effects of stabilization programmes on aggregate production in developing countries, has provided an influential work for guiding the empirical analysis on output-exchange rate relationship. Another useful framework is due to Rhodd (1993) who uses a simple three market Keynesian model to illustrate the relationship between output and exchange rate. For the present study, we shall consider the Rhodd's model as the basis for theoretical understanding and

³ Containing trade deficit and encouraging increased inflow of remittances through official channels are two other major objectives of nominal devaluations.

subsequently empirical estimation will be based on the reduced form equation for real output derived from it. In Rhodd's model the goods market is represented by:

$$Y = C + I + G + X - M \quad (4.1)$$

$$\text{Or, } Y - C - G = I + X - M \quad (4.2)$$

$$S = I_d + I_f \quad (4.3)$$

$$S = S(Y, r); S_Y > 0, S_r > 0 \quad (4.4)$$

$$I_d = I_d(Y, r); I_{dY} > 0, I_{dr} < 0 \quad (4.5)$$

$$I_f = I_f(Y, e); I_{fY} < 0, I_{fe} > 0 \quad (4.6)$$

$$S_Y = \frac{\partial S}{\partial Y}, \quad S_r = \frac{\partial S}{\partial r}, \quad I_{dY} = \frac{\partial I_d}{\partial Y}, \quad I_{fY} = \frac{\partial I_f}{\partial Y}, \quad I_{fe} = \frac{\partial I_f}{\partial e}$$

where, total expenditure, consumption expenditure, domestic investment expenditure, savings, government spending, net exports or foreign investment (I_f), domestic interest rate and exchange rate are represented respectively by $Y, C, I, S, G, X-M, r,$ and e . Equation (4.3) shows the equilibrium between aggregate demand and aggregate supply. Equations (4.4), (4.5) and (4.6) show how S, I_d and I_f are determined in the model. Foreign investment (I_f), which defines the net build-up of claims on the rest of the world or ($X-M$) is expected to vary inversely with domestic income, Y , and directly with the exchange rate (e). As Y increases, imports increase and $X-M$ worsens. An increase in e or nominal devaluation causes the trade balance to increase.

Considering the money market, the equilibrium requires the balancing of money demand and money supply. Money supply is determined by monetary policy, while money demand is determined by income and interest rate.

$$M_{s0} = M_d \quad (4.7)$$

$$M_d = L(Y, r); \quad L_Y = \frac{\partial M_d}{\partial Y} > 0, \quad L_r = \frac{\partial M_d}{\partial r} < 0 \quad (4.8)$$

The third and the final market in the model is the foreign exchange market, which gives the equilibrium of the demand for foreign exchange against its supply. Under a fixed exchange rate regime, the balance of payments is influenced by trade flows and financial flows with the former determined by Y and the latter by r . According to Rhodd (1993), the greater the level of income the worse the trade balance. Although capital flows can improve trade balance in the short-run, the long run effect is not known due to loan repayment and repatriation of dividends and interest.

$$B = T(Y) + F(r) \quad (4.9)$$

$$\frac{\partial B}{\partial Y} < 0, \quad \frac{\partial B}{\partial r} = ? \quad (4.10)$$

To facilitate the solution of the model algebraically, the equilibrium conditions can be written in linear form as given in (4.11-4.13).

$$S_0 + S_1Y + S_2r - I_{d0} - I_{d1}Y - I_{d2}r - I_{f0} - I_{f1}Y - I_{f2}R = 0 \quad (2.11)$$

$$L_0 + L_1Y + L_2r = M_s \quad (2.12)$$

$$T_0 + T_1Y + T_2e + F_0 + F_1Y + F_2r - B = 0 \quad (2.13)$$

Equations (4.11) – (4.13) can be written in matrix form to give:

$$\begin{bmatrix} (S_1 - I_{d1} - I_{f1}) & (S_2 - I_{f2}) & 0 \\ L_1 & L_2 & 0 \\ (T_1 + F_1) & F_2 & -1 \end{bmatrix} \begin{bmatrix} Y \\ r \\ B \end{bmatrix} = \begin{bmatrix} -S_0 + I_{d0} + I_{f0} + I_{f2}e \\ M_s - L_0 \\ T_0 - T_2e - F_0 \end{bmatrix} \quad (4.14)$$

From (4.14), Y can be determined, which is given by:⁴

$$Y = \frac{(L_2S_0 - L_2I_{d0} - L_2I_{f0} - L_2I_{f2}e + M_sS_2 + I_{f2}M_s) - (S_2L_0 + I_{f2}M_s)}{D} \quad (4.15)$$

⁴ Cramer's rule can be used to determine Y .

Where $D = (S_1 - I_{d1} - I_{f1})(L_2)(-1) - (-1)(L_2)(S_2 - I_{f2}) > 0$

$$\frac{\partial Y}{\partial e} = -\frac{L_2 I_{f2}}{D} > 0 \quad (4.16)$$

$(L_2 < 0, I_{f2} > 0, D > 0)$

The empirical model of our study is based on equation (4.15) that shows the relationship between real output, a measure of monetary policy as indicated by M_s , the exchange rate, and government expenditure which is included in the saving-investment identity. By including fiscal and monetary measures, Rhodd's model shows that a devaluation is not undertaken by itself but is associated with other policy measures.

4.3. Construction of RER for Bangladesh

4.3.1. Real Exchange Rate: Definition and Measurement

Since the discussions on the effects of devaluation on output usually consider the changes in the 'real' rather than the 'nominal' exchange rate, at the outset, it is useful to define the term *RER*. Despite its importance, there is a great deal of confusion over the definition and measurement of *RER*. The two main strands of *RER* are purchasing power parity (*PPP*) and trade theory definitions. The *PPP* theory is based on the observation that exchange rate movements are determined by the difference between the domestic and foreign rates of inflation. If domestic inflation is higher than that of the foreign rate, the exchange rate will appreciate, and vice versa. Thus, the *RER* is defined as the ratio of foreign prices (P_f) to domestic prices (P_d) adjusted for the nominal exchange rate (local currency per unit of foreign currency) (E), that is, $RER^* = E(P_f/P_d)$, where RER^* is the *PPP RER*.⁵ On the other hand, the trade theory definition is derived

⁵ In fact, the *PPP* theory is often postulated in terms of nominal exchange rate, which has two variants. The strong or absolute hypothesis postulates that the exchange rate between two countries should equal the ratio of the price levels in these countries. If R is the nominal exchange rate, P_d and P_f are the price levels in the home and foreign country respectively, the strong version of *PPP* can simply be written as: $R = P_f/P_d$. On the other hand, the relative or

from the dependent economy type model (e.g., Salter-Swan model), where RER is defined as the ratio of price of tradables (P_T) to non-tradables (P_{NT}), or, $RER = (P_T/P_{NT})$. A fall in RER , or a real appreciation, indicates an increase in the domestic cost of producing tradables reflecting the worsening of a country's competitiveness. Conversely, an increase in RER , or a real depreciation, represents an improvement in a country's international competitiveness.

Modern theoretical and empirical studies, however, have mostly used the trade theory definition of RER (e.g., Dornbusch, 1980; Edwards, 1988, 1989 and 1994; Elbadawi, 1994; Elbadawi and Soto, 1996; and Montiel, 1999a). This is because, although both RER^* and RER provide indices of competitiveness, the latter also gives information on the domestic incentive structure and the consequent resource allocation between tradable and non-tradable sectors. The other important reason for wider acceptance of the trade theory definition is that developing countries are likely to fit the Salter-Swan model well since these countries have a significant number of non-traded goods and they are typically 'small' countries that can hardly affect the world price of the traded goods (White and Wignaraja, 1991). Following the seminal contribution of Edwards (1988 and 1989), the trade theory definition of RER has become popular in empirical research on developing countries. In this study, we shall also use the trade theory definition.

Even though the trade theory definition is useful for analytical purposes, it is difficult to compute the RER for a number of reasons. Firstly, data on prices of tradables and non-tradables are virtually non-existent and the construction of such indices for developing countries is extremely difficult. As a result, Edwards (1989) suggested using the world price of tradables (P_T^d) as a proxy for P_T , and domestic price of non-tradables (P_{NT}^d) for P_{NT} . Thus, equation (4.17) can be considered as the operational definition of RER .

weak version of PPP specifies that the exchange rate should bear a constant proportionate relationship to the ratio of national price levels. That is: $R = \theta(P_f/P_d)$, where θ is a constant scalar. Both versions of PPP suggest that any change in price levels should result in equi-proportional change in exchange rate (Isard, 1995). For example, logarithmic transformation of relative version would yield: $\ln R = \theta + \ln P_f - \ln P_d$, and under the absolute version θ will be equal to zero. However, if we consider a change in the exchange rate then $\Delta \ln R = \Delta \ln P^f - \Delta \ln P^d$. That is, under either version of PPP a change in price ratio will call for an equi-proportionate change in exchange rate. In estimates of equations of the form: $\ln R = \theta + \beta_1 \ln P_f + \beta_2 \ln P_d + v_1$, a test of the restrictions $\beta_1 = 1$, $\beta_2 = -1$ would be interpreted as a test of the relative PPP , while the test of the same restrictions applied to the equation with the

$$RER = E \left[\frac{P_T^f}{P_{NT}^d} \right] \quad (4.17)$$

Equation (4.17), however, does not really solve the problem, as it is not possible to find an exact empirical counterpart to the above analytical construct. This means we shall still have to use proxies for the two price indices. Following Harberger (1986) and Edwards (1989), it has now become an established practice to use the foreign whole sale price index (WPI^f) as a proxy for P_T^f and the domestic consumers' price index (CPI^d) for P_{NT}^d . Studies that have used these two proxies include, Baffes, *et al.* (1999), Cottani *et al.* (1990), Domac and Shabsigh (1999), Dorosh and Valdes (1990), Elbadawi (1994), Elbadawi and Soto (1996), and White and Wignaraja (1992). In the present study, these two proxies have been used for constructing a RER series for Bangladesh.⁶

The next issue is whether to construct a bilateral or a multilateral *RER*. It can be argued that a multilateral *RER* provides a better index of competitiveness. This is because even if Taka depreciates against one currency it might appreciate against others. Edwards (1989) provides evidence that the bilateral and multilateral indexes can move in opposite directions and he advocates for constructing a broad multilateral index of the real exchange rate.

Since we need to construct a multilateral *RER* for Bangladesh, two further issues are: which countries are to be considered and what weighting system should we use. The usual practice in this regard is to consider the important trade partners with weights (α) equal to the share of each partner in the country's trade transactions (i.e. either exports or imports or both). Hence, (4.18) gives the basic formulation of the multilateral *RER*, where subscript t denotes time.

$$RER_t = \left[\sum_{i=1}^k \alpha_i \frac{E_{it} WPI_t^f}{CPI_t^d} \right] \text{ with } \sum_{i=1}^k \alpha_i = 1 \quad (4.18)$$

variables in first differences would be interpreted as a test of the absolute *PPP*. The *PPP* theory is, however, frequently restated in terms of the real exchange rate.

⁶ Note that in practical terms the difference between RER^* and RER is minimal. The RER^* uses the ratio of the same foreign to domestic price index (usually *CPI*), whereas the RER uses two different indices. However, as the *WPI* and *CPI* indices are usually highly correlated, RER^* and RER are likely to be very similar.

4.3.2. Bilateral and Multilateral RERs for Bangladesh

In order to construct the RER, initially 25 most important countries in terms of total value of trade transactions (*i.e.* exports plus imports) with Bangladesh were chosen.⁷ However, due to non-availability of the data on foreign prices, China, Hong Kong, and the United Arab Emirates had to be dropped.⁸ Indonesia and Iran were excluded because of abrupt and dramatic changes in their nominal exchange rates with respect to the US Dollar.⁹

There is no clear-cut rule about whether to use the trade share of partners in a reference year or the average share over a longer time horizon. Whilst Edwards (1989) has worked out weights on the basis of one reference year, Dorosh and Valdes (1990) have used average share for a relatively longer time span. In this study, we compute the *RER* for Bangladesh on the basis of partners' average trade shares during 1995-2000.¹⁰ The weights thus obtained are: the US (0.218), India (0.142), Japan (0.093), Germany (0.080), the UK (0.069), Singapore (0.064), Korea (0.050), France (0.046), Italy (0.037), Netherlands (0.036), Belgium (0.024), Australia (0.022), Canada (0.021), Malaysia (0.017), Pakistan (0.017), Thailand (0.017), Denmark (0.012), Switzerland (0.012), Spain (0.010) and Sweden (0.010).

It must be stressed here that when weights are used on the basis of the recorded or official trade, the share of India is underestimated, as there is a significant amount of informal (illegal) border trade between Bangladesh and India. A survey of all border check-posts by Bakht (1996) found that the informal border trade with India in 1996 was about 50 percent of official trade with India. Again, based on a study by Rahman and Razzaque (1998), World Bank (1999) has suggested that the value of all such trade could be at least as high as official trade with India (*i.e.*,

⁷ Data on Bangladesh's exports to and imports from different countries have been obtained from various issues of the Direction of Trade Statistics of the IMF.

⁸ For China and Hong Kong, prices were available only for a short period of time. For UAE, no information on either CPI, WPI or GDP deflators could be found.

⁹ In the case of Iran, the exchange rate (rials per US dollar) rose sharply from 92.3 in 1992 to 2415 in 1993. On the other hand, Indonesia staged massive devaluations of its domestic currency in response to the so-called 'East Asian crisis'.

¹⁰ Initial experiments showed that significantly different RERs would not have been obtained by using the weights for different periods.

about US\$ 0.8 billion). Despite the fact that reliable estimates of informal trade are hard to obtain for every year, considering the widespread availability of Indian goods it might not be unrealistic to assume that the volume of informal trade with India is as big as the volume of formal trade. Since the RER is also used as an indicator of competitiveness, it is important not to underestimate the role of such a large neighbouring country as India. Therefore, we decided to compute another series of RER with weights derived from an enhanced bilateral trade with India by 100 per cent. For this, the re-estimated weights are: India (0.248), the US (0.191), Japan (0.082), Germany (0.04), the UK (0.061), Singapore (0.056), Korea (0.044), France (0.04), Italy (0.03), the Netherlands (0.032), Belgium (0.021), Australia (0.020), Canada (0.019), Malaysia (0.015), Pakistan (0.015), Thailand (0.015), Denmark (0.011), Switzerland (0.011), Spain (0.009) and Sweden (0.009).

The data on *WPI* of partners and *CPI* of Bangladesh were gathered from IMF (2001).¹¹ However, there is no information available on Bangladesh's nominal exchange rates vis-à-vis all partners. This required us to modify the *RER* formula so that each partners' exchange rate with the US dollar could be used to construct the index (Dorosh and Valdes, 1990; Sadoulet and deJanvry, 1995). Precisely, P_T^f is computed as:

$$P_T^f = \sum_{i=1}^k \alpha_i \left(\frac{WPI_i}{e_i} \right) \quad (4.19)$$

where, e_i is the period average nominal exchange rate expressed in units of a country's own currency per US dollar. Equation (4.19) was divided by Bangladesh's *CPI* and was then multiplied by the end period exchange rate of Bangladesh Taka vis-à-vis the US Dollar.¹²

¹¹ Note that the data on WPI are not available for all partners. In such cases, for some countries, if available, producers' prices were used. When either of the WPI and producers' prices was not reported, consumers' prices (CPI) were used. As correlations between WPI and CPI are usually high, the choice of price series should not make major differences.

¹² The exchanges rate between Dollar and other partners' currencies are the period average rate as reported in the IFS. However, we used the end period exchange rate between Bangladesh Taka and US Dollar to capture total devaluation of the Taka in one year from the preceding year. Our experiments showed that there would not have been any significant difference had we used the period average nominal exchange rate between the Taka and the US Dollar.

Table 4.1 reports four different RER series for Bangladesh along with the bilateral nominal exchange rate between the Taka and the US Dollar. The multilateral RER computed using the weights based on the trade partners' formal trade is given by RERM while RERIND is the series which assigns a greater weight to India due to the existence of the informal border trade. Figure 4.1 exhibits the graphical plots of RERM and RERIND along with the nominal exchange rate, NER, with respect to the US Dollar (i.e., Taka per US Dollar) – all indexed to 1985=100. It shows that while the two RER series, in general, move in the same direction, the movement is not always uniform. Especially in the 1990s, the relationship between RERM and RERIND has changed noticeably compared to their co-movement until the 1980s. This can be attributable to the frequent and large downward adjustments of the Indian Rupee with respect to the US Dollar.¹³

The most striking feature of Figure 4.1 is the two contrasting trends in the RERs: prior to the early-1980s the *RERs* (both RERM and RERIND) are increasing along with the nominal exchange rate (NER) but since the mid-1980s, they have remained at the same level although during the same period the nominal rate increased by about 75 per cent. According to the definition given above, a rise in the index will imply depreciation of the RER and thus improved competitiveness. Therefore, from Figure 4.1 it can be concluded that since the mid-1980s nominal devaluations in Bangladesh have not resulted in any significant improvement in competitiveness. In other words, changes in the exchange rate have largely been offset by the fall in the foreign to domestic price ratio.

Figure 4.2 provides a simple relationship between the growth of NER (nominal devaluations) and the changes in RERM. The left figure shows that during 1980-2000 only on four instances were the changes in the RERM greater than those of NER.¹⁴ The scatter plot on the right panel depicts a positive relationship between the changes in NER and RERM and the regression equation shows that a one percentage point change in the nominal rate is associated with about

¹³ During 1990-95 India undertook a massive devaluation of its currency by about 95 per cent against the US Dollar, while the comparable figure for Bangladesh during the same period was only about 14 per cent.

¹⁴ This happened in 1987, 1990, 1994 and 2000.

0.68 percentage point rise in the RER index. However, this relationship must be considered with a great caution, as Figure 4.1 shows the relationship is more likely to have changed significantly between 1980s and 1990s.¹⁵

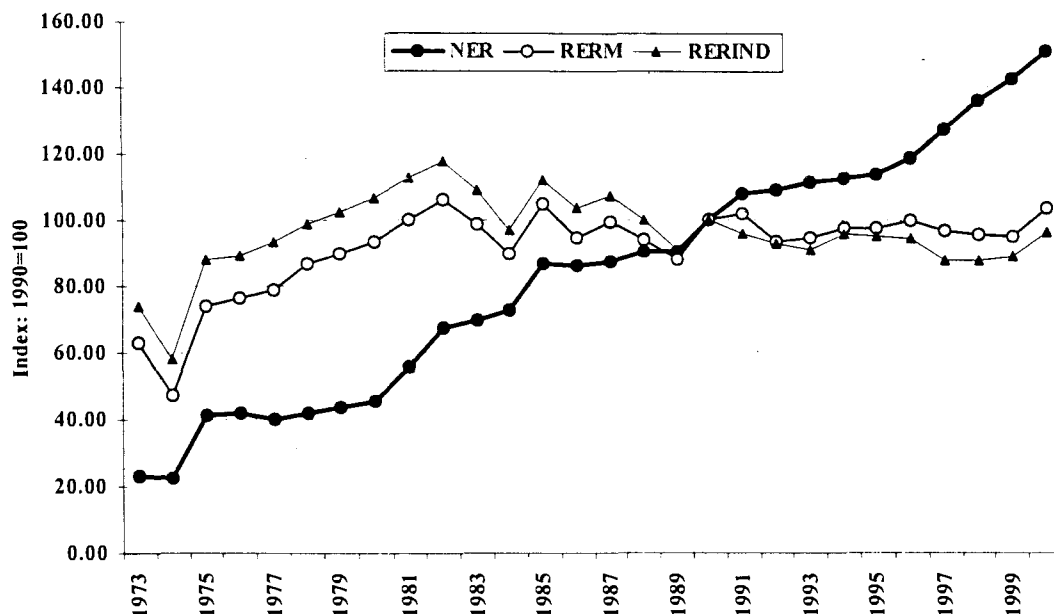
Table 4.1: Estimated RERs for Bangladesh

Year	NER	RERM	RERIND	RERB	BRERIN
1973	8.16	63.04	74.16	67.44	102.56
1974	8.07	47.10	57.95	51.38	85.35
1975	14.83	73.79	88.00	84.59	122.06
1976	14.95	76.60	89.19	87.15	118.01
1977	14.40	79.07	93.07	85.03	126.91
1978	14.93	86.67	98.95	90.17	124.73
1979	15.64	89.97	102.61	92.75	131.85
1980	16.25	93.58	106.75	96.89	144.32
1981	19.85	100.25	112.61	111.35	148.56
1982	24.07	106.02	117.44	122.20	154.54
1983	25.00	98.53	109.33	117.58	145.57
1984	26.00	89.40	96.74	113.44	123.41
1985	31.00	104.76	111.87	121.42	142.28
1986	30.80	94.67	103.43	105.61	124.81
1987	31.20	99.45	107.28	100.21	125.80
1988	32.27	94.04	99.89	98.59	111.49
1989	32.27	87.71	90.83	95.07	94.89
1990	35.79	100.00	100.00	100.00	100.00
1991	38.58	101.64	95.80	100.77	79.86
1992	39.00	93.40	92.59	98.19	85.41
1993	39.85	94.70	91.00	101.83	78.26
1994	40.25	97.53	95.69	100.55	84.44
1995	40.75	97.74	95.38	99.72	78.78
1996	42.45	100.06	94.80	102.09	80.66
1997	45.45	96.78	87.73	103.91	78.48
1998	48.50	95.52	87.83	99.78	75.77
1999	51.00	95.31	88.79	99.73	75.75
2000	54.00	103.55	96.48	109.17	77.76

Note: NER is the nominal exchange rate: Taka per US Dollar. RERM is the multilateral real exchange rate based on 20 most important trade partners' currencies; RERIND is the multilateral RER but with an enhanced weight for India considering the existence of informal border trade; RERB is the bilateral RER with respect to the US Dollar only; and finally BRERIN is the bilateral RER with respect to Indian Rupee only. Except the NER all are indexed with 1985=100.

¹⁵ Indeed, for 1980-90 the estimated relationship is: $\Delta \ln RERM = -0.062 + 0.88 \Delta \ln NER$, with the coefficient on the explanatory variable being significant at the one percent level. But for 1991-2000, the estimated relationship turned out to be $\Delta \ln RERM = -0.10 + 0.33 \Delta \ln NER$ and the coefficient on $\Delta \ln NER$ was highly insignificant. Note that these regressions do not suffer from the problems associated with the non-stationarity of the time series data, as the two first differenced variables are stationary.

Figure 4.1: Movements in Nominal and Real Exchange Rates



Note: While RERM is the multilateral real exchange rate using the weights based on Bangladesh's bilateral formal trade with 20 most important partners', RERIND is the multilateral RER when a greater weight is assigned to India to take account of the existence of the widespread informal border trade between the two neighbouring countries. NER is the nominal exchange rate: Taka per US Dollar.

Source: Authors' own computation as explained in the text.

Figure 4.2: Relationship Between Growth in Nominal Exchange Rate and Multilateral Real Exchange Rate

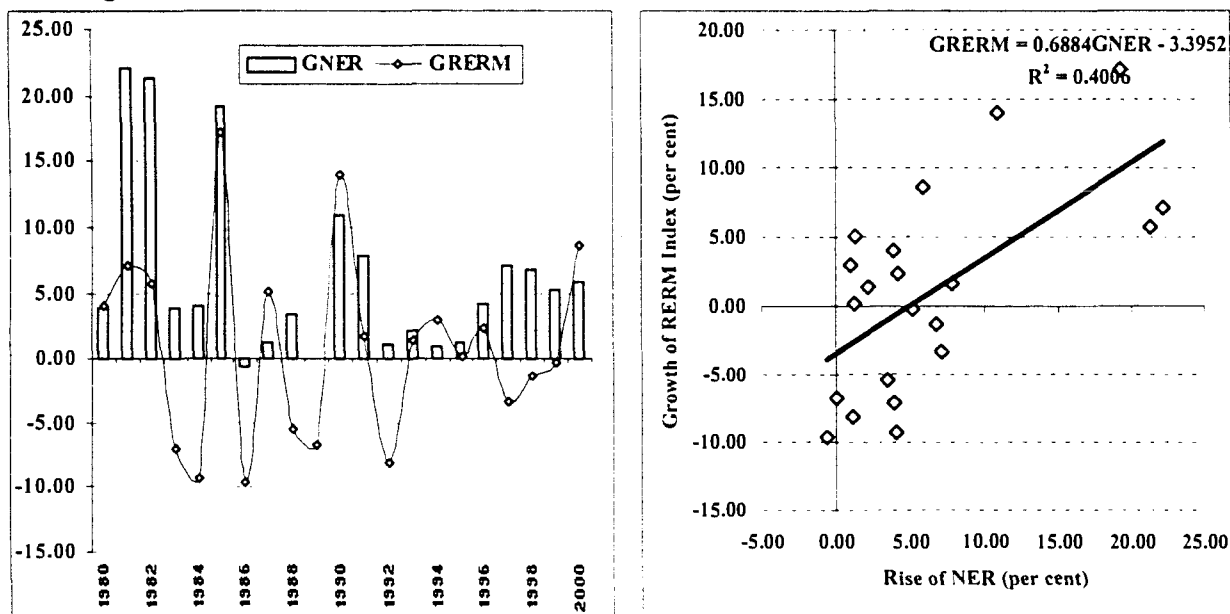
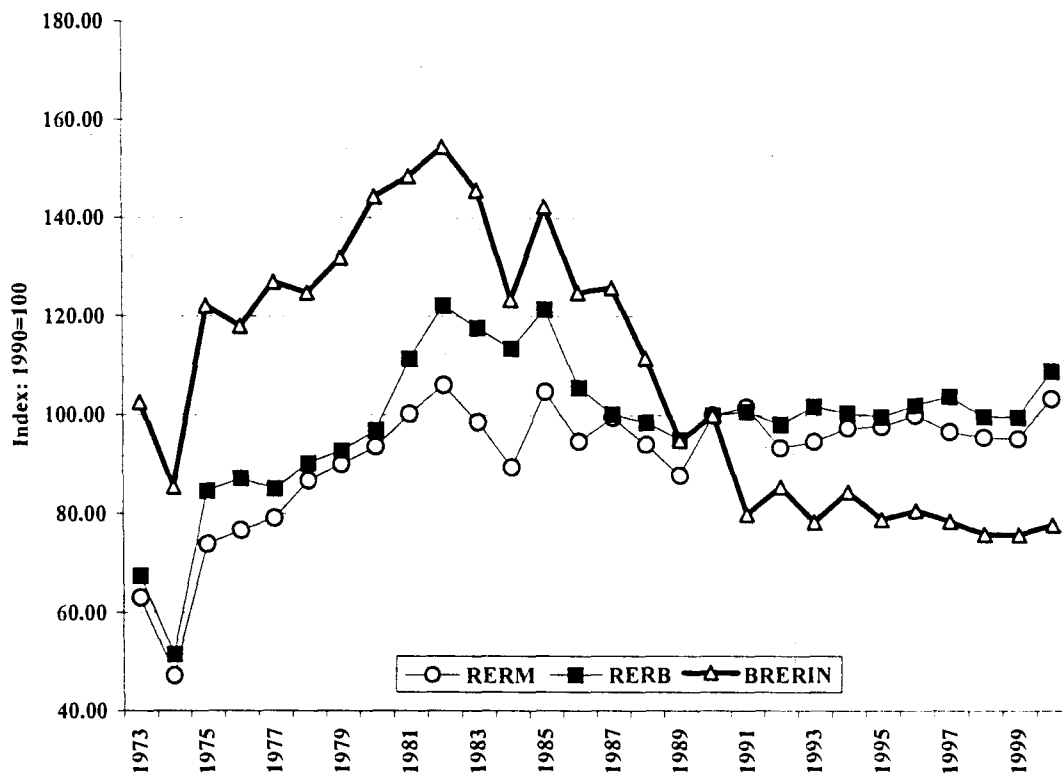


Figure 4.3: Bilateral vis-à-vis Multilateral RERs



Note: RERM is the multilateral exchange rate as explained in Figure 4.1. RERB is the bilateral exchange rate with respect to the US Dollar only while BRERIN is the bilateral real exchange rate with respect to Indian Rupee only. Source: Authors' own estimates.

Table 4.1 also provides the two bilateral real exchange rates with respect to the US Dollar (RERB) and to the Indian Rupee (BRERIN). Both the bilateral series depict significant variation from the RERM; particularly the one with respect to India differs a lot. It is found that in comparison with India, Bangladesh's competitiveness underwent a massive decline in the 1980s. In the 1990s, Bangladesh has just managed to prevent further deterioration in her competitiveness vis-à-vis India. In contrast, RERB moves rather closely to RERM except for the period of 1982-87 when the US Dollar depreciated considerably against other currencies.¹⁶ On the whole, Figure 4.3 lends support to Edwards' (1989) observation that bilateral and multilateral RER can move differently. In the following, we will concentrate only on the multilateral RERs.

¹⁶ For example, during 1982-87 the Yen-Dollar exchange rate fell from 259 to 175 resulting in more than 30 per cent appreciation in the Japanese Yen.

4.4. Empirical Specification and Data

4.4.1. Empirical Model

The theoretical model, as presented in Section 4.2, posits a long-run relationship between aggregate output and a vector of other variables comprising RER, a measure of fiscal policy, and an indicator of monetary policy. But mainly following Edwards (1986), most empirical studies (such as Atkins, 2000; Rhodd, 1993; and Upadhyaya and Upadhyay, 1999) also include the terms of trade (TOT) of the country, which is considered to render important influence on the growth of aggregate output. For a small open economy, TOT is exogenous and if not controlled explicitly in the experiment, some of its unaccounted for influence could be transmitted through the indicator of external competitiveness, RER. However, Atkins (2000) and Bahmani-Oskooee (1998) have ignored the incorporation of TOT in the model. It is true that, on the one hand, the theoretical model does not call for the inclusion of it, and on the other, many do not treat TOT to be an independent policy variable distinct from the RER (Dornbusch, 1986; Atkins, 2000).¹⁷ For the present study, while we keep TOT in our main estimating equations, results without it will also be reported.

In the empirical literature, there seems to be a consensus with regard to the use of government expenditure as a measure of fiscal policy but to represent the monetary policy two different indicators have been used. While Edwards (1986) used a ‘money surprise’ or unexpected money growth term, Atkins (2000) and Rhodd (1993) have considered total domestic credit instead.¹⁸ For this study, the estimation of money surprise function, as specified by Edwards (1986), was not satisfactory and, therefore, it was decided to use total domestic credit (DC) to represent the

¹⁷ This is because RER is often considered to be the terms of trade of the country. This is conceivable if it is assumed that the country in question cannot influence the world price of tradables, and consequently the ratio of partners’ tradable goods’ price to her own domestic non-traded goods is the terms of trade.

¹⁸ Edwards defines money surprise as the actual rate of growth of nominal money ($\Delta \log M$) less the expected rate of growth of nominal money ($\Delta \log M^*$) where it is assumed that expectations are formed rationally. This requires estimation of an expected money supply equation, which Edwards specified as $\Delta \log M_t = b_0 + b_1 \Delta \log M_{t-1} + b_2 \log M_{t-2} + b_3 DEF$, where M is the broad money, DEF is the budget deficit of the government and t is time subscript. Having estimated the money creation equation, the estimated values of $\Delta \log M$ are subtracted from the actual money growth to arrive at the surprise money growth series.

monetary policy measure in the empirical model.¹⁹ The use of DC can be justified because of its impact on income through domestic investment, and because the control of total bank credit (to government as well as to the private sector) represents one of main instruments of monetary policy in many developing countries including Bangladesh. Using the logarithmic transformation of the variables the empirical specification of the model thus can be written as:²⁰

$$\ln Y_t = \beta_0 + \beta_1 \ln(TOT_t) + \beta_2 \ln(GE_t) + \beta_3 \ln(DC_t) + \beta_4 \ln(RER_t) + v_t \quad (4.20)$$

where, \ln stands for natural logarithm, time is denoted by subscript t , Y , TOT , GE , and DC , stand respectively for real GDP, terms of trade, real government expenditure, domestic credit in real terms, real exchange rate, and v is the error term. In the above equation, it is expected that β_2 and β_3 are positive while the sign of β_1 cannot be determined a priori. The coefficient β_4 captures the effect of real devaluation on real output growth and is the primary interest of this study.

4.4.2. Data

We use the revised national income estimates by BBS (2000 and 2001), which is compiled by improving the old national income accounting methodology and widening the coverage. This revision has resulted in an increase in Bangladesh's GDP (in current prices) by 26-43 per cent. Under the new accounting system, the BBS provides comparable data for 1980-2000. As a result, our sample will be limited to only 21 annual observations. The TOT index has been estimated from the quoted unit value indices for exports and imports in the BBS (2000 and 2001). The TOT is defined here as the unit value index for exports divided the unit value index for imports. Data on total domestic credit are taken from Bangladesh Bank (2002). Government expenditure comprises government consumption expenditure (recurrent expenditure) as well as public investment expenditure allocated via the annual development plans. These data are taken from Chowdhury (1995) and from the *Bangladesh Economic Survey 2002* published by the Ministry

¹⁹ Rhodd (1993) reports that money surprise function also does not work out satisfactorily in his empirical investigation. Furthermore, in most regressions of Upadhyaya and Upadhyay (1999), money surprise terms were not significant.

²⁰ All empirical studies on the subject use log-linear models. One advantage of logarithmic transformation is that the estimated coefficients can directly be interpreted as elasticities with respect to the relevant variables.

of Finance of the Government of Bangladesh. The data on government expenditure and domestic credit are initially given in current prices but using the implicit GDP deflator (for the revised GDP) corresponding figures in real prices have been obtained. Finally, the variable, RER, has already been constructed in Section 4.3.

4.5. Estimation Results

4.5.1. Examining the Time Series Properties of Variables

As a first step toward the estimation of equation (4.20), all variables are tested to determine whether they can be represented as a stationary or non-stationary process by employing the unit root tests and examining the correlograms and autocorrelation functions. Table 4.2 provides the results of DF and ADF tests on level and first difference of the variables both with and without the trend term in the regressions, while Figure 4.4 presents the graphical plots of level and first differenced variables along with their correlograms.

Table 4.2: Unit Root Test of the Variables

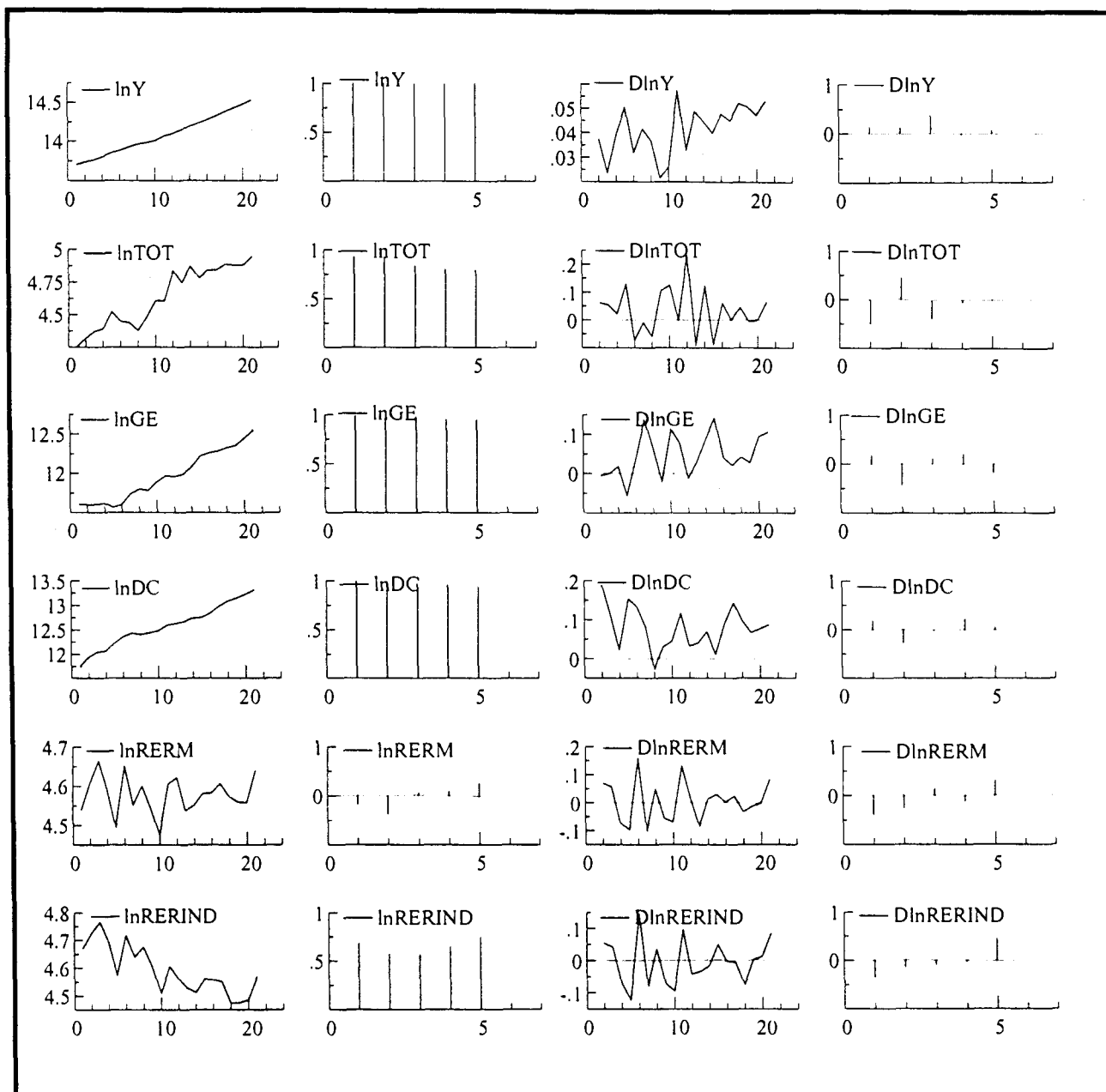
Variables	Without Trend		With Trend	
	DF	ADF	DF	ADF
$\ln Y$	2.76	2.82	-0.67	-0.35
$\Delta \ln Y$	-3.87	-2.46	-4.82	-3.63
$\ln TOT$	-1.05	-0.94	-2.79	-1.61
$\Delta \ln TOT$	-7.00	-2.63	-6.81	-2.53
$\ln GE$	-1.00	-0.76	-2.94	-3.14
$\Delta \ln GE$	-3.49	-4.12	-3.67	-4.79
$\ln DC$	-0.15	-0.039	-1.82	-2.17
$\Delta \ln DC$	-3.66	-3.77	-3.56	-3.69
$\ln RERM$	-4.69	-4.64	-4.50	-4.51
$\Delta \ln RERM$	-6.40	-6.13	-6.41	-6.05
$\ln RERIND$	-2.25	-1.68	-3.75	-3.48
$\Delta \ln RERIND$	-6.07	-4.78	-6.19	-4.79

Note: The 95 per cent critical value for DF and ADF test statistics without the trend term is -3.02 . The comparable statistic for DF-ADF regressions with the trend term is -3.67 .

We recall that the unit root test on aggregate output (GDP) was tested in Chapter 1 where, based on the evidence of sample ACFs and correlograms associated with $\Delta \ln Y$, $\ln Y$ was considered to be an $\sim I(1)$ variable. This is being supported in Figure 4.5(i), as all the sample ACFs of $\Delta \ln Y$ fall within the 95 per cent error bands defined for a stationary variable with 20 annual observations.²¹

²¹ Also, $\Delta \ln Y$ is the growth of real GDP and it does not make sense to consider that the growth rate of GDP can be non-stationary over a long period of time.

Figure 4.4: Plot of Variables on Their Levels and First Differences and Correlograms



Note: The graphs are produced by using PcFiml, version 9.10 (Doornik and Hendry, 1997).

The unit root tests on terms of trade variable (TOT) are also inconclusive. The tests cannot reject non-stationarity of $\ln TOT$ but DF and ADF statistics on $\Delta \ln TOT$ offer contrasting evidence. The graphical plot of $\Delta \ln TOT$, as shown in Figure 4.4, seems to be stationary, correlograms show random movement but the sample autocorrelation coefficient at the first lag order exceeds the 95 per cent error bar. The second difference of the variable also could not reject the non-stationarity.

As mentioned earlier that in small sample the unit root test might prove to be problematic and given the graphical plots we will consider $\ln TOT$ to be $\sim I(1)$.

Turning to government expenditure and domestic credit, we have rather strong evidence that these two variables are non-stationary on their levels but stationary on their first differences. In the case of $\ln GE$, all DF and ADF tests cannot reject the unit root hypothesis, while similar tests on $\Delta \ln GE$ decisively reject non-stationarity. Similarly, on the level of $\ln DC$ the computed DF-ADF statistics fall below the corresponding 95 per cent critical values but ADF statistics on $\Delta \ln DC$ exceed such critical values. The correlograms also clearly provide support to the unit root test results.

Finally, we consider the unit root properties of the two RER series, RERM and RERIND. All DF and ADF test statistics very strongly reject the null hypothesis of non-stationarity on both the level and first difference of RERM suggesting that $\ln RERM$ is $\sim I(0)$. The graphical plots of the $\ln RERM$ and $\Delta \ln RERM$ along with the corresponding correlograms also validate the unit root test results. Figure 4.5(iii) plots the sample autocorrelation coefficient of $\ln RERM$ and the error-bars, which also confirm the non-stationarity of the variable.

In contrast, the other multilateral RER, RERIND, appears to be an $\sim I(1)$ variable. Apart from the DF test with the trend term, all tests in Table 4.2 cannot reject the unit root for $\ln RERIND$, while the same hypothesis of non-stationarity is decisively rejected by every test. Examinations of correlograms and sample ACFs also support the non-stationarity of $\ln RERIND$ and stationarity of $\Delta \ln RERIND$.

That the integrating properties of $\ln RERM$ and $\ln RERIND$ are different is obvious from Figure 4.4. First differences of the two variables and their corresponding correlograms behave similarly and according to a stationary variable but the graphical plot of the two level variables and their correlograms are completely opposite: correlograms for $\ln RERIND$ do not damp down while those of $\ln RERM$ represent small autocorrelation coefficients and give random movements. Figure 4.5(iii) and 4.5(iv) exhibit the sample ACFs and error bars for both $\ln RERM$ and $\ln RERIND$ where it is observed that all autocorrelation coefficients for $\ln RERM$ fall within the 95 per cent confidence interval but, in the case of $\ln RERIND$ such coefficients at the first two

lags fall outside the confidence interval. The most important implication of this contrast is that $\ln RERM$ and $\ln RERIND$ do not move uniformly overtime and it is not possible to find a long-run relationship between these two variables. In other words, RER obtained by considering the existence of informal border trade results in a completely different series than the one obtained by considering the formal trade only.

Figure 4.5: Sample ACFs and Error-bars for $\Delta \ln Y$, $\Delta \ln TOT$, $\ln RERM$ and $\ln RERIND$

Figure 4.5(i)

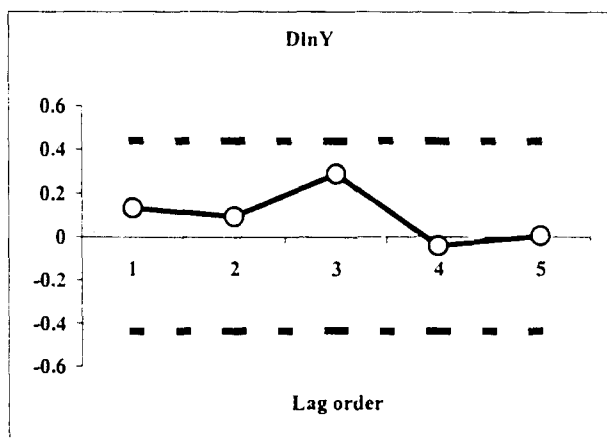


Figure 4.5(ii)

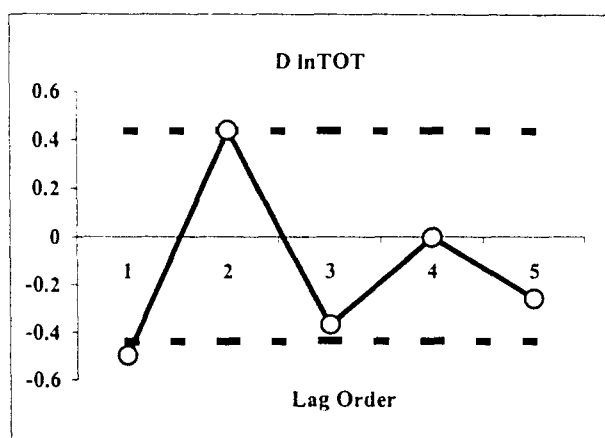


Figure 4.5(iii)

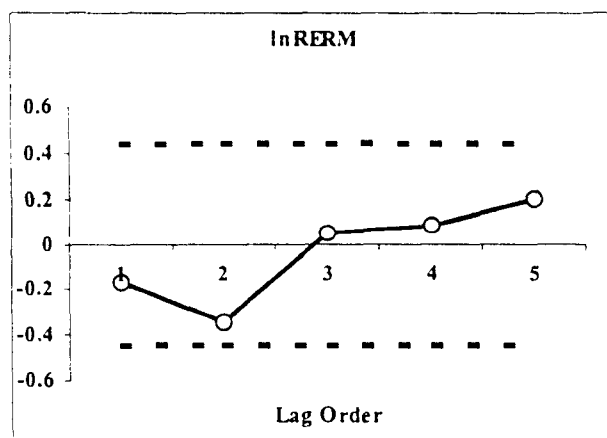
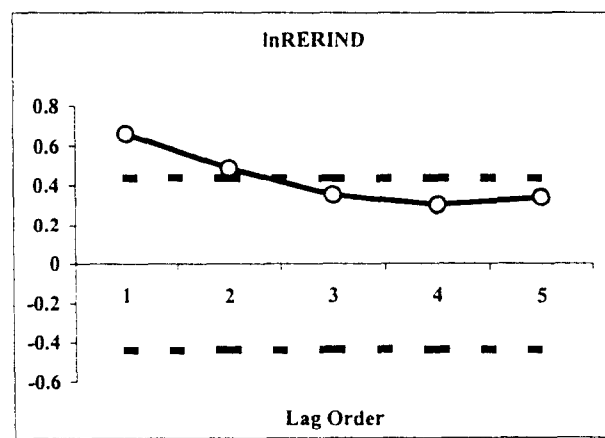


Figure 4.5(iv)



4.5.2. Estimating the Long-run Relationship

The estimating equation in (4.20) postulates a static long-run relationship among the variables. However, a valid long-run relationship can only be found if the variables in the model cointegrate. If $\ln RERM$ is used as a measure of RER, equation (4.20) will have a mixture of $\sim I(0)$ and $\sim I(1)$.²² Then the question is whether the $\sim I(0)$ regressors play a role in determining the $I(1)$ variable. In one study, Holden and Perman (1994) considered a model with two $I(1)$ and one $I(0)$ variables. The authors used the Johansen rank cointegration procedure to determine a valid long-run relationship between the two $I(1)$ variables and then included the $I(0)$ variable only in the short-run error-correction model. The procedure, thus, assumes that the $I(0)$ variable does not have any role to play in the long-run disregarding the economic theory behind it. On the other hand, Pesaran *et al.* (2001) observe that “the strict precondition for the same order of integration of the variables in a model involves a certain degree of pre-testing, thus introducing a further degree of uncertainty into the analysis of a long run relationship”. They have strongly argued that when variables in the estimating equation have different orders of integration, it does not necessarily mean that they are unlikely to have any long-run impact. Pesaran *et al.* (2001) have also devised a strategy which tests the existence of a long-run relationship when the variables are a mixture of $I(0)$ and $I(1)$. The procedure is based on an OLS estimation of unrestricted error correction model, a general specification of which can be written as:

$$\Delta \ln Z_t = \alpha + \gamma \ln X_{t-1} + \xi Z_{t-1} + \sum_{i=1}^p \pi_i \Delta \ln X_{t-i} + \sum_{i=0}^g \delta_i \Delta Z_{t-i} + \varepsilon_t \quad (4.21)$$

Estimation of (4.21) in itself is not interesting since the existence of a long-run relationship can only be tested by examining the joint null hypothesis that $\gamma = \xi = 0$ with the help of either a *Wald* or an *F* test. The presence of a long run relationship requires the rejection of this null. However, as the asymptotic distribution of these statistics is non-standard, Pesaran *et al.* provide the necessary critical upper (F_U) and lower (F_L) bound for the *F* test.²³ The F_U are derived under the assumption that all variables are $I(1)$ and the F_L considers all of them to be $I(0)$. If the

²² This is because in section 4.5.1 it has been found that $\ln Y$, $\ln GE$, $\ln DC$, and $\ln TOT$ are $I(1)$ while $\ln RERM$ is $I(0)$.

computed F statistic (F), which is obtained by restricting that $\gamma = \xi = 0$, is greater than the critical upper value, i.e. $F > F_U$, we reject the null and conclude that there is a valid long-run relationship among the variables. If $F < F_L$ then no long-run relationship exists, and finally, if $F_L < F < F_U$ the test is inconclusive. Pesaran *et al.* clearly point out that “[I]f the computed *Wald* or *F*-statistic falls outside the critical value bounds a conclusive inference can be drawn without needing to know the integration/cointegration status of the underlying regressors.”²⁴

Therefore, in order to determine the long-run relationship, we shall use the Pesaran *et al.* test. For this (5.14) was run with $p=1$ and $g=0$.²⁵ The F statistic was computed at 4.47, which compares with Pesaran *et al.*'s critical values. The critical values for a model with four regressors at the 95 percent level are $F_L = 2.86$ and $F_U = 4.01$.²⁶ Since the computed F statistic exceeds F_U , the null hypothesis of no long-run relationship between the variables in the model can be rejected. With this finding of cointegration, we now proceed to estimate the long-run equation using the PHFMOLS.

Table 4.3: PHFMOLS Estimates of Long-run Relationship

LnY =	6.147 ^{***}	+ 0.081 ^{***}	lnTOT + 0.331 ^{***}	lnGE + 0.32 ^{***}	lnDC - 0.093 ^{**}	lnRERM
(s.e.)	(0.222)	(0.026)	(0.028)	(0.022)	(0.045)	
t-ratio	28.36	3.12	11.72	14.50	-2.04	
Adjusted R ²	= 0.996					
LnY =	6.227 ^{***}	+ 0.065 ^{**}	lnTOT + 0.327 ^{**}	lnGE + 0.317 ^{**}	lnDC - 0.077	lnRERIND
(s.e.)	(0.316)	(0.0323)	(0.029)	(0.023)	(0.05)	
t-ratio	19.69	2.01	10.95	13.32	-1.53	
Adjusted R ²	= 0.996					

Note: Statistical significance at one, five, and 10 per cent level are given respectively by ^{***}, ^{**}, and ^{*}.

The top row in Table 4.3 gives the Phillips-Hansen estimates of the long-run relationship when the real exchange rate is represented by lnRERM. It is found that the terms of trade, government expenditure and domestic credit turn out to be correctly signed. The terms of trade elasticity is estimated at 0.08. While a 10 per cent rise in government expenditure is found to be associated

²³ Pesaran *et al.* give both the critical values for Wald and F Statistics. In this study, we shall only consider the F-statistics.

²⁴ Pesaran *et al.* (2001), p.1.

²⁵ Since we have a small sample, over parameterisation of the model can be very problematic in terms of having fewer degrees of freedom. Such choice of lag order can be rationalised by the fact that we are using annual data in this exercise.

²⁶ The critical values correspond to unrestricted intercept and no trend in the regression equation.

with a 3.3 per cent increase in aggregate output, almost similar magnitude of elasticity is also estimated for domestic credit. TOT, GE and DC all come out to be statistically significant at the one per cent level.

The parameter of our interest in Table 4.3, *i.e.*, the coefficient on $\ln RERM$ is negatively signed and is statistically significant at the five per cent level. The negative sign on the coefficient indicates that as the RER index rises, (or nominal currency adjustments, which result in real devaluations), aggregate output falls. The estimated coefficient of $\ln RERM$ suggests that a one per cent rise in RER index will result in a 0.09 per cent decline in the GDP.

Although Pesaran *et al.* (2001) test was carried out to infer about the cointegrating relationship of the estimated equation, autocorrelation coefficients of the residuals from the long-run relationship were examined to verify the cointegration results. Figure 4.6 gives the graphical plot of the cointegrating relationship and its autocorrelation coefficients upto the 5th lag order along with the 95 per cent level error bar. The graph seems to portray a stationary nature of the long-run relationship and all the autocorrelation coefficients are also found to lie within the confidence interval.

The bottom row in Table 4.3 estimates the long-run relationship using $\ln RERIND$ as a measure of RER. Recall that in contrast to $\ln RERM$, $\ln RERIND$ is an $\sim I(1)$ variable. Therefore, usual Engle-Granger procedure can be undertaken to infer about the long-run relationship. It is observed that the use of $\ln RERIND$ does not change the sign and significance of TOT, GE and DC. Moreover, the size of the estimated parameters is very much comparable to the previous set of estimates. The coefficient of $\ln RERIND$ is again negatively signed and more or less comparable to $\ln RERM$ but it fails to be significant at the conventional level. In fact, the coefficient becomes significant only at the 20 per cent level. The ADF test statistic of the estimated residual from this equation was computed at -4.12 against its critical value of -5.19 thus failing to reject the null hypothesis of non-cointegration. But as discussed earlier that the ADF test has low power and the critical values are very demanding in small samples, examination of the residual plot and autocorrelation coefficient should be considered before discarding the long-run validity of the model. Figure 4.7, however, shows that the residuals

behave like a stationary variable and particularly, based on the evidence of autocorrelation coefficients, the cointegrating relationship of the estimated equation in the bottom row of Table 4.5 should not be rejected.

Figure 4.6: Estimated Cointegrating Relationship with lnRERM and the Sample ACFs

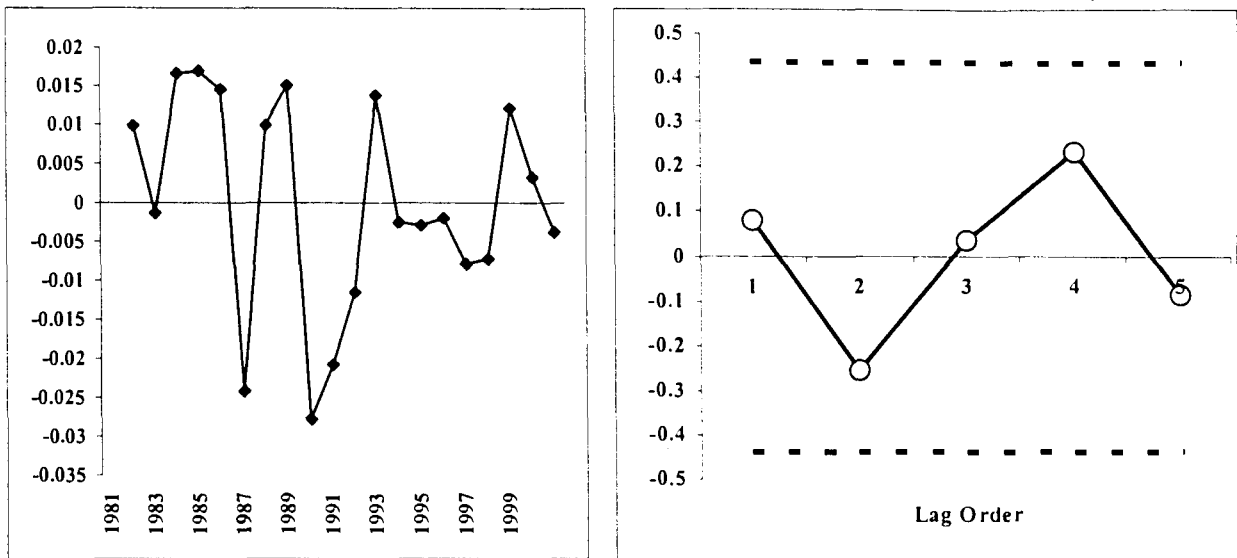
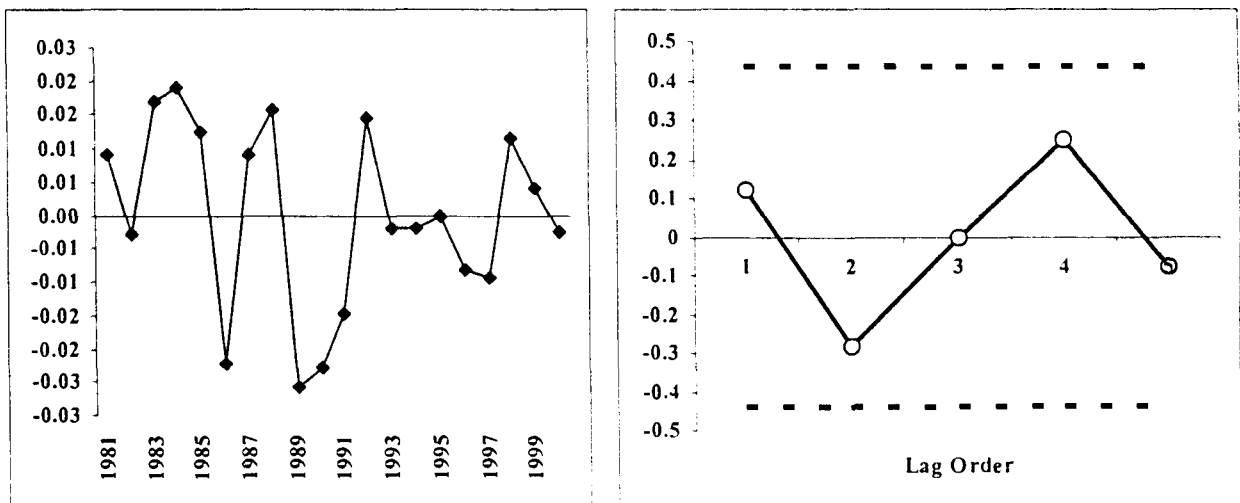


Figure 4.7: Estimated Cointegrating Relationship with lnRERIND and the Sample ACFs



In Section 4.4 it was mentioned that there is some debate over the use of TOT in the regression model. Therefore, it might be of interest to know how the results change if $\ln\text{TOT}$ is dropped from the equations in Table 4.3. Table 4.4 now shows that the exclusion of $\ln\text{TOT}$ does not change the size and significance of $\ln\text{GE}$ and $\ln\text{DC}$ much. Moreover, the coefficient on $\ln\text{RERM}$ is marginally increased (absolutely) but the negative sign on it and the level of statistical significance remain unchanged. The biggest change, however, is associated with $\ln\text{RERIND}$. The estimated parameter is now almost twice as big as the one in Table 4.3 eventually becoming significant at the five per cent level maintaining the negative sign on it. This result strongly suggests that the contractionary effect of changes in the exchange rate on real output over the long-run is not subject to the choice of the terms of trade variable in the model. The residuals obtained from the two estimated equations in Table 4.4 behaved almost in a similar fashion as the ones in Figures 4.6 and 4.7.²⁷

Table 4.4: PHFMOLS Estimates of the Long-run Relationship Excluding $\ln\text{TOT}$

$\ln Y =$	6.039 ^{***}	+ 0.353 ^{***}	$\ln\text{GE} +$	0.344 ^{***}	$\ln\text{DC} -$	0.112 ^{**}	$\ln\text{RERM}$
(s.e.)	(0.262)	(0.032)		(0.0257)		(0.05)	
t-ratio	28.36	10.85		13.36		-2.07	
Adjusted R ²	= 0.996						
$\ln Y =$	6.477 ^{***}	+ 0.342 ^{***}	$\ln\text{GE} +$	0.3286 ^{***}	$\ln\text{DC} -$	0.136 ^{**}	$\ln\text{RERIND}$
(s.e.)	(0.330)	(0.031)		(0.0265)		(0.047)	
t-ratio	19.60	11.01		12.37		-2.889	
Adjusted R ²	= 0.996						

Note: Statistical significance at one, five, and 10 per cent level are given respectively by ^{***}, ^{**}, and ^{*}.

4.5.3. Short-run Dynamics

Table 4.5 gives the resultant short-run model corresponding to the top row in Table 4.3.²⁸ It is observed that the short-run domestic credit and government expenditure elasticities are respectively 0.18 and 0.09. The terms of trade variable failed to register statistical significance and hence was dropped. Just like its long-run counterpart, the coefficient on $\Delta\ln\text{RERM}$ is negative and statistically significant. In the short-run, therefore, a one per cent rise in RER index results in about 0.06 per cent fall in aggregate output. The error-correction term, RESM_{t-1} , is

²⁷ These are available from the authors on request.

²⁸ Due to small sample size, only the first lag of the first differenced variables were tried in the general mode. None of these variables were found to be statistically significant justifying their deletion.

correctly signed and significant at the one per cent level indicating a valid representation of the long-run model. The coefficient suggests that it takes about two years to correct all short-run disequilibrium errors. The explanatory power of the short-run model is, however, low as only about 46 per cent of the variation in the growth of the real GDP can be explained by the right-hand side explanatory variables. The diagnostic tests as given by serial correlation, functional form, normality and heteroscedasticity do not suggest any problem.

Table 4.5: Short-run Error-Correction Model with $\Delta \ln \text{RERM}$

$\Delta \ln Y = 0.241^{***} + 0.178^{***} \Delta \ln DC + 0.094^{**} \Delta \ln GE - 0.058^{**} \Delta \ln \text{RERM} - 0.57^{***} \text{RESM}_{t-1}$
(s.e.) (0.004) (0.046) (0.036) (0.029) (0.155)
t-ratio 5.06 3.81 2.56 -2.03 -3.65
Diagnostic Tests
Adjusted $R^2 = 0.46$
Serial Correlation: $\chi^2(1) = 2.68$
Normality: $\chi^2(2) = 1.00$
Functional Form: $\chi^2(1) = 1.68$
Heteroscedasticity: $\chi^2(1) = 0.57$

Note: *** , ** and * are for statistical significance at the one and five per cent levels, respectively. The serial correlation test is based on Godfrey's (1978) LM test for serial correlation; Functional Form on Ramsey's (1969) RESET test; Heteroscedasticity on White's (1980) test; and Normality of residuals on Jarque-Bera (1987) test. The computed test statistics for serial correlation, functional form and heteroscedasticity are follow a chi-square distribution with one degree of freedom while normality test statistic follows a chi-square distribution with 2 degrees of freedom.

Table 4.6: Short-run Error-Correction Model with $\Delta \ln \text{RERIND}$

$\Delta \ln Y = 0.255^{***} - 0.024 \Delta \ln \text{TOT} + 0.169^{***} \Delta \ln DC + 0.086^{**} \Delta \ln GE - 0.049^{**} \Delta \ln \text{RERIND} - 0.50^{***} \text{RESI}_{t-1}$
(s.e.) (0.005) (0.027) (0.049) (0.042) (0.03) (0.161)
t-ratio 4.76 -0.89 3.42 2.03 -1.47 -3.13
Diagnostic Tests
Adjusted $R^2 = 0.39$
Serial Correlation: $\chi^2(1) = 1.87$
Normality: $\chi^2(1) = 0.75$
Functional Form: $\chi^2(1) = 1.63$
Heteroscedasticity: $\chi^2(1) = 1.11$

Note: *** , ** and * are for statistical significance at the one and five per cent levels, respectively. The serial correlation test is based on Godfrey's (1978) LM test for serial correlation; Functional Form on Ramsey's (1969) RESET test; Heteroscedasticity on White's (1980) test; and Normality of residuals on Jarque-Bera (1987) test. The computed test statistics for serial correlation, functional form and heteroscedasticity are follow a chi-square distribution with one degree of freedom while normality test statistic follows a chi-square distribution with 2 degrees of freedom.

The estimated parameters of the short-run model in Table 4.6 are, in general, comparable to those in Table 4.5. The coefficient on $\Delta \ln \text{RERI}$ comes out to be negative but falls short of becoming statistically significant at the conventional levels.²⁹ Therefore, although point estimate indicates a contractionary effect of devaluation, the confidence interval of the coefficient also contains a zero value for it. The error-correction term RESI_{t-1} , which is the lagged residual from

²⁹ The coefficient is significant only at the 20 per cent level.

the long-run relationship, is correctly signed and shows that it takes about 2 years to converge to the long-run relationship from any short-run disequilibrium situation. The adjusted R^2 for the model is only 0.39 but the diagnostics do not report any problem with regard to either serial correlation, or model misspecification, or non-normality of errors or heteroscedasticity.

Table 4.7: Estimation of Short-run Models with Additional Dummy Variables

Variables	Dependent Variable is: $\Delta \ln Y$			
	Coefficients (s.e.)	Coefficients (s.e.)	Coefficients (s.e.)	Coefficients (s.e.)
C	0.008 (0.008)	-0.027** (0.013)	0.0065 (0.01)	-0.0292 (0.036)
$\Delta \ln DC$	0.17*** (0.042)	0.199*** (0.033)	0.158*** (0.044)	0.179*** (0.038)
$\Delta \ln GE$	0.112*** (0.034)	0.176*** (0.033)	0.121*** (0.039)	0.188*** (0.04)
$\Delta \ln RERM$	-0.068** (0.026)	-0.11*** (0.024)	-	-
$\Delta \ln RERIND$	-	-	-0.057* (0.029)	-0.099*** (0.029)
$RESM_{t-1}$	-0.505*** (0.143)	-0.48*** (0.11)	-	-
$RESI_{t-1}$	-	-	-0.453*** (0.147)	-0.42*** (0.12)
D89	0.016** (0.007)	0.025*** (0.006)	0.018*** (0.008)	0.0276*** (0.008)
D86	-	0.024*** (0.007)	-	0.022** (0.008)
		Diagnostic Tests		
Adjusted R^2	0.57	0.75	0.50	0.66
Serial Correlation: $\chi^2(1)$	0.21	0.12	0.038	0.55
Functional Form $\chi^2(1)$	4.28**	2.64	3.38	3.24
Normality: $\chi^2(1)$	0.89	0.53	0.918	0.61
Heteroscedasticity: $\chi^2(1)$	0.35	0.0015	0.07	0.009

Note: Statistical significance at the one, five and ten per cent levels are indicated by ***, **, and *. D89 is the dummy variable – 0 for 1989 and 1 for otherwise and similarly D86 is another dummy variable with 0 for 1986 and 1 for otherwise.

As mentioned earlier, both the short-run models have somewhat low explanatory powers in contrast to high R^2 associated with their counterpart long-run models. It is possible that in the short-run many other factors influence aggregate output growth about which the theory is silent. This, however, should not point toward any estimation or misspecification problem especially when the diagnostic tests do not detect any such problem. Nevertheless, an attempt was made to see whether such low explanatory power could be attributable to any particular atypical year. For both models in Tables 4.5 and 4.6, the largest error was associated with the year 1989. When a dummy for this year was incorporated the explanatory power was increased to 0.57 for the model

with RERM and to 0.50 for the model with RERIND (see Table 4.7). Insertion of another dummy for 1986 increased the adjusted R^2 to 0.75 and 0.66 respectively. Interestingly, Table 4.7 shows that the regressions with the dummy variables (either only for the year 1989 or for 1989 and 1986) make the coefficient on $\Delta \ln RERIND$ statistically significant, while the significance of $\ln RERM$ becomes even more prominent.³⁰ These results seem to suggest that significant contractionary effect of downward adjustment of the RERIND on the aggregate output in the short-run is overshadowed by influential observations like 1989 and 1986.

4.6. Summary of Findings and Implications

The effect of the exchange rate on aggregate output has been a longstanding controversy in applied macroeconomics. The issue is important for a country like Bangladesh where exporters often demand for downward adjustment of the domestic currency in order to become more competitive in the international markets in sharp contrast to counter-productive arguments of devaluation put forward by the consumers and the domestic producers relying on imported goods for consumption and production. Apart from these, the government has a principal objective of maintaining sustainable trade balance for which often currency adjustment becomes essential. Theoretical possibilities of having both contractionary and expansionary effects of devaluations on aggregate output imply that, for any country the net impact has to be determined empirically. This study has made such an attempt to assess the output effects of exchange rate changes in Bangladesh using the new national income accounting data for 1980-2000.

The empirical specification, used in the study, is derived from a three-market Keynesian model that posits a long-run relationship between the real GDP and a vector of right hand side variables including terms of trade, government expenditure, domestic credit and real exchange rate. For empirical investigation, the study constructs two series of multilateral real exchange rate: one based on the weights associated with Bangladesh's bilateral formal trade with top 20 countries (RERM) while the other (RERIND) still considering the same partners but assigns a greater weight to India due to the existence of a large volume of informal border trade.

³⁰ Since $\Delta \ln TOT$ was not significant in various regressions, it has been deleted from the results reported in Table 4.7.

The estimation strategy considered the examination of the time series properties of the variables in the regression to avoid the problem of estimating a spurious relationship. In the light of the non-stationarity of the model variables, cointegration techniques were used to validate the long-run relationship. The results show that in the long-run the real exchange rate variables are associated with a negative sign, which implies contractionary effects of devaluation for Bangladesh. However, the contractionary effect appears to be statistically significant only in equations that use either the multilateral RER purely based on formal trade or excludes the terms of trade variable. In order to capture the short-run dynamics, error-correction models were constructed and again the results were in line with the long-run equations. That is, significant contractionary effect was found for the equation with RERM but when RERIND was used a negative but insignificant impact was observed. The study, however, reveals that, in the short-run, the negative coefficient on RERIND becomes significant if just one outlier is forced to fall on the fitted line.

Therefore, the main finding of the study can be summarized as follows: There is no evidence of any expansionary effect of devaluation on output in Bangladesh. Point estimates of RERs are always negatively signed suggesting that downward adjustments of the Taka adversely affect overall production.

Several factors can be identified which are responsible for the above result. First of all, it is not very difficult to perceive that the scope of enhancing external competitiveness through nominal devaluations is limited in Bangladesh. The country's export basket is dominated by ready-made garments, which are overwhelmingly dependent on imported raw materials and equipments. For a small open economy, import prices in foreign currency are fixed and consequently when the home currency depreciates, import prices will rise by the full extent. This severely reduces the capacity of exporters in a heavily-import dependent industry to benefit from devaluation. Moreover, when the backward integration of any particular export industry is weak, whatever price incentive given to it fails to generate adequate supply stimulus that could eventually outweigh the negative effect of rising costs of production in all other sectors following devaluation. For the same reason, the argument that other countries improve competitiveness and expand output by devaluing their currencies may not justify devaluation in Bangladesh.

Considering the case of textiles and clothing, there is no denying that Bangladesh's competitors, such as China, India, Korea and Pakistan, enjoy a greater amount of domestic value added and, as a result, devaluation of their currencies might not increase the cost of production by as much as would be in the case of Bangladesh's producers. Thus, while devaluation might constitute a competitiveness argument for exporters leading to expanded economic activities in those countries, for Bangladesh such a scope is severely limited.

For all other exports with relatively large domestic content, such as, jute and jute goods, tea, frozen fish, and leather and leather products can devaluation be argued to be an effective supply stimulus? The problem of jute and jute goods is well-known as they compete with cheap synthetic substitutes in the world market and it is doubtful whether devaluation alone can protect its competitiveness in the long-run. On the other hand, for tea, frozen fish, and leather products, Bangladesh is a very small supplier of these commodities and the relative significance of these sectors in overall GDP is not prominent enough to generate adequate supply response.³¹ In fact, it is the supply capacity that is more important for increasing exports and providing only price incentives through devaluation is not sufficient for achieving an expanded capacity.

Bangladesh is a country with a high ratio of import to GDP (currently about 18 per cent) and a significant proportion of these imports is in the form of intermediate inputs, raw materials, and plants and machinery, which cannot be produced domestically but are essential to the country's production processes in the non-export and non-traded sectors. By making these imports costlier, devaluation might have resulted in reduced profits and contracted the funds to be reinvested in these sectors thereby adversely affecting output and economic growth. Very little is known about how consumers substitute between imported goods and domestically produced goods (or, between tradables and non-tradables). If imports are price inelastic, it could be possible that following devaluation, consumers cut back spending on home goods to offset the price rise of imported items. This can result in contractionary effect in the import-competing and non-traded sectors.

³¹ Total receipts for Bangladesh from combined exports of leather, tea and frozen food stood at US\$ 0.8 billion in 2000.

It is to be acknowledged that maintaining a sustainable external balance under a fixed or managed system of exchange rate is a challenging task. In the face of an unsustainable trade balance, it often requires downward adjustment of the nominal exchange rate, which is undoubtedly among the most unpopular policy decisions. On the other hand, under a flexible exchange rate system, the adjustment is automatic and the policy makers do not have to decide whether to devalue or not although the government can exert some influence in a market friendly way. In recent times, Bangladesh has been suggested to adopt a freely floating exchange rate regime and the government is seriously contemplating a move to that direction. A free-floating exchange will certainly ensure long-run equilibrium in the balance of payments but, in the absence of a sound management, there might be short-run fluctuations which are destabilizing in nature, hostile towards inflow of foreign capital, and impede domestic investment decision both in the traded and non-traded sectors. There is also an apprehension that free floating exchange will result in considerable depreciation of the Taka. The results obtained from our study imply that such a situation might have serious consequences for Bangladesh as a 10 per cent devaluation is found to be associated with as high as 1.3 per cent decline in aggregate output. Therefore, it is important to strike a delicate balance between maintaining a sustainable trade balance and ensuring growth in overall output. A smooth transition toward a flexible system along with the central bank's capacity of absorbing shocks and preventing rapid depreciation would have important bearings on the growth performance of the economy.

Chapter 5

Trade Liberalisation, Poverty and Inequality

5.1. Introduction

Any study on the impact of trade liberalisation is inevitably confronted with the need for addressing the issue of poverty and inequality. In fact, the underlying reason for undertaking trade liberalisation is to facilitate growth, which is perceived to be one of the most important ingredients in the package of poverty alleviating (anti-poverty) measures. There is also empirical evidence to suggest that “growth is good for poor” (Dollar and Kraay, 2001). However, the theoretical connection between trade liberalisation and poverty is quite complex and the country specific empirical analysis is plagued with methodological limitations and data constraints. The objective of this chapter is to provide a brief discussion on the link between trade liberalisation and poverty and then to highlight the problem of empirical assessment in the context of Bangladesh. The chapter also presents some descriptive analysis of poverty and inequality situation in the pre and post-liberalisation periods.

5.2. Trade Liberalisation and Poverty – The Theoretical Links

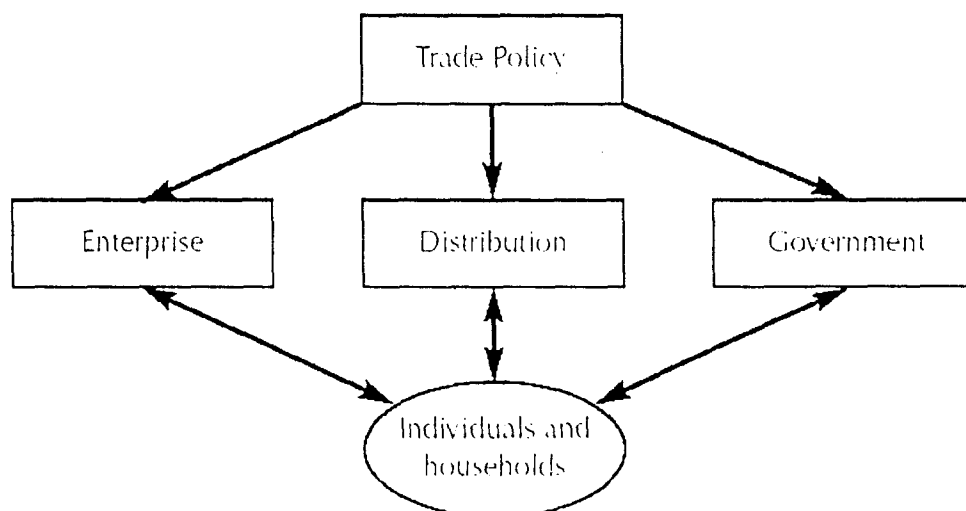
At the aggregate or macro level, trade liberalisation affects poverty via economic growth. High economic growth emanating from liberalisation may benefit the poor through increasing the demand for labour or expanding employment opportunities. Increased real income can potentially enhance the capacity of the government to allocate more resources in poverty alleviation programmes thereby directly benefiting the poor. In order to investigate the relationship between income of the poor and overall income (GDP) using a cross-country data set for 80 countries, Dollar and Kraay (2000) find that as overall income increases, on average, incomes of the poor increase by exactly the same amount.¹ This finding undermines the concerns that economic growth ‘by passes’ the poor by worsening the income distribution.²

¹ Other studies that have also found favourable effects of growth on poverty include Bruno *et al.* (1996), Ravallion and Chen (1996), and Roemer and Gugerty (1997).

² According to Datt and Ravallion (2002), higher aggregate economic growth is, however, only one element of an effective strategy for poverty reduction. Focusing on the growth and poverty reduction across Indian states the authors observe that the sectoral and geographic composition of growth is also important, as is the need to redress existing inequalities in human resource development and between rural and urban areas.

On the other hand, the theoretical links connecting trade policy and poverty and inequality at the household level are multifarious. Winters (2000) provides a comprehensive analytical framework covering all these aspects to explore the static effects of trade and trade liberalisation on poverty. In the theoretical construct, the effects of trade policy are linked to the households via a set of important institutions comprising of enterprises, distribution channels and the government, as shown in Figure 5.1.

Figure 5.1: The Analytical Link Between Trade Policy and Poverty



Source: Adapted from Winters (2000).

According to Winters, the first impact of trade liberalisation is on the prices of the liberalized goods. If price changes are translated into changes in the prices actually faced by the poor households, then the direct impact on poverty depends on whether poor households are net consumers or net producers of the product whose price has changed – a price increase benefits net producers and hurts net consumers.

Trade liberalisation also affects the households through its impact on profits of enterprises and hence on employment and wages. If wages are flexible and there is full employment, any price shocks caused by trade liberalisation will be reflected in wage changes, with no change in employment. Alternatively, trade liberalisation will cause changes in employment. In reality, how these two mechanisms affect poverty depends not only on how employment changes, but also on the types of labour that poor households supply and on the level of various wage rates relative to the poverty line.

The third important link in Winters' framework is through the changes in government revenue and expenditure as a direct consequence of liberalisation. When trade taxation is an important source of revenue, reduced public resources as a result of trade policy reform is more likely to affect the households dependent on provisioning of the public services.

While trade liberalisation might involve changes in income distribution across households, it is important to recognize the dynamics of intra-household distribution. It is widely viewed that the costs of poverty fall disproportionately on women, children and the elderly. Thus, although it may be useful to analyse the impact of trade liberalisation on households, it is also important to consider the distribution of welfare within the household.³

5.3. Constraints on Empirical Analysis

Empirical analysis to test a specific theory about how trade liberalisation and poverty might be linked in the context of Bangladesh is constrained by data availability. Information on various measures of poverty incidence exists only for a few discrete points in time, with which any meaningful econometric exercise cannot be undertaken.⁴

An alternative is to follow the modelling approach by constructing a theoretical model of the linkages between trade liberalisation and poverty and use this to predict what is likely to happen to poverty if certain trade reforms are implemented. An important component of this exercise is to base the model on empirical reality by deriving the parameters of the model from empirical analysis of real data. One attractive feature of modeling method is that it can be implemented without the time series data and its most important strength lies in the fact that it provides with an explicit view of the links between poverty and trade reform, so that the significance of several different links can be appraised and different forms of reform and complementary policy explicitly explored.⁵ Besides, once the model is built, it can be

³ Intra-household distribution is usually ignored in the existing poverty estimating/monitoring surveys as they implicitly assume away any bias in the distribution of household income or expenditure among its members. Therefore, if per capita household consumption expenditure (or income), adjusted for adult-equivalence, is found to exceed a predetermined per capita poverty line consumption expenditure/income, all members of the household are thought to have escaped from poverty.

⁴ That is, continuous time series data are not available for estimating an econometric model.

⁵ See McCulloch *et al.* (2001) for a very useful non-technical review of strengths and weaknesses associated with various data based approaches to evaluating the impact of trade policy reforms.

implemented by making alternative assumptions about the economic relationships and alternative set of parameter values in order to test the robustness of the results.

One important problem with the modeling approach, however, is that it predicts the effects of liberalisation rather than explain what has happened in the past. Therefore, although useful in predicting the outcomes of alternative policy options, modeling approach is not suitable for ex-post analysis with the historical data. Construction of a suitable model is a time consuming task and falls beyond the scope of the present study.

5.4. Poverty and Inequality in the Pre- and Post-Liberalisation Periods⁶

Given the data constraints as discussed above, we shall consider the basic trends in poverty estimates for Bangladesh in the pre- and post-liberalisation period. It goes without saying that the following analysis can neither explain the trends nor can it provide the statistical significance of the association between various poverty measures and trade regimes.

Table 5.1: Incidence of Poverty

Year	Head Count Ratio (per cent)		
	Rural	Urban	Total
1983-84	59.6	50.2	58.5
1988-89	59.2	43.9	57.1
1991-92	61.2	44.9	58.8
1995-96	56.7	35.0	53.1
1997	46.8	43.4	46.0
1999	44.9	43.3	44.7
2000	53.0	36.6	49.8

Note: The figures for 1983-84, 1988-89, 1991-92, 1995-96, and 2000 are based on the Household Expenditure Survey (HES) while those for 1997 and 1999 are taken from Poverty Monitoring Survey (PMS).

Source: Mujeri (2002).

As measured by the head count index, the post-liberalisation period has witnessed a significant decline in poverty incidence. In the pre-liberalisation period (from 1983-84 to 1991-91), the proportion of the people living below the poverty line slightly increased due to rising rural poverty despite decline in urban poverty at a rate 1.4 percentage points per year. In contrast, between 1991-92 and 1999, the head count index fell by 14.1 percentage points, i.e., at a rate of 1.8 percentage points per year. The first half of the 1990s actually experienced a relatively rapid decline in poverty incidence at an annual rate of 2.5 percentage points – with rural and urban annual declining rates of 1.9 and 6 percentage points respectively. What is, however, striking is to observe that moving from 1999 PMS to 2000

⁶ This section draws on Mujeri (2002).

HES increases poverty incidence substantially, which poses serious doubts about the comparability of the data.

In fact, it must be noted here that the data on various years are not strictly comparable due to differences in survey techniques and poverty estimates. The poor in the HES are estimated using the cost of basic needs (CBN) method and are taken as those living below the poverty line which corresponds to an intake of 2,122 kcal per person per day and a non-food allowance. The poverty line in the PMS uses the food energy intake (FEI) method and refers to calorie intake of 2,122 kcal per person per day in rural areas and 2,112 kcal per person per day in urban areas.

Therefore, any meaningful comparison between the pre- and post liberalisation periods can only be done with the help of HES 1991/92 and HES 2000 estimates, which reveal that between these two periods national poverty declined by 9 percentage points with both the urban and rural incidence of poverty falling at a same rate. It is, however, worth noting that compared to 1995-96, urban poverty actually increased in 2000 by 1.6 percentage points.⁷ In terms of other measures of poverty incidence such as the poverty gap and the squared poverty gap, positive changes in both rural and areas are noticed (Table 5.2).

Table 5.2: Other Measures of Poverty Incidence

	HES 1991-92	HES 2000
Poverty Gap		
National	17.2	12.9
Urban	12.0	9.5
Rural	18.1	13.8
Squared Poverty Gap		
National	6.8	4.6
Urban	4.4	3.4
Rural	7.2	4.9
Gini Index of Inequality		
National	0.259	0.306
Urban	0.307	0.368
Rural	0.243	0.271

Source: A national strategy for economic growth, poverty reduction and social development, Economic Relations Division, Ministry of Finance, Government of Bangladesh, December, 2002.

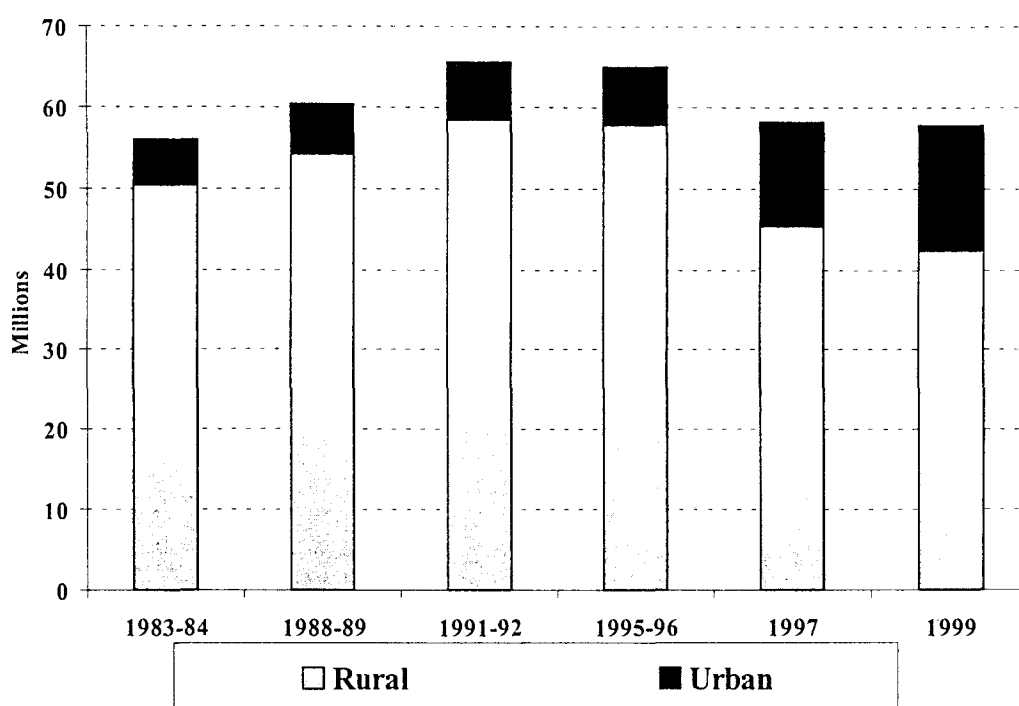
Notwithstanding the problem of comparability, poverty in rural areas is found to be higher among those who possess little or no land, who have no education and marketable skills, and who depend on wage labour for their livelihood. Agriculture labour households and tenants

⁷ Since both the 1995-96 and 2000 poverty estimates are based on the same HES methodology, they can be comparable.

have a high incidence of poverty as do non-agricultural casual workers and self-employed workers with little capital. According to BBS (2000), about 78 per cent of the households who report agriculture wage labour as their principal occupation live in poverty. In urban areas, households headed by casual and manual labourers and employees in the informal sector with little assets.

It has been estimated that during 1984-99, the absolute number of the poor in the country increased to 58 million from 56 million (Mujeri 2002).⁸ This increment is about 6 per cent of the total population increase (which is about 34 million) during the same period. Figure 5.2 shows while, in the pre-liberalisation period, the number of absolute poor increased; in the post-liberalisation period, the number actually declined from 65.6 percent to 57.8 per cent. What is, however, striking about the development of the 1990s is a rapid rise in the number of the urban poor. In 1991-92, the urban poor numbered 7.2 million, which had risen to 15.4 million in 1999.

Figure 5.2: No. of Poor (in millions)



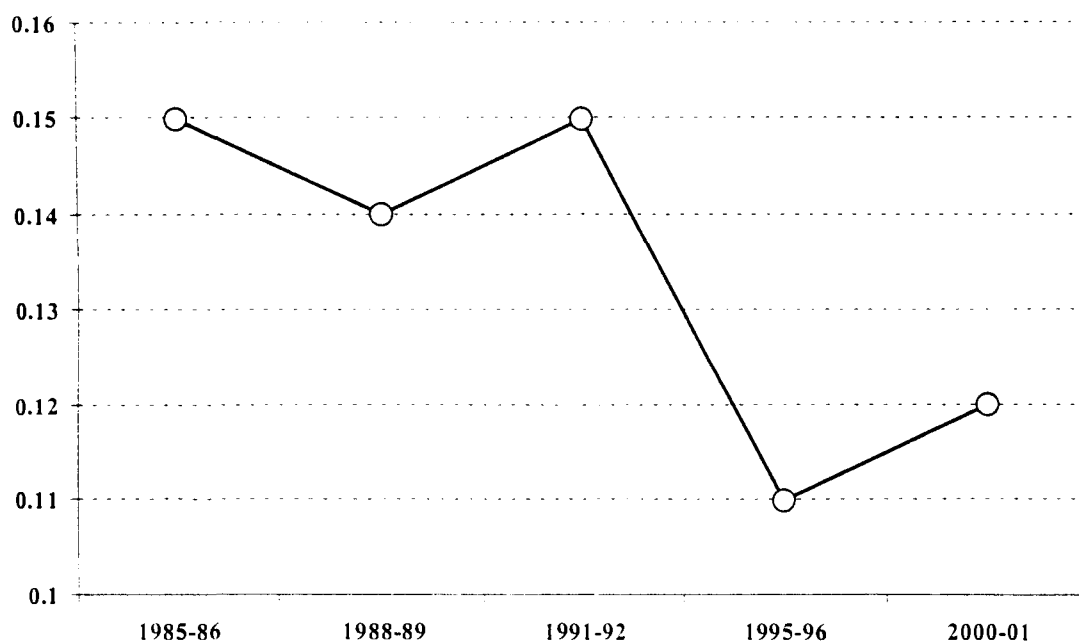
Source: Mujeri (2002).

Although even by comparable surveys (HES 1991-92 and HES 2000), the incidence of poverty declined in the 1990s, inequality increased considerably between 1992 and 2000. The

Gini index of inequality, as presented in Table 5.2, in urban areas increased from 0.259 in 1991/92 to 0.306 per cent in 2000. Similarly, inequality in the rural areas rose to 0.27 from 0.24 over the same period. Therefore, urban inequality increased more than rural inequality and the disparity between rural and urban areas widened.

Between the mid-1980s and the end of 1990s, the average per capita income in the country increased by 41 per cent. However, the per capita income of the poorest 20 per cent of the households increased by only 24 per cent while that of the richest 20 per cent by nearly 60 per cent. The percentage increase during the post-liberalisation period, however, is much higher for the 20 per cent richest households – 49 per cent compared to 21 per cent for the poorest 20 per cent households. Similar increases during the pre-liberalisation period of 1985-86 to 1991-92 were 7 per cent for the richest 20 per cent households compared to less than 3 per cent for the poorest 20 per cent households. Figure 5.3 shows that the ratio of the per capita income of the poorest 20 per cent households to richest 20 per cent declined from 15 per cent to 12 per cent during the post-liberalisation period.

Figure 5.3: Ratio of Per Capita Income of Poorest 20 Percent to Richest 20 Percent Households



⁸ However, this estimate might be subject to methodological problem as discussed above.

5.5. Concluding Observations

From the above discussions it becomes clear that comparable and consistent data for rigorous empirical work are not available. The information on the links between trade liberalisation and poverty and welfare indicators at the household level are also not readily available. However, based on two comparable HES surveys of 1991-92 and 2000 that correspond respectively to the pre- and post liberalisation periods, it appears that the latter period is associated with lower level poverty incidence. However, the same survey shows that inequality has increased in the post-liberalisation period.

Chapter 6

Conclusions

During the past two decades or so, Bangladesh has implemented many important liberalisation measures to make its economy more outward-oriented. These reform measures led to a significant decline in quantitative restrictions, opening up of trade in many restricted items, rationalisation and diminution of import tariffs, and the liberalisation of the foreign exchange regime. How trade liberalization has influenced economic growth in Bangladesh remains, however, a subject matter of great interest to the researchers, academics and the policy makers. However, most studies undertaken to investigate the matter have been descriptive in nature, which cannot test specific theories or propositions concerning the relationship between liberalisation and growth. In this study, an empirical approach has been followed to analyse three important and closely related issues of liberalisation and growth, export-growth nexus and liberalisation, and exchange rate changes and growth. The recently revised BBS estimates of the national income (GDP) data have been used to investigate the relationships.

The first empirical exercise examined a general relationship between liberalisation and growth by augmenting the theoretical constructs of neo-classical and endogenous growth models to incorporate some measure of trade liberalisation. Based on the information available at hand, three different measures of trade liberalisation, viz. trade-GDP ratio, the ratio of imports of consumers' goods to GDP, and the implicit nominal tariff rate were constructed. The estimation results fail to reveal any significant positive effect of any of the liberalisation indicators on growth either in the long-run or in the short-run. This is despite the fact that the trend growth rate associated with the post-liberalisation period (4.8 per cent) is significantly higher than that of the pre-liberalisation regime (3.6 per cent). It could be possible that the constructed liberalisation measures did not truly reflect liberalisation in Bangladesh. Nonetheless, the insignificance of such type of simple measure as the openness ratio (i.e., trade-GDP ratio) that has been shown to have significantly contributed to the growth of output in numerous studies may undermine the growth-promoting role of liberalisation in Bangladesh.

There is also no evidence of any significant influence of liberalisation on the total factor productivity growth. However, one remarkable feature of the results is the finding of increasing returns to scale in the production of aggregate output, which tends to suggest the relevance of adopting an endogenous growth model for Bangladesh. A significantly higher trend growth in the post-liberalisation period, in such a case, might have been the result of the interaction between the inherent production function for the economy exhibiting increasing returns to scale in production and accumulation of factors of production at a faster rate.

The second issue that has been explored in the study is the link between exports and growth. Taking into consideration of a robust export performance of the 1990s, Bangladesh is usually considered to have benefited substantially from trade reform measures. However, if the export-led growth hypothesis were to be true for Bangladesh, the growth in the export sector should have driven overall economic growth. Therefore, how exports and growth are related, and how liberalisation affects the export-growth nexus constitute two important issues of empirical investigation.

Quite surprisingly, the results do not reveal any significant positive effect of exports on output. This is true irrespective of whether a simple bi-variate relationship between exports and output is estimated or a multivariate framework controlling for other factors is used. Even more strikingly, a significant inverse long-run relationship between export and non-export GDP emerges.

When the impact of liberalisation on the export-growth relationship is examined, it is found that if anything the effect of exports on output has been weakened further in the post-liberalization period. Finally, no evidence of causality running from export to output can be found to validate the export-led growth hypothesis for Bangladesh.

These apparently surprising results might be attributable to low value added content of Bangladesh's main export product, RMG, which overwhelmingly dominates the growth of exports. Although the export-GDP ratio in the last decade has increased from 6 to 14 per cent, consideration of the fact that a significant proportion of RMG exports is actually spent on imported raw materials and input reduces the ratio of export value added to GDP to only 7 per cent in 2000, which is about 3 percentage points higher than the corresponding figure in the mid-1980s. Since it is the value added that contributes to GDP, once the net contribution

to domestic economy is considered, the spectacular performance of the 1990s is overshadowed by the export industry's continued excessive dependence on imported raw materials and intermediate inputs. When the domestic valued added content of exports is so low, the finding of no significant effect of exports on output may not be surprising.

How the changes in the exchange rate affect output has been the last issue of investigation. An empirical estimation of a theoretical specification – postulating a long-run relationship between real GDP and a vector of variables including terms of trade, government expenditure, domestic credit and real exchange rate – appears to support the contractionary effect of downward adjustments of the exchange rate. It is argued that, due to the dominance of low value added items of ready-made garments in the country's export basket, devaluations may not have provided much scope for enhancing the external competitiveness as the depreciation of the home currency in a small open economy raises the prices of imported goods and inputs by the full extent of changes in the nominal exchange rate. Amongst the high value added exports, the problem with jute and jute goods is the stiff competition that they face from cheap synthetic products and it is doubtful whether devaluation alone can protect its competitiveness in the long-run. In the case of all other exports, the main problem is supply capacity and providing only price incentives through devaluation is not sufficient for achieving an expanded capacity.

A significant proportion of imports into Bangladesh is also essential for the production of the country's non-export and non-traded sectors. By making these imports costlier, devaluation might result in reduced profits and availability of funds to be reinvested in these sectors thereby adversely affecting output and economic growth. Moreover, if imports are price inelastic, devaluation induces reduced spending on home goods by the consumers to offset the price rise of imported items. This results in contractionary effect on the import-competing and non-traded sectors.

Due to non-availability of data, no attempt is made in the study to analyse the effect of liberalisation on poverty. However, simple analysis of trends in a descriptive manner shows that the post liberalisation period is associated with lower head count ratio but higher inequality. The link between trade liberalisation and poverty and inequality is a complicated one and theoretical constructs are being developed only recently. Therefore, it is important to carry out further research on the issue.

References

- Aghion, P. and Howitt, P. (1999), *Endogenous Growth Theory*, MIT Press.
- Ahmad, J. and Kwan, A.C. (1991), "Causality Between Exports and Economic Growth: Empirical Evidence From Africa", *Economics Letters*, vol.37, pp.243-48.
- Ahmed, N. (2001), *Trade Liberalization in Bangladesh: An Investigation into Trends*, University Press Limited, Dhaka.
- Akaike, H. (1969). "Fitting Autoregressive Models for Prediction", *Annals of the Institute of Statistical Mathematics*, vol. 21, pp.243-47.
- Alogoskoufis, G. and Smith, R. (1991), "On Error-Correction Models", *Journal of Economic Surveys*, vol.5, pp.97-128.
- Amirkhalkhali, S. and Dar, A.A. (1995), "A Varying Coefficients Model of Export Expansion, Factor Accumulation and Economic Growth: Evidence from Cross-Country Time Series Data", *Economic Modelling*, vol.12, pp.435-41.
- Amsden, A. (1989), *Asia's Next Giant: South Korea and Late Industrialization*, Oxford University Press.
- Amsden, A.H. (1992), "Why Isn't the Whole World Experimenting With the East Asian Model to Develop?: Review of The East Asian Miracle", *World Development*, vol.22, no.4, pp.627-33.
- Andriamananjara, S. and Nash, J. (1997) "Have Trade Policy Reforms Led to Greater Openness in Developing Countries?" Policy Research Working Paper 1730, the World Bank, Washington.
- Athukorala, P.C. and Riedel, J. (1994), "Demand and Supply Factors in the Determination of NIE Exports: A Simultaneous Error-Correction Model for Hong Kong: A Comment" *Economic Journal*, vol.104, pp.1411-14.
- Athukorala, P.C. and Riedel, J. (1996), "Modelling NIE Exports: Aggregation, Quantitative Restrictions and Choice of Econometric Methodology", *Journal of Development Studies*, vol.33, no.1, pp.81-98.
- Atkins, F. (2000), "Revisiting the Exchange Rate Debate: The Jamaican Experience", *Journal of International Trade and Economic Development*, vol.12, pp.121-131.
- Baffes, J., Elbadawi, I.A., and O'Connell, S. (1999), "Single Equation Estimation of the Equilibrium Exchange Rate", in Hinkle, L.E. and Montiel, P.J. (eds) *Exchange Rate Misalignment: Concepts and Measurement for Developing Countries*, Oxford University Press for the World Bank.
- Bahmani-Oskooee, M. (1998), "Are Devaluations Contractionary?", *Journal of Economic Development*, vol.23, No. 1, pp.131-43.
- Bahmani-Oskooee, M. and Alse, J. (1993), "Export Growth and Economic Growth: An Application of Cointegration and Error-Correction Modelling", *The Journal of Developing Areas*, vol. 27, pp. 535-42.
- Bahmani-Oskooee, M., Mohtad, H. and Shabsigh, G. (1991), "Exports, Growth and Causality in Developing Countries: A Re-examination", *Journal of Development Economics*, vol.36, pp.405-15.
- Bakht, Z (1996), "Cross Border Illegal Trade in Bangladesh: Composition, Trends and Policy Issues", Bangladesh Institute of Development Studies (BIDS) for the World Bank.
- Bakht, Z. (2000), "Trade liberalisation, Exports and Growth of Manufacturing Industries in Bangladesh", chapter 5 in Mozammel Huq and Jim Love (eds.) *Strategies for Industrialisation: The Case for Bangladesh*, University Press Limited, Dhaka.
- Balassa, B. (1964), "The Purchasing Power Parity Doctrine: A Reappraisal", *Journal of Political Economy*, vol.72, pp.584-96.

- Balassa, B. (1978), "Exports and Economic Growth: Further Evidence", *Journal of Development Economics*, vol.5, pp.181-89.
- Balassa, B. (1982), *Development Strategies in Semi-Industrialised Economies*, New York: Oxford.
- Balassa, B. (1985), "Exports, Policy Choices, and Economic Growth in Developing Countries After the 1973 Oil Shock", *Journal of Development Economics*, vol.18, pp.23-35.
- Banerjee, A., Dolado, J.J., Galbraith, J.W. and Hendry, D.F.(1993), *Cointegration, Error-correction, and the Econometric Analysis of Non-stationary Data*, Oxford University Press.
- Bangladesh Bank (various years), *Economic Trends*, Statistics Department, Bangladesh Bank, Dhaka.
- Bangladesh Bureau of Statistics (BBS) (2000), *Poverty Incidence in Bangladesh Regional and National Estimates*, Ministry of Planning.
- Bangladesh Bureau of Statistics (BBS), *The Statistical Yearbook of Bangladesh*, Dhaka, Bangladesh, Various Issues.
- Bangladesh Bureau of Statistics (BBS) (2001), *National Accounts Statistics (Gross Domestic Product, 2000-2001)*, Ministry of Planning.
- Bangladesh Bureau of Statistics (BBS) (2000), *National Accounts Statistics of Bangladesh (Revised Estimates): 1989-90 to 1998-99*, Ministry of Planning.
- Bardhan, P.K. (1970), *Economic Growth, Development and Foreign Trade*, New York: Wiley.
- Barro, R.J. and Sala-i-Martin, X. (1995), *Economic Growth*, McGraw Hill.
- Bayes, A., Hussain, I. And Rahman, M. (1995) "Trends in the External Sector: Trade and Aid", Chapter 8 in Sobhan, R. (ed.) *Experiences with Economic Reforms: A Review of Bangladesh's Development 1995*, Centre for Policy Dialogue and University Press Limited, Dhaka, pp.243-297.
- Beddies, H. (1999), "Investment, Capital Accumulation, and Growth: Some Evidence from The Gambia 1964-98", *IMF Working Paper*, WP/99/117.
- Begum, S. and Shamsuddin, A.F.M. (1998), "Exports and Economic Growth in Bangladesh", *Journal of Development Studies*, vol.35, pp.89-114.
- Bhagwati, J.N. (1990), "Export Promoting Trade Strategy: Issues and Evidence", in Milner, C.R. (ed) *Export Promotion Strategies: Theory and Evidence from Developing Countries*, New York University Press.
- Bhagwati, J.N. (1978), *Anatomy and Consequences of Exchange Control Regime*, vol.1, Studies in International Economic Relations, No. 10, NBER: New York.
- Bhattachariya, D. (2002), "Bangladesh Economy in FY2001: Macroeconomic Performance", Chapter 1 in Sobhan, R (ed), *Bangladesh Facing the Challenges of Globalisation: A Review of Bangladesh's Development 2001*, Centre for Policy Dialogue and University Press Limited, Dhaka.
- Brecher, A. R. (1974), "Optimal Commercial Policy for a Minimum-Wage Economy", *Journal of International Economics*, vol.4, pp.139-49.
- Brecher, A. R. (1992), "An Efficiency-Wage Model with Explicit Monitoring: Unemployment and Welfare in an Open Economy", *Journal of International Economics*, vo.32, pp.179-91.
- Bruno, M., Ravallion, M. and Squire, L. (1996), "Equity and Growth in Developing Countries: Old and New Perspective on the Policy Issues", Policy Research Working Paper, No. 1563, World Bank.
- Buffie, E. (1986), "Devaluation, investment, and growth in LDCs", *Journal of Development Economics*, pp.361-79.

- Centre for Policy Dialogue (CPD) (1995), *Experiences With Economic Reform: A Review of Bangladesh's Development 1995*, University Press Limited, Dhaka.
- Charemza, W.W. and Deadman, D.F. (1992), *New Directions in Econometric Practice*, Edward Elgar, England.
- Chow, P.C.Y. (1987), "Causality Between Export Growth and Industrial Development: Empirical Evidence from the NICs", *Journal of Development Economics*, vol.26, pp.55-63.
- Chowdhury, O. H. (1995), "Fiscal Performance of Bangladesh", Chapter 4 in Sobhan, R. (ed), *Experiences with Economic Reforms: A Review of Bangladesh's Development 1995*, Centre for Policy Dialogue and University Press Limited, Dhaka.
- Coe, D. and Helpman, T. (1995), "International R&D Spillovers", *European Economic Review*, vol.39, no.5, pp.859-887.
- Connolly, M. (1983), "Exchange Rates, Real Economic Activity and the Balance of Payments: Evidence from the 1960s", in E. Claassen, and P. Salin (eds.) *Recent Issues in the Theory of Flexible Exchange Rates*, Amsterdam: North Holland.
- Cottani, J.A., Cavallo, D.F., and Khan, M.S. (1990), "Real Exchange Rate Behaviour and Economic Performance in LDCs", *Economic Development and Cultural Change*, pp.61-76.
- Darrat, A.F. (1987), "Are exports an Engine of Growth? Another Look at the Evidence" *Applied Economics*, vol. 19, pp.277-83.
- Datt, G. and Ravallion, M (2002), "Is India's Economic Growth Leaving the Poor Behind?", Policy Research Working Paper, World Bank, May.
- Davidson, R. and MacKinnon, J. (1993), *Estimation and Inference in Econometrics*, Oxford University Press.
- Deraniyagala, S. and Fine, B. (2001), "New Trade Theory Versus Old Trade Policy: A Continuing Enigma", *Cambridge Journal of Economics*, vol.25, pp.809-25.
- Dhawan, U. and Biswal, B. (1999), "Re-examining Export-led Growth Hypothesis: A Multivariate Cointegration Analysis for India", *Applied economics*, vol.31, pp.525-30.
- Diaz-Aalezandro, C. (1980), "Exchange Rates and the Terms of Trade in the Argentine Republic", Discussion Paper No. 341, Economic Growth Centre, Yale University.
- Diaz-Alejandros, C (1982), "Exchange Rate and Terms of Trade in the Argentine Republic, 1913-1976", in M.Syrquin and S Teitel (eds.), *Trade, Stability, Technology and Equity in Latin America*, Academic Press, 1982.
- Diaz-Alejandros, C. (1963), "A note on the impact of devaluation and the redistributive effect", *Journal of Political Economy*, vol71, pp.577-80.
- Diaz-Alejandros, C. F. (1965), *Exchange Rate Devaluation in a Semi-Industrialised Economy: The Experience of Argentina 1955-61*, MIT Press.
- Dickey, D.A. and Fuller, W.A. (1979), "Distribution of the Estimators for Autoregressive Time Series With a Unit Root", *Journal of the American Statistical Association*, vol. 74, pp.427-81.
- Dickey, D.A. and Fuller, W.A. (1981), "Likelihood Ratio Statistics for Autoregressive Time Series With A Unit Root", *Econometrica*, vol. 49, pp. 1057-72.
- Dixon, H. (1999), "Controversy: Exchange Rates and Fundamentals", *Economic Journal*, vol.109, November, pp.F652-F654.
- Dodaro, S. (1991), "Comparative Advantage, Trade and Growth: Export-Led Growth Revisited", *World Development*, vol. 19, pp. 1153-65.
- Dollar, D (1992), "Outer-Oriented Developing Economies Really Do Grow More Rapidly: Evidence From 95 LDCs. 1976-85", *Economic Development and Cultural Change*, vol.40, 545-66.

- Domac, I. and Shabsigh, G. (1999), "Real Exchange Rate Behaviour and Economic Growth: Evidence from Egypt, Jordan, Morocco, and Tunisia", *IMF Working Paper*, WP/99/40 International Monetary Fund.
- Doornik, J.A. and Hendry, D. (1997), *Modelling Dynamic Systems Using PcFiml 9 for Windows*, London: Timberlake Consulting.
- Dornbusch, R. (1980), *Open Economy Macroeconomics*, Basic Books: New York.
- Dornbusch, R., Fischer, S. and Samuelson, P. (1977), "Comparative Advantage, Trade and Payments in a Ricardian Model with a continuum of Goods", *American Economic Review*, vol.67, No.5, pp.823-839.
- Dorosh, P. and Valdes, A (1990), *Effects of Exchange Rate and Trade Policies on Agriculture in Pakistan*, Research Report 84, International Food Policy Research Institute, Washington, DC.
- Dornbusch, R. (1987), "Exchange Rates and Prices", *American Economic Review*, vol.77, pp.93-106.
- Dowla, A. (1996), "Real Exchange Rate in Bangladesh: An Empirical Analysis", in A.N.M. Wahid and C.E.Weiss (eds.), *The Economy of Bangladesh*, Chapter 10, pp. 139-150.
- Dowlah, C.A.F. (1999), "The Future of the Ready-made Clothing Industry in Bangladesh", *World Economy*, pp.933-953.
- Dutt, S.D. and Ghosh, D. (1994), "An Empirical Investigation of the Export Growth and Economic Growth Relationship", *Applied Economics Letters*, vol.1, pp.44-48.
- Dutt, S.D. and Ghosh, D. (1996), "The Export Growth and Economic Growth Nexus: A Causality Analysis", *Journal of Developing Areas*, vol.30, pp.167-82.
- Dutta, D. and Ahmed, N. (2001), "Trade Liberalisation and Industrial Growth in Pakistan: A Cointegration Analysis", mimeo.
- Edwards, S (1989), *Real Exchange Rates, Devaluation and Adjustment: Exchange Rate Policy in Developing Countries*, MIT Press.
- Edwards, S. (1986), "Are Devaluations Contractionary?", *Review of Economics and Statistics*, pp.501-508.
- Edwards, S. (1988), *Exchange Rate Misalignment in Developing Countries*, The International Bank for Reconstruction and Development/World Bank, Washington, DC.
- Edwards, S. (1989), *Real Exchange Rates, Devaluation, and Adjustment: Exchange Rate Policies in Developing Countries*, MIT Press.
- Edwards, S. (1989), *Real Exchange Rates, Devaluation, and Adjustment: Exchange Rate Policies in Developing Countries*, MIT Press.
- Edwards, S. (1992), "Trade Orientation, Distortion, and Growth in Developing Countries", *Journal of Development Economics*, vol.39, pp.31-57.
- Edwards, S. (1993), "Openness, Trade Liberalisation and Growth in Developing Countries", *Journal of Economic Literature*, vol.31, pp.1358-93.
- Edwards, S. (1997), "Trade Liberalisation Reforms and the World Bank", *American Economic Review*, vol.87, Issue 2, Papers and Proceedings, pp.43-48.
- Edwards, S. (1998), "Openness, Productivity and Growth: What Do We Really Know?", *Economic Journal*, vol.108, pp.383-98.
- Elbadawi, I. A. (1994), "Estimating Long Run Equilibrium Exchange Rate", in J. Williamson (ed.), *Estimating Equilibrium Exchange Rate*, Chapter 4, pp.93-132, Institute for International Economics, Washington, DC.
- Elbadawi, I and Soto, R. (1996), "Real Exchange Rate and Macroeconomic Adjustment in Sub-Saharan Africa and Other Developing Countries", *Journal of African Economics*, Vol.6, No.3, p-74-120.
- Engle, R. F., and Granger, C.W.J. (1987), "Cointegration and Error-Correction: Representation, Estimation and Technique", *Econometrica*, vol.55, pp.251-76.

- Engle, R.F. and Yoo, S. (1987), "Forecasting and Testing in Cointegrated Systems", *Journal of Econometrics*, vol.35.
- Esfahani, H.S. (1991), ""Exports, Imports and Economic Growth in Semi-Industrialized Countries, *Journal of Development Economics*, vol.35, pp.93-116.
- Feenstra, R.C., Dorsati Madani, T. Yang and C. Liang (1997), 'Testing Endogenous Growth in South Korea and Taiwan', NBER Working Paper No.6028.
- Feder, G. (1983), "On Exports and Economic Growth", *Journal of Development Economics*, vol.12, pp.59-73.
- Fosu, A.K. (1990), "Exports and Economic Growth: The African Case", *World Development*, vol.18, pp.831-35.
- Frankel, J.A. and Romer, D. (1999), "Does Trade Cause Growth", *American Economic Review*, vol.89, No.3, pp.379-99.
- Frenkel, J.A. (1981), "The Collapse of Purchasing Power Parity During the 1970s, *European Economic Review*, vol.16, no.1, pp.145-65.
- Ghartey, E.E. (1993), "Causal Relationship Between Exports and Economic Growth: Some Empirical Evidence in Taiwan, Japan and the US", *Applied Economics*, vol.25, pp.1145-52.
- Ghatak, S., Milner, C. and Utkulu, U. (1995), "Trade Liberalisation and Endogenous Growth: Some Evidence for Turkey", *Economics of Planning*, vol.28, pp.147-67.
- Ghatak, S., Milner, C. and Utkulu, U. (1997), "Exports, Export Composition and Growth: Cointegration and Causality Evidence for Malaysia", *Applied Economics*, vol. 29, 213-23.
- Ghura, D. (1997), "Private Investment and Endogenous Growth: Evidence Cameroon", *IMF Working Paper*, 97/165.
- Giles, J. and Williams, C. (2000), "Export-Led Growth: A Survey of the Empirical Literature and Some Non-Causality Results", *Journal of International Trade and Economic Development*, vol. 9, no.3, pp.261-338.
- Godfrey, L.G. (1978), "Testing Against General Autoregressive and Moving Average Error Models When the Regressors Include Lagged Dependent Variables", *Econometrica*, vol.46, pp.1293-1302.
- Granger, C.W.J. (1969), "Investigating Causal Relations by Econometric Models: Cross Spectral Methods", *Econometrica*, vol.37, pp.424-38.
- Granger, C.W.J. (1988), "Some Recent Development in A Concept of Causality", *Journal of Econometrics*, vol.39, pp.199-211.
- Granger, C.W.J. and Newbold, P. (1974), "Spurious Regressions in Econometrics", *Journal of Econometrics*, vol.2, pp.111-20.
- Greenaway, D. and Sapsford, D. (1994a), "What does Liberalisation Do for Exports and Growth", *Weltwirtschaftliches Archiv*, vol. 130, pp.152-74.
- Greenaway, D. and Sapsford, D. (1994b), "Exports, Growth and Liberalisation: An Evaluation", *Journal of Policy Modelling*, vol. 16, pp.165-86.
- Grennaway, D., Morgan, W. and Wright, P. (1998), "Trade Reform, Adjustment and Growth: What Does the Evidence Tell Us?", *Economic Journal*, vol.108, pp.1547-1561.
- Grossman, G., and Helpman, E. (1991), *Innovation and Growth in the Global Economy*, Cambridge, M.A., MIT Press.
- Gujarati, D. (1995), *Basic Econometrics*, Third Edition, McGraw Hill.
- Gylfason, T. (1999), "Exports, Inflation and Growth", *World Development*, vol. 27, no.6, pp.1031-1057.
- Gylfason, T. and Radetzki, M. (1985), "Does Devaluation Make Sense in the Least Developed Countries?" IIES Seminar Paper, University of Stockholm.

- Gylfason, T., and Schmid, M. (1983), "Does Devaluation Cause Stagflation?" *Canadian Journal of Economics*, pp.641-54.
- Hall, S.G. (1986), "An Application of the Granger and Engle Two-Step Estimation Procedure to the United Kingdom Aggregate Wage Data", *Oxford Bulletin of Economics and Statistics*, vol.48, p.238.
- Hall, S.G. (1991), "The Effects of Varying Lag Length VAR Models on the Maximum Likelihood Estimates of Cointegrating Vectors", *Scottish Journal of Political Economy*, vol.38, pp.317-23.
- Hanson, J. (1983), "Contractionary Devaluation, Substitution in Production and Consumption, and the Role of Labour Market", *Journal of International Economics*, vol.14., pp.179-189.
- Harberger, A. (1986), "Economic Adjustment and the Real Exchange Rate" in S. Edwards and L. Ahmed (eds.) *Economic Adjustment and Exchange Rates in Developing Countries*, Chicago, University of Chicago Press, pp.371-414.
- Harris, R.(1995), *Using Cointegration Analysis in Econometric Modelling*, Pentice Hall and Harvester Wheatsheaf.
- Harrison, A. (1996), "Openness and Growth: A Time-Series, Cross-country Analysis for Developing Countries", *Journal of Development Economics*, vol. 48, pp.419-447.
- Harrison, A. and Hanson, G.H. (1999), 'Who Gains from Trade Reform? Some Remaining Puzzles', *Journal of Development Economics* 59, pp. 125-54.
- Helleiner, G. (1994), "Introduction", in Helleiner, G. (ed.) *Trade Policy and Industrialisation in Turbulent Times*, Routledge.
- Heller, P.S. and Porter, R.C. (1978), "Exports and Growth: An Empirical Re-investigation", *Journal of Development Economics*, vol. 5, pp.191-93.
- Hendry, D. (1980), "Econometrics: Alchemy or Science", *Econometrica*, vol.47, p.403.
- Hendry, D. (1995), *Dynamic Econometrics*, Oxford University Press.
- Hendry, D. (1999), "An Econometric Analysis of US Food Expenditure, 1931-1989", Chapter 17 in Magnus, J.R. and Morgan, M.S. (eds), *Methodology and Tacit Knowledge: Two Experiments in Econometrics*, John Wiley and Sons.
- Hendry, D. and Richard, J.F. (1983), "The Econometric Analysis of Economic Time Series", *International Statistical Review*, vol.51, pp.3-33.
- Henriques, I, and Sadorsky, P. (1996), "Export-led Growth or Growth-driven Exports? The Canadian Case", *Canadian Journal of Economics*, vol.29, pp.541-55.
- Holden, D. and Perman, R. (1994), "Unit Roots and Cointegration for the Economists", in B. Bhaskara Rao (ed.) *Cointegration for the Applied Economists*, St. Martin's Press.
- Hsiao, C (1997), "Statistical Properties of the Two-Stage Least Squares Estimators Under Cointegration", *Review of Economic Studies*, vol. 64, pp. 385-98.
- Hsiao, C. (1979), "Autoregressive Modelling of Canadian Money and Income Data", *Journal of the American Statistical Association*, vol. 74, pp.553-60.
- Hsiao, C. (1981), "Autoregressive Modelling and Money-Income Causality Detection", *Journal of Monetary Economics*, vol.7, pp.85-106.
- Hussain, I., Rahman, A. and Rahman, M. (1997), "Current External Sector Performance and Emerging Issues", Chapter 6 in Sobhan, R. (ed.) *Growth or Stagnation? A Review of Bangladesh's Development 1996*, UPL, Dhaka, pp.161-219.
- Hwang, I. (1998), "Lon-run Determinant of Korean Economic Growth: Empirical Evidence from Manufacturing", *Applied Economics*, vol.30, pp.391-405.
- International Monetary Fund (2002), *International Financial Statistics Yearbook*, IMF, Washington, D.C.
- Isard, P. (1995), *Exchange Rate Economics*, Cambridge University Press.

- Islam, M. N. and Iftekharuzzaman, M. (1996), "Export-Growth Nexus in A Small Open Economy: The Case of Bangladesh" Chapter 15 in Weis, C.E. and Wahid A.N.M. (eds), *The Economy of Bangladesh: Problems and Prospects*, Westport, CT: Prager Publishing.
- Islam, M.N. (1998), "Exports Expansion and Economic Growth: Testing for Cointegration and Causality", *Applied Economics*, vol.30, pp.415-25.
- Islam, N., (1995), "Growth empirics: a panel data approach" *Quarterly Journal of Economics* vol. 110, pp. 1127–1170.
- Jarque, C.M. and Bera, A.K. (1987), "A Test for Normality of Observations and Regression Residuals", *International Statistical Review*, vol.55, pp.163-72.
- Jin, J.C. and Yu, E.S.H. (1995), "The Causal Relationship Between Exports and Income", *Journal of Economic Development*, vol.20, pp.131-40.
- Johansen, J. (1988), "Statistical Analysis of Cointegrating Vectors", *Journal of Economic Dynamics and Control*, vol.12, pp.231-54.
- Johansen, S. and Juselius, K. (1990), "Maximum Likelihood Estimation and Inference on Cointegration With Application to the Demand For Money", *Oxford Bulletin of Economics and Statistics*, vol.52, pp.169-210.
- Jung, W.S. and Marshall, P.J. (1985), "Exports, Growth and Causality in Developing Countries", *Journal of Developing Economics*, vol.18, pp.1-12.
- Kavoussi, R.M. (1984), "Export Expansion and Economic Growth: Further Empirical Evidence", *Journal of Development Economics*, vol.14, pp.241-50.
- Krueger, A.O.(1998), "Why Trade Liberalisation in Good for Growth", *Economic Journal*, vol.108, pp.1513-1522.
- Krueger, A.O. (1974), "The Political Economy of the Rent Seeking Society", *American Economic Review*, vol.64, No.3.
- Krugman, P. and Taylor, L. (1978), "Contractionary Effects of Devaluation", *Journal of International Economics*, pp.445-456.
- Kugler, P. (1991), "Growth, Exports and Cointegration: An Empirical Investigation", *Weltwirtschaftliches Archiv*, vol. 127, pp.73-82.
- Kunst, R.M. and Marin, D. (1989), "On Exports and Productivity: A Causal Analysis", *Review of Economics and Statistics*, vol.71, pp.699-703.
- Kwon, J. (1992), "The East Asia Challenge to Neoclassical Orthodoxy", *World Development*, vol.22, no.4, pp.635-44.
- Lall, S. (1992), "The East Asian Miracle: Does the Bell Toll for Industrial Strategy?", *World Development*, vol.22, no.4, pp.645-54.
- Lateef, S. (1995) (ed.), *The Evolving Role of the World Bank*, World Bank, Washington D.C.
- Leamer, E. (1988), "Measure of Openness", in *Trade Policy and Empirical Analysis*, edited by Baldwin, R., Chicago.
- Levine, R. and Renelt, D. (1992), "A Sensitivity Analysis of Cross-Country Growth Regressions", *American Economic Review*, vol.82, pp.942-63.
- Lizondo, J.S. and Montiel, P. (1989), "Contractionary devaluation in developing countries: an analytical overview", *IMF Staff Papers*, vol.36.
- Love, J. (1994), "Engines of Growth: The Export and the Government Sectors", *The World Economy*, vol.17, 203-18.
- Love, J. (1995), "Adoption of Export-led Growth Strategy in Bangladesh: Some Thoughts", Chapter 2 in Grieve, R. and Huq, M. (eds), *Bangladesh Strategies for Development*, University Press Limited, Dhaka.
- Lucas, R.E. (1988), "On the Mechanics of Economic Development", *Journal of Monetary Economics*, vol.22, pp.3-42.

- MacKinnon, J. (1991), "Critical Values for Cointegration Test", in Engle, R. and Granger, C. (eds) *Long-Run Economic Relationships: Readings in Cointegration*, Oxford University Press.
- Maddala, G.S. (1992), *Introduction to Econometrics*, 2nd Edition, McMillan: New York.
- Maddala, G.S. and Kim, I.M. (1998), *Unit Roots, Cointegration and Structural Change*, Cambridge University Press.
- Mallick, S.K. (1999), *Modelling Macroeconomic Adjustment With Growth in Developing Economies: The Case of India*, Ashgate.
- Marin, D. (1992), "Is the Export-led Growth Valid for the Industrialised Countries", *Review of Economics and Statistics*, vol.74, pp.678-88.
- McKinnon, J. (1991), "Critical Values of Cointegration Tests", Chapter 13 in Engle R.F. and Granger, C.W.J. (eds), *Long-Run Economic Relationships: Readings in Cointegration*, Oxford University Press.
- Medina-Smith, E. J. (2001), "Is the Export-Led Growth Hypothesis Valid For Developing Countries? A Case Study of Costa Rica", Policy Issues in International Trade and Commodities Study Series, No.7, UNCTAD, New York and Geneva.
- Michaley, M. (1977), "Exports and Growth: An Empirical Investigation", *Journal of Development Economics*, vol. 4, pp.49-53.
- Miller, S.M. and Upadhyay, M.K. (2000), "The Effects of Trade Orientation, Openness and Human Capital on Total Factor Productivity", *Journal of Development Economics*, vol.63, pp.399-423.
- Milner, C. and Morrissey, O. (1997) "Measuring Trade Liberalization in Africa", CREDIT Research Paper No. 97/3, University of Nottingham.
- Montiel, P.J. (1999a), "The Long-run Equilibrium Real Exchange Rate: Conceptual Issues and Empirical Research", in Hinkle, L.E. and Montiel, P.J. (eds) *Exchange Rate Misalignment: Concepts and Measurement for Developing Countries*, Oxford University Press for the World Bank.
- Montiel, P.J. (1999b), "Determinants of Long-run Equilibrium Exchange Rate: An Analytical Model", in Hinkle, L.E. and Montiel, P.J. (eds) *Exchange Rate Misalignment: Concepts and Measurement for Developing Countries*, Oxford University Press for the World Bank.
- Mujeri, M.K. (2002), "Globalisation and Poverty Links in Bangladesh: Some Broad Observations", Chapter 5 in Rehman Sobhan (ed) *Bangladesh Facing the Challenges of Globalisation: A Review of Bangladesh's Development 2001*, University Press Limited.
- Mujeri, M.K. (2001), "Macroeconomic Developments in the 1990s", in Abu Abdullah (ed) *Bangladesh Economy 2000: Selected Issues*, Bangladesh Institute of Development Studies, Dhaka.
- Muscатели, V.A. (1995), "NIE Export Performance Revisited: The Estimation of Export Demand Elasticities, and the Role of Product Differentiation and Growth" Chapter 2 in Currie D. and Vines, D. (eds.) *North-South Linkages and International Macroeconomic Policy*, Cambridge University Press, pp. 9-28.
- Muscатели, V.A., Stevenson, A.A., and Montagna, C. (1995), "Modelling Aggregate Manufactured Exports for Some Asian Newly Industrialising Economies", *Review of Economics and Statistics*, vol. 77, no. 1, pp.147-155.
- Muscатели, V.A., Srinivasan, T.G. and Vines, D. (1994), "The Empirical Modelling of NIE exports: An Evaluation of Different Approaches", *Journal of Development Studies*, vol.30, pp.279-302.
- National Board of Revenue (NBR) (2001), *Annual Report 1999-2000*, National Board of Revenue, Dhaka.

- Ocampo, J. and Taylor, L. (1998), "Trade Liberalisation in Developing Economies: Modest Benefit but Problem with Productivity Growth, Macro Prices and Income Distribution", *Economic Journal*, vol.108, 1523-46.
- Onafowora, O. and Oweye, O. (1998), "Can Trade Liberalization Stimulate Economic Growth in Africa", *World Development*, vol. 26, No. 3, pp.497-506.
- Park, S. R. and Kwon, J. K. (1995), "Rapid Economic Growth With Increasing Returns to Scale and Little or No Productivity Growth", *The Review of Economics and Statistics*, vol.77, pp.332-51.
- Perkins, D. H. (1992), "There are at Least Three Models of East Asian Development", *World Development*, vol.22, no.4, pp.655-61.
- Pesaran, M. H., Shin, Y. and Smith, R.J. (2001), "Bounds Testing Approaches to the Analysis of Long Run Relationships", *Journal of Applied Econometrics*, Special Issues in Honour of J.D. Sargan on the Theme, *Studies in Empirical Macroeconomics*, edited by D.F. Hendry and M.H. Pesaran, pp.289-326 and also University of Cambridge DAE Working Paper No.9907, Accessed from <http://www.econ.cam.ac.uk/faculty/pesaran/pss1r1.pdf>.
- Pesaran, M.H. and Pesaran, B. (1997), *Working With Microfit 4.0: Interactive Econometric Analysis*, (Users' Manual), Oxford University Press.
- Phillips, P. (1995), "Fully Modified Least Squares and Vector Autoregression", *Econometrica*, vol.63, 1023-78.
- Phillips, P.C.B. and Hansen, B. (1990), "Statistical Inference in Instrumental Variables Regression With I(1) Processes", *Review of Economic Studies*, vol.57, pp.99-125.
- Prebisch, Y. (1950), "The Economic Development of Latin America and Its Principal Problems", *Economic Bulletin for Latin America*, vol.7, pp.1-22.
- Pritchett, L. (1996), "Measuring Outward Orientation in LDCs: Can It be Done?", *Journal of Development Economics*, vol.49, pp.307-335.
- Rahman, A. and Razzaque, M.A. (2002), "Informal Border Trade Between Bangladesh and India: An Empirical Study in Selected Areas", Chapter 5 in Cookson, F.E. and Alam, S. (eds), *Towards Greater Sub-regional Economic Cooperation: Limitation, Obstacles, and Benefits*, University Press Limited, Dhaka.
- Rahman, M. (1999), "Export Promotion through Export Incentives: Bangladesh Incentive Regime in the Regional Context" in M. Huq (ed.) *Bangladesh Industrialisation Strategies*, University Press Limited, Dhaka, 1999.
- Rahman, S. H.(1994), "Trade and Industrialisation in Bangladesh: An Assessment", in G.K. Helliner (ed.) *Trade and Industrialisation in Turbulent Times*, Chapter 8, pp.259-291, Routledge.
- Rahman, S. Z. and Shilpi, F. J. (1996), *A Macroeconometric Model of the Bangladesh Economy: Model Estimation, Validation and Policy Simulation*, Research Monograph No. 17, Bangladesh Institute of Development Studies (BIDS), Dhaka.
- Rahman, S.H. (1990), *The External Economy of Bangladesh: Trends, Structure, and Terms of Trade*, Research Report No. 120, Bangladesh Institute of Development Studies, Dhaka.
- Rahman, S.H. (1994), "Trade and Industrialisation in Bangladesh", Chapter 8 in G.K. Helliner (ed), *Trade and Industrialisation in Turbulent Times*, Routledge.
- Rahman, S. and Rahman, A. (2002), "Estimation of Capital Stock for the Bangladesh Economy, Working Paper No.11, MIMAP-Bangladesh, BIDS, Dhaka.
- Ram, R. (1987), "Exports and Economic Growth in Developing Countries: Evidence from Time Series and Cross Section Data", *Economic Development and Cultural Change*, vol.35, pp.51-72.

- Ramsey, J.B. (1969), "Tests for Specification Errors in Classical Linear Least Squares Regression Analysis", *Journal of the Royal Statistical Society, Series B*, vol.31, pp.350-71.
- Rashid, M.A. and Rahman, M. (1998), "Management of Import Liberalisation and Export Promotion Strategies in Bangladesh", in Sobhan, R. (ed.) *Crisis in Governance: A Review of Bangladesh's Development 1997*, UPL, Dhaka.
- Ravallion, M., and Chen, S. (1996), "What can new survey data tell us about the recent changes in distribution and poverty"? Policy Research Working Paper 1694, World Bank.
- Razzaque, M.A. and Ahmed, N. (2000), "A Re-examination of Domestic Saving-Foreign Aid Relationship in the Context of Bangladesh", *The Bangladesh Development Studies*, vol. 26, No.4, December.
- Redding S. (1999), "Dynamic Comparative Advantage and Welfare Effects of Trade", *Oxford Economic Paper*, vol.51, pp.15-39.
- Rhodd, R. (1993), "The effects of real exchange rate changes on output: Jamaica's devaluation experience", *Journal of International Development*, vol.5, pp.291-303.
- Riedel, J. and Athukorala, P.C. (1995), "Export Growth and the Terms of Trade: the Case of Curious Elasticities", Chapter 3 in Currie D. and Vines, D. (eds.) *North-South Linkages and International Macroeconomic Policy*, Cambridge University Press, pp. 29-45.
- Riezman, R.G., Summers, P.M. and Whiteman, C.H. (1996), "The Engine of Growth or Its Handmaiden? A Time Series Assessment of Export-Led Growth", *Empirical Economics*, vol. 21, pp.77-113.
- Rodriguez, C. A. (1974), "The Non-Equivalence of Tariffs and Quota Under Retaliation", *Journal of International Economics*, vol. 4, pp.295-98.
- Rodriguez, F., and Rodrik, D. "Trade Policy and Economic Growth: A Skeptic's Guide to Cross National Evidence", NBER Macroeconomics Annual 2000.
- Rodrik, D. (1992), "Closing the Productivity Gap: Does Trade Liberalisation Really Help?" in Helleiner, G. (ed.) *Trade Policy and Industrialisation in Turbulent Times*, Routledge.
- Rodrik, D. (1995), "Getting Interventions Right: How South Korea and Taiwan Grew Rich", *Economic Policy*, pp. 55-107.
- Roemer, P. and Gugerty, M.K. (1997), "Does Economic Growth Reduce Poverty?" CAER Discussion Paper No. 5, Harvard Institute for International Development.
- Romer, P., (1992), "Two strategies for economic development: using ideas and producing ideas", WorldBank Conference on Economic Development. The World Bank, Washington, DC.
- Romer, P. (1986), "Increasing Returns and Long-run Growth", *Journal of Political Economy*, vol.94, pp.1002-37.
- Sachs, J. and Warner, A. (1995), "Economic Reforms and the Process of Global Integration", *Brookings Papers on Economic Activity*, p.1-95.
- Sadoulet, E. and de Janvry, A. (1995), "The Real Exchange Rate" in *Quantitative Development Policy Analysis*, Johns Hopkins.
- Sala-i-Martin, X. (1997), "I just ran two million regressions", *American Economic Review*, vol.82, 178-83.
- Sengupta, J.K. and Espana, J.R. (1994), "Exports and Economic Growth in Asian NICs: An Econometric Analysis for Korea", *Applied Economics*, vol.26, pp.41-51.
- Senhadji A. and Montenegro, C. (1998), "Time Series Analysis of Export Demand Equations: A Cross-Country Analysis", *IMF Working Paper*, WP/98/149.
- Senhadji, A. (1998), "Time Series Estimation of Structural Import Demand Equations: A Cross-Country Analysis", *IMF Staff Papers*, vol.45, no.2, pp.236-267.

- Senhadji, A. (1999), "Sources of Economic Growth: An Extensive Growth Accounting Exercise", *IMF Working Paper*, WP/99/77.
- Serletis, A. (1992), "Exports Growth and Canadian Economic Development", *Journal of Development Economics*, vol.38, pp.133-45.
- Sharma, S.C. and Dhakal, D. (1994), "Causal Analysis Between Exports and Economic Growth in Developing Countries", *Applied Economics*, vol.23, pp.1145-57.
- Sheehey, E.J. (1990), "Exports and Growth: A Flawed Framework", *Journal of Development Studies*, vol.27, 111-16.
- Sheehey, E.J. (1992), "Exports and Growth: Additional Evidence", *Journal of Development Studies*, vol.28, 730-34.
- Shun, J. and Sun, F. (1998), "On the Export-Led Growth Hypothesis: The Econometric Evidence From China", *Applied Economics*, vol.30, pp.1055-65.
- Siddiki, J.U. (2002), "Trade and Financial Liberalisation and Endogenous Growth in Bangladesh", *International Economic Journal*, vol. 16, No.3, pp.23-37.
- Sims, C. A. (1972), "Money, Income and Causality", *American Economic Review*, vol.62, pp.540-52.
- Singer, H. (1950), "The Distribution of Gains Between Investing and Borrowing Countries", *American Economic Review, Papers and Proceedings*, vol.40, pp.473-85.
- Sobhan, R. (ed) (1995), *Experiences with Economic Reforms: A Review of Bangladesh's Development 1995*, Centre for Policy Dialogue and University Press Limited, Dhaka.
- Solow, R.M. (1956), "A Contribution to the Theory of Economic Growth", *Quarterly Journal of Economics*, vol.70, pp.65-94.
- Stern J.J., Mallon, R D, and Hutcheson, T.L. (1988), "Foreign Exchange Regimes and Industrial Growth in Bangladesh" *World Development*, Vol.16, No.12, pp.1419-1439.
- Swan, T.W. (1956), "Economic Growth and Capital Accumulation", *Economic Record*, vol. Vol.32, pp.334-61.
- Swan, T.W. (1960), "Economic Control in a Dependent Economy", *Economic Record*, Vol.36, pp.51-66.
- Thornton, J. (1996), "Cointegration, Causality and Export-Led Growth in Mexico, 1895-1992", *Economics Letters*, vol.50, pp.413-16.
- Tyler, W. (1981), "Growth and Export Expansion in Developing Countries", *Journal of Development Economics*, vol.9, 121-30.
- Ukpolo, V. (1994), "Export Composition and Growth of Selected Low Income African Countries: Evidence From Time Series Data", *Applied Economics*, vol.26, pp.445-49.
- Upadhyaya, K. and Upadhyay, M. (1999), "Output effects of devaluation: Evidence from Asia", *Journal of Development Studies*, vol.35, pp.89-103.
- Vamvakidis, A. (2002), "How Robust is the Growth-Openness Connection? Historical Evidence", *Journal of Economic Growth*, vol.7, pp.57-80.
- Van den Berg H. and Schimidt, J.R. (1994), "Foreign Trade and Economic Growth: Time Series Evidence From Latin America", *Journal of International Trade and Economic Development*, vol.3, pp.121-30.
- Wade, R (1990), *Governing the Market: Economic Theory and the Role of Government in East Asian Countries*, Princeton University Press.
- White, H. (1980), "A Heteroscedascity Consistent Covariance Matrix Estimator and a Direct Test of Heteroscedasticity", *Econometrica*, vol.48, pp.817-818.
- White, H. and Wignaraja, G. (1991), "Nominal and Real Devaluation During Trade Liberalization: Aid Induced Dutch Disease in Sri Lanka", Development Studies Working Paper, Centro Studi Luca D'Agliano, Queen Elizabeth House, Oxford University.

- White, H. and Wignaraja, G. (1992), "Exchange Rate, Trade Liberalization and Aid: The Sri Lankan Experience", *World Development*, vol.20, pp.1471-1480.
- Winters, L. A. (2000), "Trade, Trade Policy and Poverty: What Are the Links?",
- World Bank (1993), *The East Asian Miracle: Economic Growth and Public Policy*, Oxford University Press.
- World Bank (1996), *Bangladesh: Trade Policy Reform for Improving Incentive Regime*, Private Sector Development and Finance Division, Country Department I, South Asia Region, Report No. 15900-BD.
- World Bank (1999), *Bangladesh: Trade Liberalization: Its pace and Impact*, Report No. 19591-BD, Poverty Reduction and Economic Management Division, South Asia Region.
- World Bank (2002), *World Development Indicators 2002 CD-ROM*, World Bank, Washington, D.C.
- Xu, Z. (1996), "On the Causality Between Export Growth and GDP Growth: An Empirical Re-investigation", *Review of International Economics*, vol.4, pp.172-84.
- Young, A. (1994), "Lessons from East Asian NICs: A Contrarian View", *European Economic Review*, vol.38, pp.964-73.