EXCHANGE RATES, INTERNATIONAL TRADE AND INFLATION: A DEVELOPING ECONOMY PERSPECTIVE

by

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ABSTRACT

The thesis focuses on empirical modelling and estimation of the role of exchange rate in international trade adjustment, trade prices and domestic inflation in the context of developing countries. Although the study's prime focus is to estimate empirically, using Bangladesh as the main case study, the theoretical assumptions about the effectiveness of exchange rates polices towards trade prices, domestic inflation and trade performance, we also examine the asymmetric behaviour of 'large exchange rate shocks' in trade flows of other South Asian countries such as India, Pakistan and Sri Lanka. Estimated results demonstrate that the exchange rate has a significant positive impact on trade balance in the short- and long-run. However, the *J-curve* phenomenon can be explained as an appropriate response of trade balance to exchange rate shocks. Along with relative prices and domestic real income, the export demand is also found to be the significant determinant of import demand function. We find '*complete*' exchange rate pass-through to import price in both the short- and long-run. However, the '*second stage pass-through*' to consumer prices is found to be only '*partial*' in both the short- and long-run. Trade liberalization is a significant phenomenon for Bangladesh's trade and inflation. Hysteresis in international trade is found to be a 'commodity and country specific' phenomenon. Sunk costs are not found to be significant for hysteresis.

To

my parents, wife
and
my daughter, Naira

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CONTENTS

List of Tables

List of Figures

Abbreviations and Acronyms

ADB:	Asian Development Bank
ADF:	Augmented Dickey-Fuller
AR:	Autoregression
ARCH:	Autoregressive Conditional Heteroscedasticity
ASEAN:	Association of Southeast Asian Nations
BBS:	Bangladesh Bureau of Statistics
CPI:	Consumers Price Index
CUSUM:	Cumulative Sum
DF	Dickey-Fuller
DOTS:	Direction of Trade Statistics
ECM:	Error Correction Model
EC:	Error Correction
EG:	Engle and Granger
ERPT:	Exchange Rate Pass-Through
EMS:	European Monetary System
ESAF:	Extended Structural Adjustment Facilities
EU	European Union
FIML:	Full-Information Maximum Likelihood
GDP:	Gross Domestic Product
HYS:	Hysteresis
IFS:	International Financial Statistics
IMF:	International Monetary Fund
IRF:	Impulse Response Function
KPSS:	Kwiatkowski-Phillips-Schmidt-Shin
LCP:	Local Currency Pricing
LDCs	Least Developed Countries
LM:	Lagrange Multiplier
LOP:	Law of One Price
MFA:	Agreement the Multifibre Arrangements
ML:	Marshall-Lerner

NEER:	Nominal Effective Exchange Rate
$NEER^m$:	Nominal Effective Exchange Rate of Import
$NEER^x$:	Nominal Effective Exchange Rate of Export
OECD:	Organization for Economic Cooperation and Development
OLS:	Ordinary Least Squares
PTM:	Pricing-To-Market
PCP:	Producer Currency Pricing
PP:	Phillips-Peron
PPI:	Producers Price Index
PRGF:	Poverty Reduction and Growth Facility
RMG:	Readymade Garment
REER:	Real Effective Exchange Rate
RER:	Real Exchange Rate
RESET:	Regression Error Specification Test
SAF:	Structural Adjustment Facilities
SITC:	Standard International Trade Classification
US:	United States
USA:	United States of America
UK:	United Kingdom
VAR:	Vector Autoregression
WTO:	World Trade Organization
WDI:	World Development Indicators
WPI:	Wholesale Price Index

Articles and Conference Papers from this Thesis

Journal Article:

_Does a real devaluation improve the balance of trade? Empirics from Bangladesh economy', ***The Journal of Developing Areas,*** forthcoming.

Conference Papers:

1. *"Is there exchange rate hysteresis in UK imports: Evidence from bilateral aggregate and disaggregate South Asian data"* – presented in the ***ESRC Corporate Governance, Regulation and Development Seminar Series***, Seminar V, Birmingham Business School, University of Birmingham, 25 September, 2009, and the Department of Economics, University of Birmingham on 19 November 2009.

2. *'Exchange Rate Pass-Through to Import, Export and Domestic Prices: Evidence from a Developing Country'* – presented in the _2009 Annual Conference', ***Scottish Economic Society***, 27 - 29 April 2009, Perth, Scotland with the conference grant provided by the Department of Economics, University of Birmingham and the 5th PhD Meeting, 16-17 January, 2010 of the ***Royal Economic Society***, City University London. Australasian Meeting 2009 (***Econometrics Society***), ***AIB Annual Meeting***, USA, Hong Kong Economics Association also accepted my papers for presentation.

3. *„Determinants of Aggregate Imports Demand of Bangladesh: Cointegration and Error Correction Modelling'* – presented in the 18th International Conference, ***International Trade and Finance Association***, May 21-24, 2008, Lisbon, Portugal with the conference grants provided by the Department of Economics, University of Birmingham, UK.

4. *„Does a real devaluation improve the balance of trade? Empirics from Bangladesh economy'* – presented in the ***Small Open Economics in a Globalized World conference***, June 12-15, 2008, Waterloo, Ontario, Canada with the conference grants provided by the _Royal Economic Society', UK and _School of Social Sciences', University of Birmingham.

CHAPTER ONE

INTRODUCTION

1.1 Introduction

Since the collapse of ‗Bretton Woods System' in 1971, the economics of exchange rates has become an interesting area of research for academics, practitioners and policy makers. The study of appropriate exchange rate alignment to improve economic performance (see, for example, Edwards 1989; Cottani, Cavallo and Khan 1990) is an important issue of research for policy measures. Another important motivational factor which has encouraged research into the study of exchange rates has been the world's major financial crises in the 1990's, namely, the European Monetary System (EMS) crisis in 1992-1993, the Mexican crisis in 1994-1995 (which spread to a number of South American countries) and the Asian crisis in 1997-1998. Noticeably all the above mentioned crises and the ongoing financial crisis (i.e., Credit-Crunch), which was first observed in spring 2007 in the US real estate mortgage market and then spread to Europe and the rest of the world at the end of July 2007 (see, Jobst and Kwapil, 2008), led to massive volatility in exchange rates and these exchange rate shocks ultimately affected bilateral and multilateral trade of host countries. Hence, the derivation of appropriate policy implications requires investigating the *de facto* behaviour of exchange rate shocks and the short and long-term impact of exchange rate movements on the economy.

The exchange rate is a powerful factor which has the potential to influence both the internal and external balance of an economy. Studies have found that the real exchange rate significantly affects economic growth (see, for example, Rodrik, 2008; Berg and Miao, 2010) particularly for developing countries (see, for example, Rodrik, 2008). Growth may be achieved through higher savings (see, for example, Montiel and Servén, 2008), productivity growth (see, for example, Aghion, Bacchetta, Ranciere and Rogoff, 2006),

and/or growth in the exports sector (see, for example, Chan and Dang, 2010; Sulaiman and Saad, 2009; Khalid and Cheng, 1997; Ahmad and Yang, 1997; Mahadevan, 2009).

The exchange rate regime also plays an important role in macroeconomic performance (see, for example, Rogoff, Husain, Mody, Brooks and Oomes, 2003; Domac, Peters and Yuzefovich, 2001; Ghosh, Gulde, Ostry and Wolf, 1997).

There are three key basic exchange rate regimes: pegs, managed float and free float. However, in practice Edwards and Savastano (1999) find nine different exchange rate regimes. Furthermore, the International Monetary Fund (IMF) (Annual Report 2005-09), has categorised eight to eleven different types of recently practised exchange rate arrangements. All regimes listed by the IMF in last five years and the respective number of countries under each regime are given as follows:

Table 1.1: De facto Classifications of Exchange Rate Regimes

Exchange Rate Regime	Number of Countries				
	2005	2006	2007	2008	2009
(a) Hard Pegs:					
Exchange arrangements with no separate legal tender	41	41	10	10	10
Currency board arrangements	7	7	13	13	13
(b) Soft Pegs:					
Conventional peg arrangements	42	49	70	68	42
(c) Intermediate Pegs:					
Stabilized arrangement	-	-	-	-	13
Crawling pegs	5	5	6	8	5
Crawling bands/ Crawl-like arrangement	1	-	1	2	1
Pegged exchange rates within horizontal bands	5	6	5	3	4
Managed floating with no pre-determined path for the exchange rate /Other managed arrangement	52	53	48	44	21
(d) Floating Arrangements:					
Floating exchange rate	-	-	-	-	46
Independent/Free floating	34	26	35	40	33

Source: Appendix II, IMF Annual Report 2005- 2009.

The choice of the exchange rate arrangement depends on the policy makers‘ objectives. The IMF classifies (see, for example, IMF Annual Reports 2005-09) the

principle monetary policy framework of the member countries which directly or indirectly influence exchange rate regime choices. The major monetary policy frameworks are presented as follows:

Table 1.2: Monetary Policy Framework

Monetary policy framework	Number of Countries				
	2005	2006	2007	2008	2009
Exchange rate anchor	89	96	103	115	103
Monetary aggregate target	22	31	22	22	25
Inflation target framework	22	24	27	44	29
Fund supported (IMF/donors) or other monetary programs	19	8	7	-	-
Others (including countries which have no explicitly stated nominal anchor, but rather monitor various indicators in conducting monetary policy.)	38	35	34	11	31

Source: Appendix II, IMF Annual Report 2005-2009.

The majority of the world‘s developed and transition economies follow a free floating exchange rate arrangement (see, Appendix Table II.9, IMF Annual Report 2009). Hence, the exchange rates of these economies are determined by market demand and supply of foreign and domestic currencies. Countries with a ‗free floating exchange rate arrangement‘ may influence their exchange rate indirectly through macroeconomic intervention (e.g. by varying macroeconomic variables such as the money supply and interest rates). On the contrary, developing countries generally (with few exceptions) adopt

a _soft-pegs‘ or _intermediate pegs‘ exchange rate regime (see, Appendix Table II.9, IMF Annual report 2009). As a result, unlike developed countries, developing countries may implement their exchange rate policies to influence their volumes and prices of export and import, as well as domestic inflation.

Developing economies, particularly those economies with an _export-led growth policy‘ have tried to carry out their own exchange rate policies, in particular to maintain competitiveness of their products in the world markets and maintain a viable _external account‘ position. Other important objectives of an active exchange rate policy of developing countries are to maintain stable internal prices, encourage remittances inflow and increase foreign exchange reserves. However, these policies are not necessarily always successful. Razin and Collins (1997), for example, find that merely a very large overvaluation is associated with lower economic growth, whilst a moderate-to-high undervaluation is associated with rapid economic growth. Moreover, Krugman and Taylor (1978) demonstrate that there are some contradictory effects of devaluation too, which can be easily seen from real world data.

The exchange rate, in general, directly affects a country‘s export and import, thereby impacting the trade balance (see, for example, Rose, 1990; Rose, 1991; Zhang, 1996; Wilson, 2001; Singh, 2002; Vergil, 2002; and Musila and Newark, 2003; Matesanz G´omez and Fugarolas ´Alvarez-Ude, 2007). The trade balance (specifically, imports and exports) of a country depends on the following aspects: (i) effectiveness of its exchange rate regimes (pegs, managed float or free float), (ii) choice of exchange rate policy (undervaluation or overvaluation), (iii) exchange rate pass-through to internal[1] and external[2] prices (complete or partial), (iv) size of exchange rate devaluation-or-revaluation

[1] CPI and WPI/PPI
[2] Export and import prices

(appreciation-or-depreciation) and (v) the trade response to ‗large exchange rate shocks' (symmetric or asymmetric response; and positive or negative response). It is worth noting that the impact of exchange rate movements is not always symmetric. For example, in the literature (see, for example, Baldwin, 1986; Baldwin, 1988b; Baldwin and Krugman, 1989; Dixit, 1989a; Dixit, 1989b; Baldwin and Lyons, 1994; Roberts and Tybout, 1997) theories of asymmetrical behaviour of large exchange rate shocks have been proposed. Empirical studies have also provided evidence to support asymmetrical behaviour (see for example, Bean, 1987; Baldwin, 1988a; Parsley and Wei, 1993; Anderton, 1999; Giovannetti and Samiei, 1995; Martinez-Zarzoso, 2001; Campa, 2004).

Moreover, the effectiveness of exchange rate can be country and commodity specific. The impact of an exchange rate shock also depends on the size (small or large economy) and the openness status (amount of trade barriers) of the economy.

The main aim of this study is to develop an understanding of the role of the exchange rate in trade balance and aggregate import demand, trade prices and domestic inflation of developing countries. Although, this research will focus on Bangladesh as a case study; we will also examine the impact of ‗large exchange rate shocks' on the trade flows of other South Asian countries such as India, Pakistan and Sri Lanka.

1.2 Motivation

Since independence in 1971, Bangladesh, similar to many other developing countries, has pursued an active exchange rate policy. This active exchange rate policy is reflected in its frequently announced exchange rate devaluations and exchange rate regime shifts. Exchange rate studies on Bangladesh have noted frequent exchange rate movements. For instance Islam (2003) cites 89 adjustments in the exchange rate from 1983 to 2003 of which 83 were devaluations, while Aziz (2003) observed 41 devaluations between 1991 and 2000. Younus and Chowdhury (2006) also note significant devaluations (130 times) between 1972 and 2002. Moreover, the active exchange rate policy is also reflected by the exchange rate regime shifts of the country – first from _pegs' to _managed float' in 1979, and then from _managed float' to _free float' in 2003 (*de jure*).

The principal objectives of the exchange rate policy of Bangladesh are to maintain competitiveness of Bangladeshi products in the world market, accelerate exporting, reduce extra pressure of imports, maintain a viable external account position, maintain stable internal prices, and encourage remittances. Islam (2003) states that the monetary authority determines the exchange rate policy aiming to achieve both _domestic' and _external' targets. The _external targets' include: reduction of the current account gap, promotion of the level of international reserves, controlling the trends of exchange rate movements into the local inter-bank foreign exchange market and adjusting the trends in exchange rates of neighbouring trade partners. Hossain and Allauddin (2005) demonstrate that the main objectives of the exchange rate policies of Bangladesh are to: promote international competitiveness; encourage export diversification; withdraw subsidies from the export sector; discourage import growth and rearrange resources in import substitute and export oriented sectors. According to the _Financial Sector Review (2006)' of the Bangladesh

Bank, the key aims of exchange rate policy are to: maintain competitiveness of Bangladeshi products in the world markets, encourage remittances inflow, maintain stable internal price and maintain a viable external account position. However, only few studies examine the effectiveness of the exchange rate on international trade of Bangladesh. Rahman and Islam, 2006; Chowdhury and Siddique, 2006; and Hoque and Razzaque, 2004 are the exceptions who estimate the J-curve/S-curve hypothesis, exchange rate pass-through to domestic prices and exchange rate pass-through to export prices at industry level, respectively.

A continual devaluation of currency causes high volatility in exchange rates which affects macroeconomic variables such as inflation and interest rates. Historically, Bangladesh has been concerned with its inflation rate, which on average in the past five years from 2005-2009 has stood at 8 percent[3] and has become a considerable threat to economic stability. A high degree of exchange rate pass-through to domestic prices may be assumed as one of the potential reasons for the country‘s higher inflation rate. This is because if exchange rate pass-through to domestic prices is higher, undervaluation will cause high inflation for the country. Consequently, Bangladesh needs to be sure about actual scale of pass-through from the exchange rate to inflation. However, Chowdhury and Siddique (2006) is the only paper which has studied exchange rate pass-through to domestic prices for Bangladesh and find, surprisingly, insignificant exchange rate pass-through to domestic prices. This finding needs to be re-investigated to derive the appropriate policy implications.

Moreover, for developing economies, the investigation of exchange rate pass-through to import prices is an important issue for the following reasons. First, most

[3] Source: Table VIII, (Monthly) Economic Trends, May 2010, Bangladesh Bank.

developing countries have been pursuing an export-led growth strategy wherein exchange rates policy is expected to play a very active and key role. Secondly, developing economies usually import technology and other intermediate inputs for their exporting industries. Given this, any exchange rate undervaluation obviously leads to increased demand for exports which, in turn, increases the overall demand for imports at the same time. If viewed from this perspective, exchange rate pass-through to import prices becomes a significant area of study especially for developing countries. Not only that, as import price is one of the principal channels through which the exchange rate affects domestic prices also, the pass-through of the exchange rate to domestic prices can be an important area of research. However, none of the studies estimates the exchange rate pass-through to import prices of Bangladesh.

The existing theoretical and empirical literature suggests that temporary but large exchange rate shocks have a permanent effect on international trade. Precisely, although a temporary but large appreciation shows an enormous increase in import volume, a reverse situation cannot reduce import volume in equal magnitude. For example, a certain magnitude of large appreciation (suppose) can increase the import up to a certain level. However, an equal magnitude of depreciation cannot reduce import to the same level. In this particular case, the impact of appreciation on import demand is larger in magnitude than that of depreciation. There is therefore an asymmetric effect of the exchange rate on imports. This asymmetric behaviour of large exchange rate shocks is known as hysteresis in international trade.

It is worth noting that the current literature has tested the hysteresis hypothesis for developed countries only and there is no work in the context of developing countries.

Furthermore, the theoretical literature on the hysteresis phenomenon suggests that hysteresis in trade occurs due to ‗sunk costs' of exporting firms. However, none of the papers in the literature assesses the above statement empirically.

There currently exist knowledge gaps in understanding the effectiveness of exchange rates polices and their impact upon trade prices, domestic inflation and trade adjustment. Hence, the effectiveness of exchange rate policy of developing countries, especially Bangladesh, is important both for analysing the performance of these measures and also for drawing out further policy implications. The main aim of this study is to develop a better understanding about the justification for frequent exchange rate policy channel in Bangladesh. The thesis therefore estimates the effectiveness of exchange rate movement on trade.

The study will focus on empirical modelling and estimation of the trade balance, determinants of import demand, exchange rate pass-through and hysteresis in trade for developing countries. However, the study's prime focus is to estimate empirically, using Bangladesh as the main case study, the theoretical assumptions about the effectiveness of exchange rates polices towards trade prices, domestic inflation and trade balance. We also examine the asymmetric behaviour of ‗large exchange rate shocks' in trade flows of other South Asian countries such as India, Pakistan and Sri Lanka.

1.3 Key concepts

The study empirically estimates the following concepts of international trade theory in the context of developing countries. A brief definition of the concepts is given as follows; however, details about the notions are presented in the relevant chapters as appropriate.

Exchange Rate

The exchange rate, in this thesis, is defined as the amount of domestic currency per unit of foreign currency. Hence, increase in the exchange rate stands for devaluation or depreciation, and decrease in the exchange rate stands for revaluation or appreciation. The Nominal Effective Exchange Rate (NEER) is the trade weighted exchange rate with foreign currencies (trade partners‘ currency). The Real Effective Exchange Rate (REER) adjusts NEER by respective foreign price level and deflated by the domestic price level.

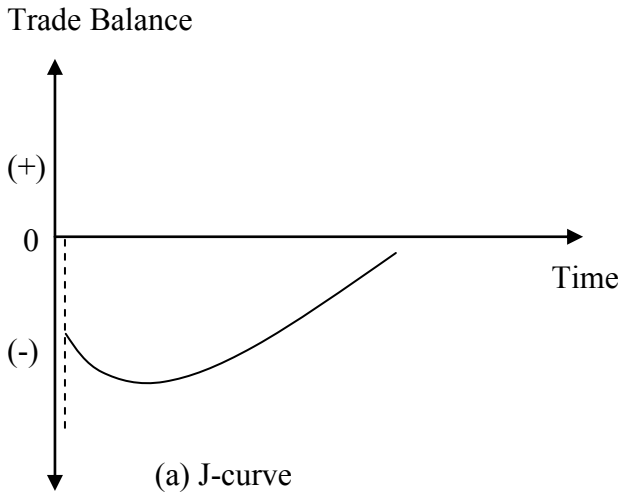
Marshall-Lerner Condition:

The Marshall-Lerner condition states that devaluation in the exchange rate can improve the balance of trade if the sum of import and export demand elasticities is greater than unity. However, empirical evidence suggests that even if the Marshall-Lerner condition holds in an economy, devaluation may worsen the balance of trade initially (in the short-run); however, it should improve the balance of trade in the long-run (see, for example, Bahmani-Oskooee, 1985; Backus, Kehoe and Kydland, 1994; Senhadji, 1998; Onafowora, 2003).

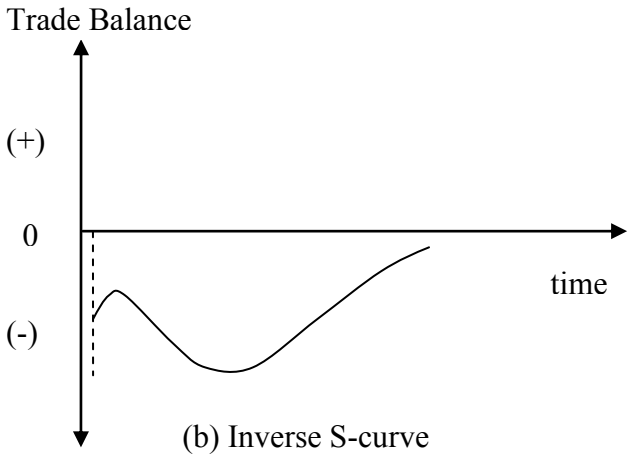
J-curve/S-curve hypothesis:

This concept emerged when empirical studies had attempted to apply the Marshall-Lerner condition in real data of developing and developed countries. The J-curve hypothesis refers to a specific type of response of trade balance to real devaluation in the exchange rate, saying that - following devaluation in the real exchange rate the balance of trade deteriorates initially; however, it improves eventually and we experience a _J'-shaped balance of trade curve.

Figure 1: The J-Curve/S-curve-shaped response of trade balance to exchange rate shocks.



(a) J-curve



(b) Inverse S-curve

Some literature also suggests that the S-curve (inverse S) seems to be an actual response of trade balance to the real exchange rate devaluations (see, for example, Backus, Kehoe and Kydland, 1994; Senhadji, 1998). The S-shape balance of trade curve suggests that following devaluation the balance of trade improves in the very short-run, however, it deteriorates in the medium-run and eventually it improves again (in the long-run).

Exchange rate pass-through:

By ‗exchange rate pass-through' we mean the percentage changes in the import and domestic prices (in local currency term) in response to a one percent change in the exchange rate. If the response is one-to-one, the pass-through is known as the *'complete'* exchange rate pass-through. However, if the pass-through is found to be less than one, it is known as the *'partial'* exchange rate pass-through. It is worth mentioning that the exchange rate in this thesis is calculated by the amount of local currency exchanged for each unit of foreign currency.

Second-stage-pass-through:

External prices may affect the domestic prices; especially, import prices may affect domestic prices. As the exchange rate can influence the import prices, the domestic prices can be affected indirectly by the exchange rate change. This is called the ‗second-stage-pass-through' in international trade.

Hysteresis in International Trade:

The term "hysteresis" is derived from an ancient Greek word meaning "deficiency" or "lagging behind". Hysteresis in economics refers to a phenomenon that ‗a temporary

shock may have a permanent (long lasting) effect‘. This concept was first introduced in labour economics, which says that hysteresis is assumed to be present in the labour market if after some period of unemployment workers lose their ability to influence wage settlement and therefore they may become permanently unemployed.

Baldwin (1986) first formally introduced the idea of the hysteresis hypothesis in international trade. In international trade, it is a common belief that a temporary exchange rate shock would have only a temporary affect on trade prices and trade volumes. The size of the impact depends on the size of exchange rate shock. However, if a temporary exchange rate shock has a persistent (i.e., hysteretic) effect on trade prices and trade volumes we define this concept as _hysteresis‘ in international trade (see, for example, Baldwin, 1986; Dixit, 1989a; Dixit, 1989b; Parsley and Wei, 1993).

Vector Autoregression (VAR):

In linear model estimation, it is customary to arbitrarily choose one of the variables as endogenous and other variables as exogenous. However, Sims (1980) points out that in macroeconomics, there may have simultaneous relation among the variables and therefore all variables in a model should be treated on equal footings. Hence, there should not be any prior distinction between endogenous and exogenous variables before testing them. Sims then suggests the VAR model approach. In a simple regression framework, the VAR model can be given as follows:

$$Y_t = \alpha + \sum_{i=1}^{n} \beta_i Y_{t-i} + \sum_{j=1}^{m} \gamma_j X_{t-j} + u_{1t}$$

$$X_t = \mu + \sum_{i=1}^{n} \theta_i Y_{t-i} + \sum_{j=1}^{m} \lambda_j X_{t-j} + u_{2t}$$

where, Y_t and X_t depend on the lags of each other and they are also autoregressive series in the sense that they depend on own lags as well; u_{1t} and u_{2t} are the stochastic error terms which are called impulses or innovations in the VAR language.

Co-integration:

In the time series analysis, two or more variables may produce a very high R^2 value in the regression although, in reality, there is no meaningful relationship between them. This is called *„spurious regression'*. This may occur if the variables (in the model) show strong trend. Hence the high R^2 observed is due to the presence of trend, not to an actual relation. A test for cointegration can be run to avoid the spurious regression. If two or more variables are cointegrated, we assume that the features of the time series regression model are stable in the long-run. Presently, there are many existing econometric techniques (such as the Engle-Granger method, the Johansen maximum likelihood cointegration test, the bound testing approach, the Phillips-Ouliaris cointegration test) which are used to test the cointegration among variables.

Error Correction Model (ECM):

If we find that the variables of our interest are cointegrated, i.e, a long-run equilibrium relationship holds between the variables, we still find that in the short-run there may be disequilibrium. In the ECM the short-run dynamics of the variables in the system are influenced by the deviation from long-run equilibrium. The ‗error correction term' in a dynamic equation, called the ‗speed of adjustment', captures the rate of adjustment towards the long-run equilibrium in each period. For example, if we consider

two cointegrated variables, y_t and x_t, and the general form of equation is written as follows,

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \beta_0 x_t + \beta_1 x_{t-1} + \varepsilon_t \qquad \text{where, } \varepsilon_t \sim IN(0, \sigma^2)$$

If $\alpha_1 + \beta_0 + \beta_1 = 1$ or $1 - \alpha_1 = \beta_0 + \beta_1$, the equation can be written as:

$$\Delta y_t = \alpha_0 + (1 - \alpha_1)(y_{t-1} - x_{t-1}) + \beta_0 \Delta x_t + \varepsilon_t$$

The above equation now is in the ECM form where $(y_{t-1} - x_{t-1})$ is the error correction term and the coefficient of it, $(1 - \alpha_1)$ is called the speed of adjustment.

It is worth mentioning that although Sargan (1964) first introduced an _ECM' type model, it has become a very popular specification for dynamic equations since Davidson, Hendry, Srba, and Yeo (1978) was published.

1.4 Contribution of the Research

This study has made several contributions to existing knowledge. The main contribution of the study is empirically modelling and investigating trade balance, and trade and domestic prices of developing countries in response to exchange rate shocks. Furthermore, the thesis empirically tests some key theoretical notions of international trade namely, the *„J-curve hypothesis'*, *„exchange rate pass-through'* (*ERPT*), *„pricing-to-market'* (*PTM*) and the *„hysteresis hypothesis'*. The study constructs nominal effective exchange rates (*NEER*), real effective exchange rates (*REER*), import trade weighted nominal effective exchange rates ($NEER^m$), export trade weighted nominal effective exchange rates ($NEER^x$) which are not readily available for Bangladesh in any of the national or international databases.

Currently, this study is the first and only empirical research which models the balance of trade of Bangladesh with a theoretical foundation. The study tests whether the *„Marshall-Lerner Condition'* is met using data from Bangladesh. We also examine whether the J-curve pattern can be explained as appropriate response of Bangladesh's trade balance to real exchange rate movements. Currently there is only one study (see, Rahman and Islam, 2006) which estimates whether the J-curve or S-curve hypothesis is appropriate for Bangladesh. However, Rahman and Islam (2006) use 'taka-dollar exchange rate' as the explanatory variable for the trade balance of Bangladesh in a bivariate framework. The shortcomings of Rahman and Islam's (2006) study are twofold; firstly they ignore the real effective exchange rate and secondly the study may experience 'excluded variable bias'. The 'taka-dollar exchange rate' cannot be an appropriate proxy for the overall exchange rate for estimating the aggregate trade balance of Bangladesh. It is worth noting that Bangladesh, on an average, exports only about 27 percent and imports about 4 percent to

and from the USA, respectively, which represents only 15.5% of total trade of the country (see, Direction of Trade statistics 1972-2007, the IMF). Furthermore, the theoretical and empirical literature (see, for example, Dornbusch, 1975; Rose, 1990 and 1991; Rose and Yellen, 1989; Singh, 2002; Gomes and Paz, 2005; Hsing 2008) support the use of domestic and foreign income as the determinants of trade balance; Rahman and Islam (2006) have not used these factors. Subsequently, neither the exchange rate proxy, nor the empirical model used by Rahman and Islam (2006), is appropriate for accurately estimating the relationship between the exchange rate and the Bangladeshi trade balance. On the contrary, our study employs an empirical model with a proper theoretical foundation. The *REER* is used as the main control variable for estimation, thereby eliminating the shortcomings of Rahman and Islam (2006).

Testing the J-curve phenomenon for Bangladesh leads us to test whether export demand is a significant determinant of import demand of Bangladesh. The J-curve behaviour occurs when devaluation of the currency encourages imports or/and discourage exports in the short-run. However, if the Marshall-Lerner condition holds in an economy, a devaluation of currency leads to improve the trade balance subsequently. In case of Bangladesh, it seems that real devaluation increases the export demand of the country. However, this increased demand cannot increase export supply immediately due to capacity constraint. As Bangladesh imports a large amount of capital goods for its exporting industries, in effect, devaluation of currency can increase the demand for import of capital goods for exporting firms in the first place. This assumption leads us to test whether export demand is a significant determinant of import demand for Bangladesh. Hence, the study estimates the import demand function of Bangladesh using both

traditional and uncommon determinants (e.g. export demand, foreign exchange reserves) of import demand.

Secondly, conventional wisdom suggests that in developing countries exchange rate pass-through is _omplete', unlike for developed countries. In this study we investigate whether, the exchange rate pass-through to import and domestic prices are _omplete' for developing countries. Although, Hoque and Razzaque (2004), and Chowdhury and Siddique (2006) have studied exchange rate pass-through to export and domestic prices for Bangladesh, respectively, neither of these studies has investigated the exchange rate pass-through to import prices. Moreover, Chowdhury and Siddique (2006) find no evidence of pass-through to domestic prices. By contrast, this study has found evidence of a significant exchange rate pass-through to domestic prices in the short-and long-run.

Finally, the thesis tests the hysteresis hypothesis in bilateral international trade flows for developing countries, particularly hysteresis in the UK imports from South Asian countries. We also investigate the validity of the proposition that _hysteresis occurs due to _sunk entry costs' of trading firms'. We initiate a _double dummy approach' to test the hysteretic effect of _large appreciations' and/or _large depreciations', which subsequently, helping us to correctly identify the size (magnitude) and type (sign) of hysteretic effects in trade flows. It is worth noting that the existing literature has used a _single dummy approach' to test the hysteresis hypothesis. A shortcoming of the _single dummy approach' is that the dummy cannot clearly indicate the effect of large appreciation and large depreciation on trade flows. Moreover, this study, for the first time, estimates the hysteresis hypothesis in the context of developing countries.

1.5 Structure of the Thesis

The thesis is structured to present the theoretical background as well as empirical estimates of the role of exchange rate in international trade adjustment, trade prices, and domestic inflation. The study also investigates whether the exchange rate has any asymmetrical effect (due to large exchange rate shocks) on international trade flows in the perspective of developing countries.

The thesis is structured into six chapters following this introduction.

Chapter two presents an historical overview of the exchange rate, trade policies, and trade performance of Bangladesh from its independence until now. This chapter also point outs the structural changes in Bangladesh‘s trade and exchange rate policies, such as trade liberalization policy, exchange rate regime shifts and significant swing in monetary policy frameworks over time. Product-wise structural change, country-wise export trade over-decades and latest share of major export products are also presented in this chapter.

Chapter three provides a theoretical background and an empirical estimation of the role of exchange rate in the evolution of trade balance of Bangladesh. This chapter tests whether there is any causal relation between the exchange rate and the balance of trade using the Granger Causality test. We subsequently test for cointegration and estimate the error correction model in this chapter to find the long- and short-run relations between trade balance and exchange rate. This chapter also tests the validation of the Marshall-Lerner condition and the J-curve phenomenon for Bangladesh using a VAR approach.

Chapter four critically evaluates the existing theoretical and empirical models for the import demand function and empirically estimates the significant determinants of aggregate import demand function for developing countries. Different cointegration techniques and error correction modelling are used for estimation. Using empirical

evidence, this chapter attempts to show that along with the relative prices and real income variables, export demand and foreign exchange reserves are also significant determinants of import demand for developing countries.

Chapter five estimates the exchange rate pass-through to internal and external prices. Using the ECM, this chapter estimates the exchange rate pass-through to import and domestic prices for Bangladesh in the short- and long-run. The paper uses the _delta method' to measure the non-linear, long-run coefficients of variables. The paper examines whether pricing-to-market occurs in the imports of this developing country. The paper also tests whether trade liberalization significantly affects the import prices and rate of inflation.

Chapter six tests an important hypothesis in international trade theory, called _the hysteresis hypothesis' in a bilateral aggregate and disaggregate commodity trade framework. More specifically, the paper tests whether any asymmetric behaviour in response to large appreciations and depreciations can be noticed in UK bilateral import from South Asian countries. The paper constructs both single (see, Parsley and Wei, 1993) and double hysteresis dummies and subsequently applies them while estimating the hysteresis model. We plot a single hysteresis dummy variable which exhibits the large appreciations and depreciations of UK exchange rate for entire sample period. Similar to our previous paper (Chapter Five), the paper use the ECM and the delta methods to find short- and long-run coefficients. Recursive estimates are provided to examine the movements of import demand in response to large exchange rates shocks, over time.

Chapter seven concludes the thesis with some policy implications, discussing the shortcomings of the study, and suggesting further research in the relevant field.

CHAPTER TWO

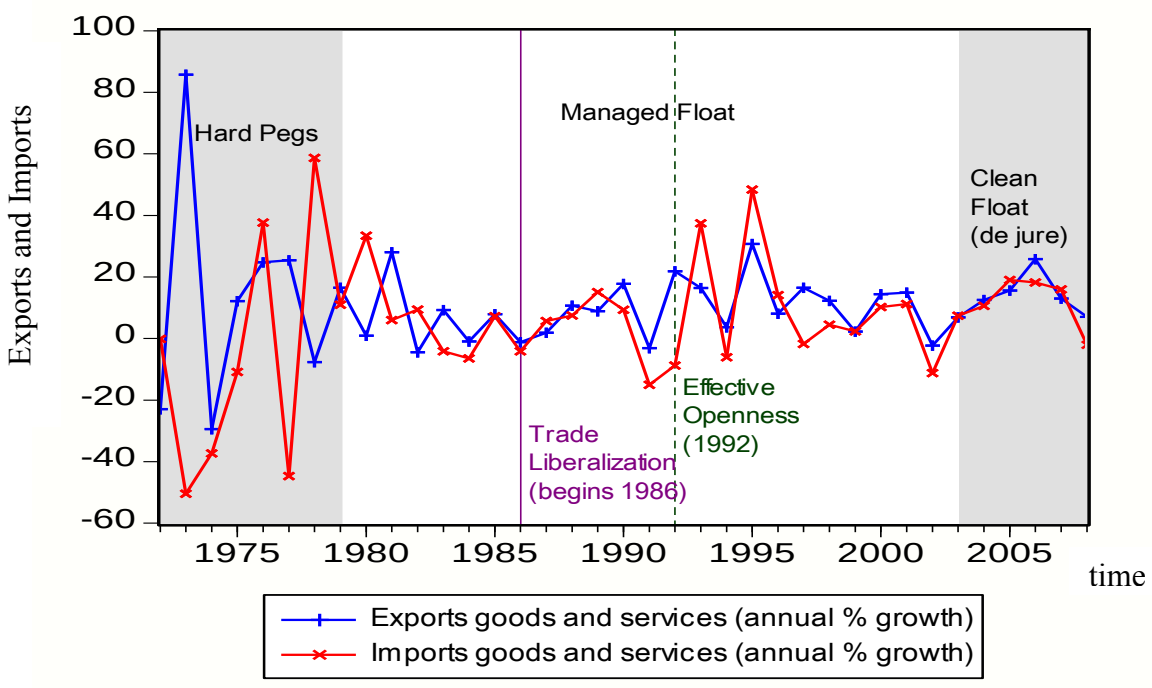
AN OVERVIEW OF EXCHANGE RATE AND TRADE POLICY OF BANGLADESH

2.1 Introduction

Immediately after independence in 1971, Bangladesh adopted a highly regulated financial, fiscal and industrial policy along with an inward-oriented, _import-substituting' trade and _overvalued' exchange rate system. The resulting _macroeconomic performance' was not satisfactory in terms of GDP growth, inflation, industrial output, fiscal deficit and balance of trade. To achieve higher and sustained economic growth and rapid development, Bangladesh, like many other developing countries, soon shifted from the inward-looking regime towards a more liberalized, market oriented regime. Since the 1980's, trade and industrial policies have been aimed at achieving higher export growth. The main hallmarks of the then exchange rate and trade policies were to achieve international competitiveness in the export sector, faster growth of export-oriented industries, tariff rationalization, access to bigger markets, encourage import of intermediate _capital goods'. Although _trade liberalization' has gradually taken place since the 1980s, it gained momentum during the early 1990s through a huge reduction in tariff rates and quantitative restrictions and convertibility in exchange rates (see, for example, Dutta and Ahmed, 1999). Since the early -1980's Bangladesh has pursued a liberalizing trade policy consistent with the idea of Uruguay Round Accord of the World Trade Organization (WTO). It is worth mentioning that Bangladesh has been pursuing its trade liberalization policies in two decades through three phases (see, for example, Razzaque, Khondker, Ahmed and Mujeri, 2003) which gradually took place in 1982 (World Bank suggested policy), 1986 (IMF suggested the Structural Adjustment Facilities, *SAF*) and 1989 (IMF suggested the Extended Structural Adjustment Facilities, *ESAF*). However, the actual liberalization process began from 1986 with a significant reduction in tariff and quota

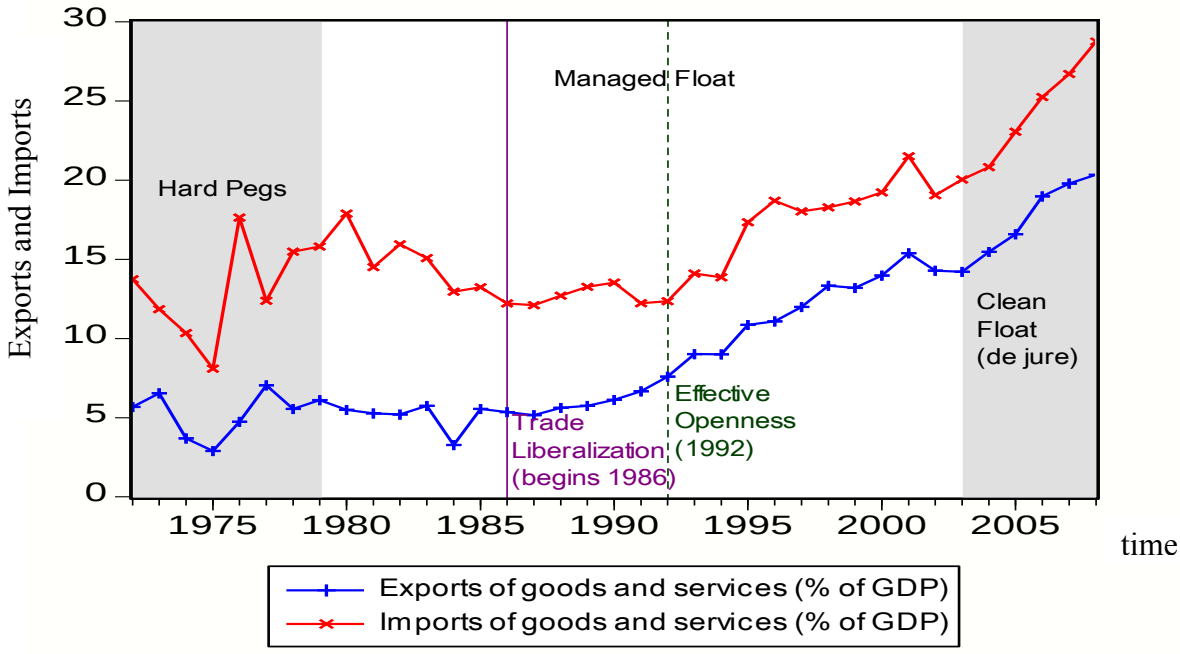
restrictions. The following figures show Bangladesh's export and import performance over time:

Figure 2.1: Exports and imports of goods and services over-time (annual % growth).



Data Source: World Development Indicators (Edition: April 2010), World Bank.

Figure 2.2: Exports and imports of goods and services over-time (% of GDP)



Data Source: World Development Indicators (Edition: April 2010), World Bank.

Figure 2.1 and Figure 2.2 indicate that volatility in trade flows is higher in the ‗pegged regime' and the early stages of ‗managed float' regime of Bangladesh compared to the latter stage of ‗managed float' and ‗free float' regimes. Until 1980, the volatility may also be explained as the outcome of economic and political turmoil (oil shock in the early 1970s and a bloody military coup in 1975)[4] or exchange rate undervaluation or both. However, after 1980, Bangladesh's trade flows might be explained as a result of exchange rate or trade policy or both.

2.2 Trade Policy and Performance

Bangladesh has pursued some short and long term import and export policies in its economic history. The country has pursued short-term (one-year and two-year export-import policies in the 1980s) and long-term (five-year, 1997-2002) liberalized export-import policy to achieve a favourable balance of trade along with enhancement in remittances and foreign exchange reserves. After the termination of the first five-year policy the authority further announced a medium-term, three-year (2003-2006) export-import policy for the country. According to the ‗Trade Policy Review' report of the Bangladesh government (August 2006), the key objectives of the above mentioned policies were mainly (a) export-led growth and development, (b) reallocate resources in export oriented and import substituting sectors, (c) trade liberalization and (d) sustaining the shocks of rapidly changing world trade regimes.

According to the ‗Trade Policy Review Report' (2006) of the WTO, keeping in view a long-term development goal, Bangladesh has been pursuing an outward looking growth strategy, trying to reduce anti-export bias and improve competitiveness in export

[4] see, Kalam and Aziz (2009).

markets. According to the ‗Import Policy Order 2003-2006', the country wishes to expand the import of modern technology, make importing easy for exporting industries, and coordinate import policy with export, industrial and other relevant policies to facilitate the WTO objectives, globalization and gradual development of a free market economy.

The following Table 2.1 and Figure 2.3 present the changes in Bangladesh's tariff structures due to the above mentioned openness policies over time.

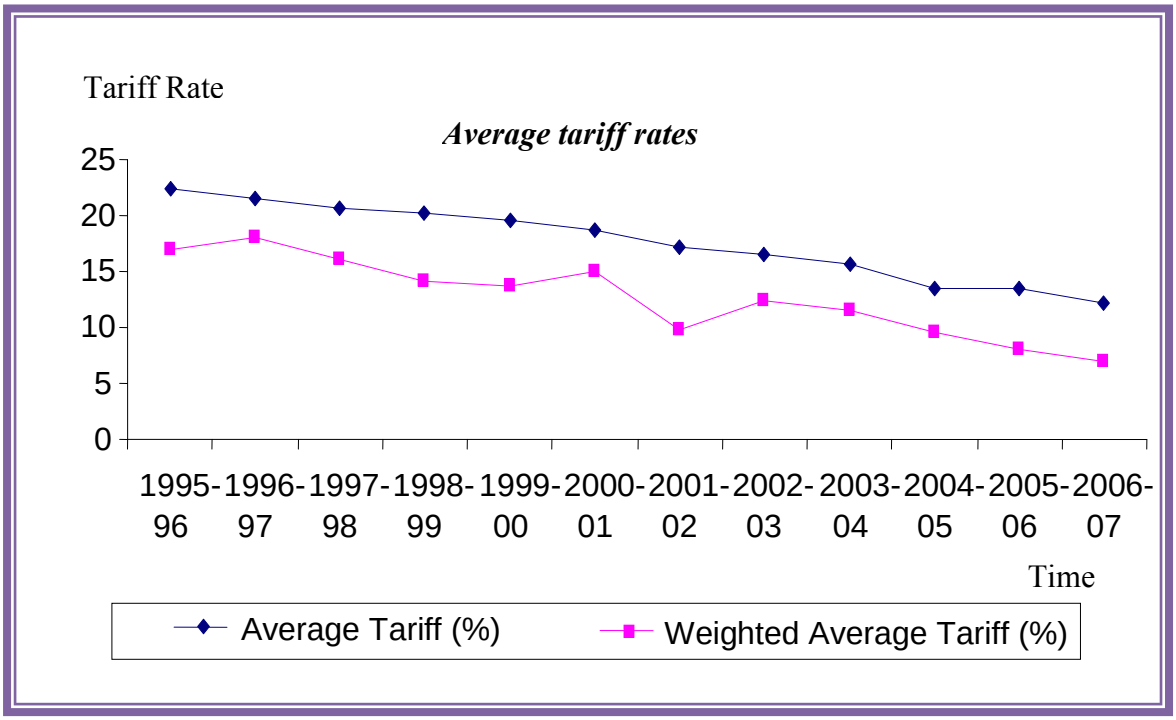
Table 2.1: Trend in applied tariff rates, item-wise, 1999/00 and 2005/06

Product and Processing	Number of items	Tariff average 1999/00	Tariff 2005/06		
			Average	Standard Deviation	Coefficient of Variation (CV)[5]
Total	6637	22.2	15.5	8.8	0.6
1st stage of processing	932	17.7	14.9	10.0	0.7
Semi-processed	2014	20.6	14.4	7.6	0.5
Fully processed	3691	24.1	16.3	9.1	0.6

Data Source: Trade Policy Review 2006, WTO Secretariat

[5] *CV<1 indicates low-variance; however, CV>1 indicates high-variance.*

Figure 2.3: Import liberalization of Bangladesh



Data Source: National Revenue Board (NBR), Bangladesh.

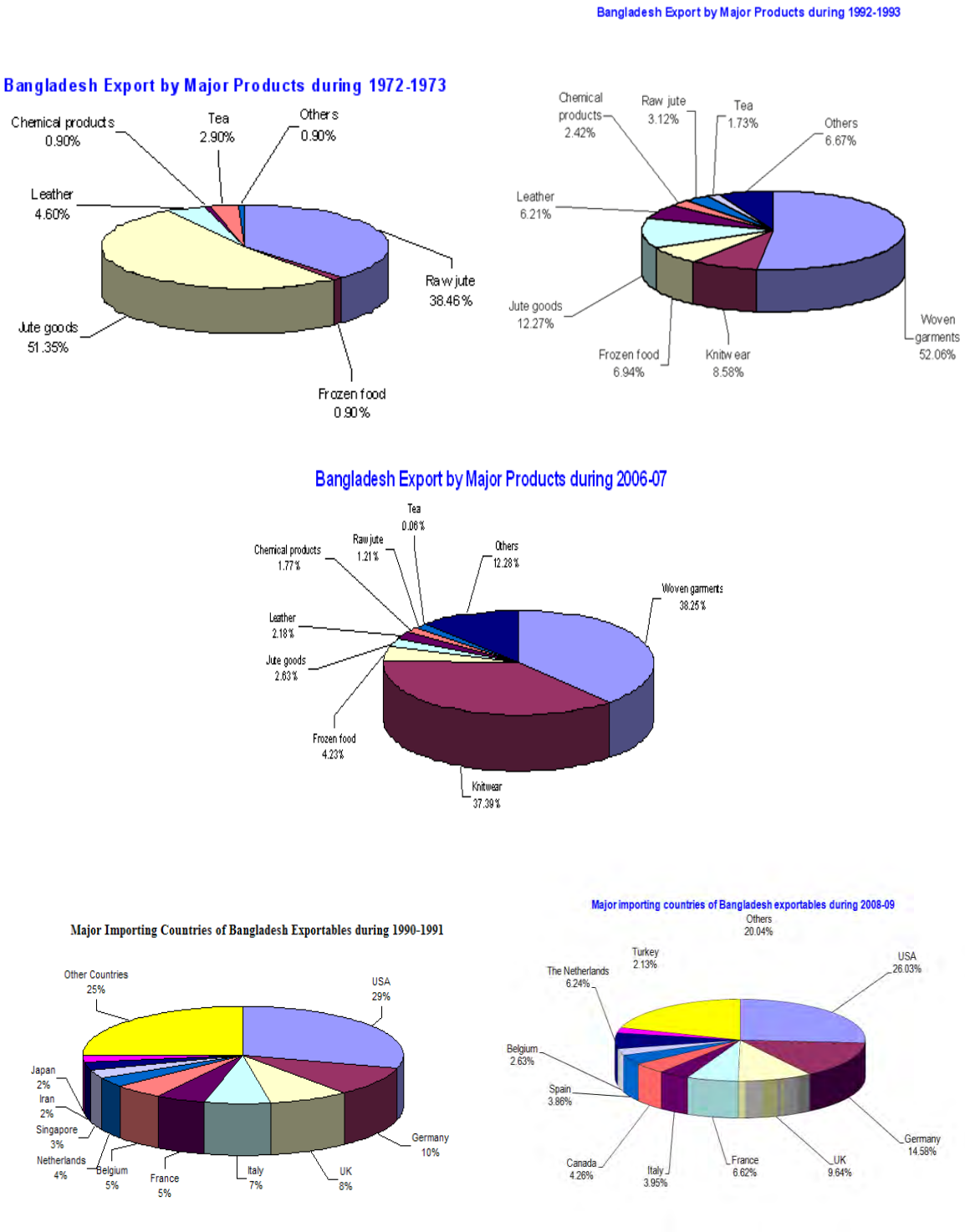
The above figure and table show a downward trend of Bangladesh‘s average tariff rate which indicates that trade liberalization has been gradually taking place over time.

At present, about 80 percent of Bangladesh‘s total exports depend on merely one product: readymade garment (RMG)[6]. Until the 1990‘s jute and jute products were the major exporting commodities of the country. However, RMG has taken the place of jute items since the 1990‘s. RMG exports have been growing faster since 1986 when the USA and EU imposed *‗quota restrictions*‘. The quota system has been an advantage rather than a disadvantage for Bangladesh for the following reasons: (i) the quota for Bangladesh was very large and this attracted foreign buyers to source their merchandises from Bangladesh, (ii) RMG needs low-technology and is labour-intensive, and Bangladesh is a labour abundant country, (iii) the government of Bangladesh has been providing special

[6] Export Promotion Bureau, Ministry of Commerce, Bangladesh .

incentives to promote this export-oriented industry, (iv) due to a large quota for Bangladesh the country enjoyed privileged access to the US and European market, while its competitors (in RMG sector), namely India, China, Malaysia, South Korea, Sri Lanka and other countries were disadvantaged by the ‗quota restrictions'. Following the Uruguay Round Agreement, the ‗*Multifibre Arrangements'* (MFA) for ‗textiles and clothing' was valid until December 2004. Hence, after the MFA era, there could have been an enormous fall in RMG industrial growth. However, the MFA protection helped the RMG industry to be a strong competitor in the world market and this industry is still going strong. A product-wise structural change over decades and product-wise export shares are given as follows (see, Figure 2.4 and Table 2.2). It is worth mentioning that although there were some structural changes in Bangladesh's exports in term of its product share, however, there was no structural difference in Bangladesh's exports in terms of its trade partners (see, Figure 2.4).

Figure 2.4: Product-wise structural change and country-wise export trade over-decades.



Source: Export Promotion Bureau, Ministry of Commerce, Bangladesh (18th February, 2010).

Table 2.2: Share of major export products

Share of major export products (2009-2010)		
01	Woven Garments	37.11%
02	Knitwear	40.01%
03	Frozen Food	2.73%
04	Jute Goods	4.86%
05	Leather	1.40%
06	Agricultural Products	1.50%
07	Chamical Products	1.92%
08	Footwear	1.26%
09	Other	9.21%

Source: Export Promotion Bureau, Ministry of Commerce, Bangladesh.

2.3 Exchange Rate Policy

Immediately after independence Bangladesh pegged its exchange rate with the British Pound Sterling in January 1972. However, after the breakdown of the Bretton Woods system sterling floated against the dollar. Since then the ‗taka' was floated through its link to the sterling. In August 1979, the monetary authority pegged the exchange rate to a basket of major trading partners' currencies and the sterling was used as the intervening currency. Since 1983 the US Dollar has replaced the Pound Sterling as the intervening currency.

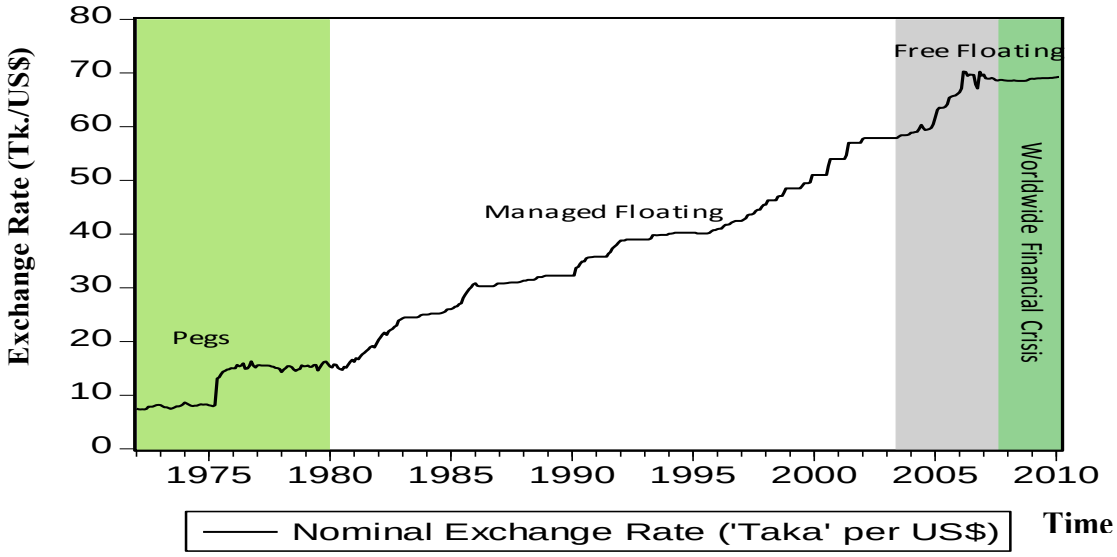
Bangladesh followed a ‗pegged exchange rate' system till 1979. Between 1979 and mid-2003, the country pursued a managed floating exchange rate regime. Continual devaluation of the domestic currency, in order to maintain a stable real exchange rate and

avoid overvaluation of domestic currency, was the prime goal of this regime. Although the IMF believes that from 1979 till now Bangladesh has pursued a *de facto* managed floating exchange regime (see, IMF Annual Report 2009), since May 2003 the country has officially introduced a kind of ‗clean floating' exchange rate policy by making it fully convertible on the current account, although capital account controls still are in place.

This is worth mentioning that in this study the exchange rate is measured by the amount of local currency per unit of foreign currency. For example, if we consider Bangladesh as the domestic country and the US as the foreign country, then, devaluation (in a non-floating exchange rate system) or depreciation (in a free floating exchange rate system) of the *Taka* would require more amount of *Taka* per US dollar (i.e., exchange rate increases). On the other hand, appreciation of the *Taka* stands for less amount of *Taka* per US dollar (i.e, exchange rate falls).The following figures represent Bangladeshi nominal exchange rate movements, and the variation in export and import trade under different exchange rate regimes. Figure 2.5 shows that the Bangladeshi exchange rate with respect to the US dollar has been depreciating since 1972, with some large and small shocks. In 1975, there was a huge devaluation of the ‗taka' caused perhaps by a massive famine in 1974 and a bloody coup in 1975 (see, for example, Kalam and Aziz 2009). Thus, to attract investors to invest in export oriented firms and attracts more export demand, the authorities enormously devalued the currency at this time. A notable feature of the behaviour of Bangladesh's exchange rate is that the exchange rate was increasing at a moderate rate until 2003. However, after inception of floating exchange rate regime in 2003, exchange rate depreciated faster than before. This faster growth of exchange rate continued until around August 2007. Finally, the currency appreciated during the world financial crises from the late-2007s.

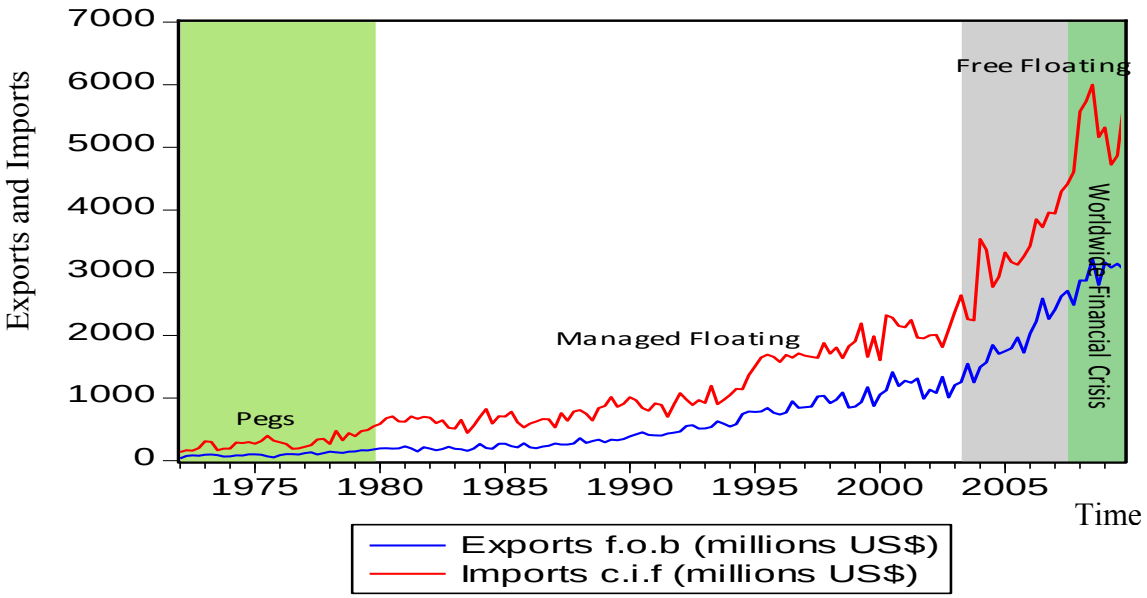
The gap between nominal import and export trade (see, Figure 2.6) has increased from around the 1990s onward. This happened may be because of the effect of trade liberalization policies (see, for example, Dutta and Ahmed, 1999).

Figure 2.5: Nominal exchange rate movements over three (basic) exchange rate regimes of Bangladesh.



Data Source: Monthly IFS Series (Country Tables), May 2010

Figure 2.6: Nominal export and import of Bangladesh (in million US$).



Data Source: Quarterly IFS Series (Country Tables), May 2010

However, the aforesaid fundamental changes in exchange rate policy did not stem from within; instead the government adopted it as a result of its obligations under the IMF article VIII on March 24, 1994 by making the _taka' fully convertible for current account transactions. Subsequently, as a member of the IMF, the country was under pressure to open its exchange rate market. Finally, on May 31, 2003 the monetary authority introduced a floating exchange rate arrangement (*de jure*) in the current account and then the IMF approved a loan for the country under the Poverty Reduction and Growth Facility (PRGF). As mentioned above, although Bangladesh has been pursuing a *de jure* free floating exchange rate regime in the current account, the IMF still classifies the Bangladesh's exchange rate arrangement as a form of managed floating regime. The IMF has been publishing a classification of the *de facto* exchange rate regimes of member countries since 1998 (see, for example, Habermeier, Kokenyne, Veyrune and Anderson, 2009). A brief

history of exchange rate arrangements of Bangladesh along with its monetary policy framework is given as follows:

Table 2.3: Regime shifts of Bangladesh's exchange rate and monetary policy (1996-2009)[7].

Year	**Exchange rate regimes**	**Monetary policy framework**
1996	*Pegged - Currency Composite (other than SDR)*	N/A
1997	*Pegged - Currency Composite (other than SDR)*	N/A
1998	*Pegged - Currency Composite (other than SDR)*	N/A
1999	*Other conventional fixed peg arrangements (including de facto peg arrangements under managed floating)- with a basket of currencies.*	*IMF supported or other Monetary Program*
2000	*Other conventional fixed peg arrangements (including de facto peg arrangements under managed floating) – Against a composite*	*Exchange Rate Anchor*
2001	*Other conventional fixed peg arrangements (including de facto peg arrangements under managed floating) – Against a composite*	*Exchange Rate Anchor*

[7] Source: Appendix II: Financial Operations and Transactions, IMF Annual Report 1996-2009. Note, IMF annual reports start listing the *de facto* exchange rate regimes from 1996.

2002	*Other conventional fixed peg arrangements (including de facto peg arrangements under managed floating) – Against a single currency*	*Exchange Rate Anchor*
2003	*Other Conventional Fixed Peg Arrangements*[8]	*Exchange Rate Anchor*
2004	*Managed Floating with No Predetermined Path for the Exchange Rate*	*Monetary Aggregate Anchor*
2005	*Managed floating with no predetermined path for the exchange rate*	*Monetary aggregate target*
2006	*Managed floating with no predetermined path for the exchange rate*	*Monetary aggregate target*
2007	*Managed floating with no predetermined path for the exchange rate*	*Monetary aggregate anchor*
2008	*Other conventional fixed peg arrangements*	*Exchange rate anchor*
2009	*Stabilized arrangements*	*Exchange rate anchor*

The above table indicates that Bangladesh is still pursuing a *de facto* managed floating exchange rate regime. Historically, the country targets two alternative monetary policy frameworks: the Monetary Aggregate Anchor (monetary authority uses its instruments such as M1, M2 and international reserves to achieve a targeted growth rate of economy) or/and the Exchange rate anchor (to keep the exchange rate at its pre-announced

[8] *‗de jure'* exchange rate regime is ‗free floating' in current account.

level or range monetary authority buy or sell foreign exchange). Although high inflation rate, very often, is considered as a big concern for the country, it seems, the monetary authority of Bangladesh never targets ‗inflation' as its monetary policy framework.

2.4 Conclusion

It is clear from the discussion above, that Bangladesh has been pursuing a very active exchange rate policy which is reflected by its five exchange rate regime shifts (since independence in 1971 till 2010) and on average four exchange rate movements per year (almost all of which were devaluations). On the contrary, India (which is a South Asian country and neighbouring country of Bangladesh), being one of the most rapidly growing countries in the world, had pursued only six major and seven minor devaluations and three exchange rate regime shifts since its independence in 1947 till July 2010[9].

Figure 2.5 as well as Figure 2.6 suggests that Bangladesh's nominal exchange rate, exports and imports have been increasing over time. It seems from Figure 2.6 that imports have been growing faster since the 1990s which has occurred may be due to massive trade liberalization polices (see, Figure 2.3 and Table 2.1). The exchange rate also might have worked as an influential variable for rapid import growth for Bangladesh in this period (which is rather against conventional wisdom). As Bangladesh's exporting industries requires capital goods (which is about 60 percent[10] of total imports) to import, the exchange rate may have a positive effect on the country's import demand.

There was a structural change in terms of commodity exports from Bangladesh. In the 1970s, raw jute and jute products explained about 90 percent of total Bangladesh's

[9] Chanda, A. (2010), Foreign Exchange Value Determination, IndianBlogger.com, accessed on 29 December 2010

[10] Calculate from Key Indicators 2006 (Bangladesh)-Asian Development Bank (www.adb.org/statistics)

exports (see, Figure 2.4). However, in the post-liberalization period (since the 1990s), the RMG industry has been taking over the place of raw-jute and jute-products. At present RMG industry alone explains about 80 percent of total exports of Bangladesh (see, Table 2.2). On the contrary, there was no structural change of Bangladesh‘s exports in terms of destination markets (see, for example, Figure 2.4).

Although inflation has been a great concern for the country (see, for example, Policy Paper 0901, Bangladesh Bank), it seems from the IMF data that Bangladesh has never targeted inflation as a monetary policy framework. The ‗exchange rate anchor‘ and the ‗monetary aggregate anchor‘ have been main monetary policy frameworks for Bangladesh since its independence (see, Table 2.3).

CHAPTER THREE

DOES A DEVALUATION OF THE REAL EXCHANGE RATE IMPROVE THE BALANCE OF TRADE? [11]

[11] Paper presented in the Small Open Economics in a Globalized World conference, June 12-15, 2008, Waterloo, Ontario, Canada with a conference support from the Royal Economics Society, UK and the School of Social Science, University of Birmingham. Note, a moderated version of this paper is accepted for publication in the Journal of Developing Areas, USA and the first version of the paper is available in the conference site.

ABSTRACT

Similar to many other developing countries Bangladesh, which is the country of our concern, has been pursuing an active exchange rate policy basically to maintain a viable external account position, and competitiveness of its products in the world market. The purpose of the study is, therefore, to estimate the impact of real devaluation on this country's trade balance. The study constructs nominal and real effective exchange rates at both quarterly and annual frequencies which are not readily available for the country. Using the multivariate cointegration tests for non-stationary data, an error correction model, and impulse response functions in VAR, this paper examines the impact of exchange rate policy in both the short- and long-run. The estimated results demonstrate that the real exchange rate has a significant positive impact on the trade balance in the long-run. Thus currency devaluation has been a significant stimulus for the country's export growth and improvement in her current account position. However, we find that real devaluation deteriorates the trade balance in the short-run. Hence, the J-curve pattern is found appropriate when Bangladesh improves its trade balance in response to exchange rate devaluations.

Keywords: *Real effective exchange rate, balance of trade, J-curve, cointegration, impulse response*

JEL Classification Code: *C22, F31, F32*

3.1 Introduction

There is no consensus in the theoretical and empirical literature about any unique consequence of exchange rate policies on macroeconomic variables. For instance, Rose and Yellen (1989) and Rose (1990 and 1991) depict the exchange rate as an insignificant determinant of the balance of trade. In contrast, Singh (2002), and Onafowora (2003) find the real exchange rate to be a significant determinant of the trade balance.

The empirical studies on this issue can be classified broadly into two categories. Firstly, a section of the literature investigates whether the exchange rate is a significant determinant of the balance of trade in the long- and short-run (see, for example, Rose, 1990; Rose, 1991; Zhang, 1996; Wilson, 2001; Singh, 2002; Vergil, 2002; and Musila and Newark, 2003; Matesanz G´omez and Fugarolas ´Alvarez-Ude, 2007). Some of them report a significant (for example, Singh, 2002; Vergil, 2002; Musila and Newark, 2003; Matesanz G´omez et al., 2007) impact of exchange rate movements on the balance of trade while others find an insignificant result (for example, Rose, 1990; Rose, 1991; Zhang, 1996; Wilson, 2001).

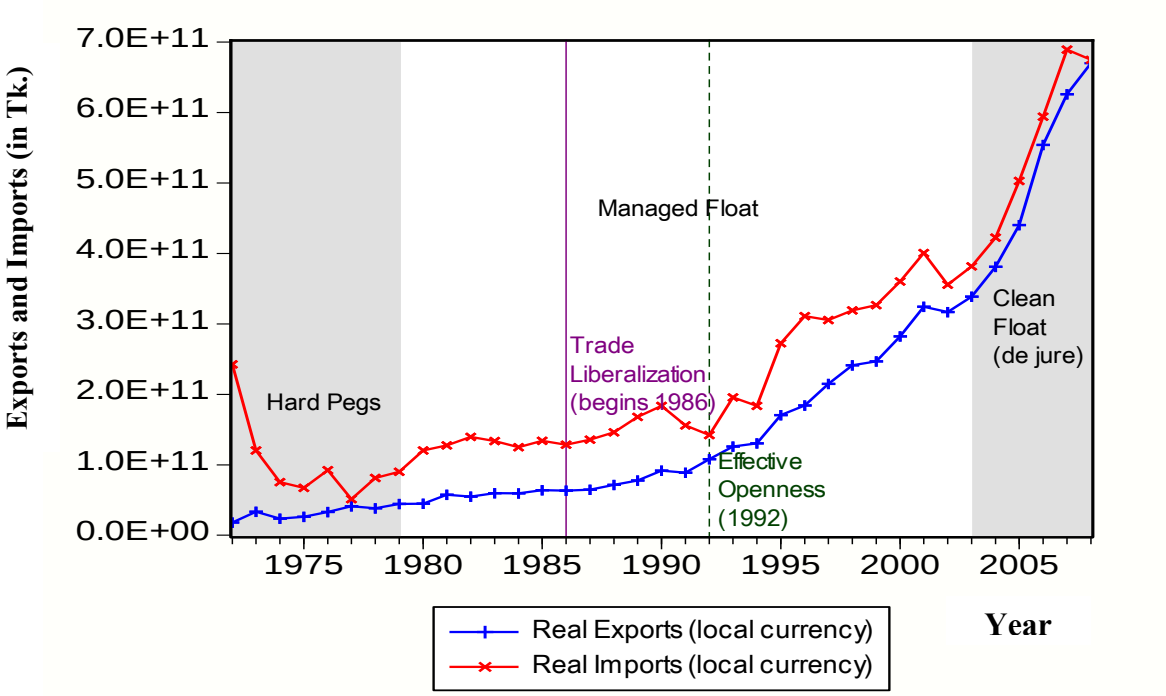
Secondly, there exists another set of studies which test whether the Marshall-Lerner condition and the J-curve or S-curve hypothesis - following a devaluation in exchange rate the balance of trade initially deteriorates but improves eventually - hold in reality (see, for example, Bahmani-Oskooee, 1985; Rose and Yellen, 1989; Mahdavi and Sohrabian, 1993; Marwahm and Klein, 1996; Bahmani-Oskooee; and Brooks, 1999; Arora, Bahmani-Oskooee and Goswami, 2003; Onafowora, 2003; Yousefi and Wirjanto, 2003; Gomes and Paz, 2005; Rahman and Islam, 2006; Yusoff, 2007; Matesanz G´omez et al., 2007; Hsing and Sergi, 2010). A number of these report favourable evidence (for example, Bahmani-Oskooee, 1985; Demirden and Pastine, 1995; Marwahm and Klein, 1996; Kale, 2001;

Onafowora, 2003; Gomes and Paz, 2005), while some studies depict no evidence (for example, Rose and Yellen, 1989; Bahmani-Oskooee et al., 1999; Arora et al., 2003; Hsing et al., 2010) of the J-curve hypothesis. A few of them depict a delayed (for example, Rosenswieg et al., 1988; Mead, 1988; Mahdavi et al,, 1993; Marwah et al,, 1996; Rahman et al,, 2006; Yusoff, 2007) J-curve phenomenon. There exists yet two more groups of studies reporting mixed evidence for the J-curve pattern (for example, Hsing, 2008; Wilson, 2001; Mahmud, Ullah and Yucel, 2004; Yousefi and Wirjanto, 2003) and the S-curve pattern (see, for example, Backus, Kehoe and Kydland, 1994 (OECD countries); Senhadji, 1998 (LDCs)).

Such contradictory and even opposite empirical findings, as the ones noted above, clearly constrains any consensus and unambiguous prediction about the impact of the exchange rate on either trade balance or the J-curve hypothesis to be made. Given this dichotomy of empirics on the subject we attempt to estimate the role of real exchange rates in both the above mentioned categories (of existing literature) to resolve the controversy so far as it relates to Bangladesh, a developing country that has frequently and consistently adopted the exchange rate as a tool for improving its trade balance.

As mentioned in Chapter 1, Bangladesh has been pursuing an active exchange rate policy since inception of the country‘s independence, which is reflected in its frequently announced exchange rate devaluations and exchange rate regime shifts. The principal objectives of the exchange rate policies of Bangladesh are to accelerate exports, reduce extra pressure of imports and thereby improve the balance of trade. The following trend (1972-2008) of the exports and imports of Bangladesh demonstrates improvement in its balance of trade over time. Now the question is whether these improvements are due to an effective exchange rate policy or otherwise.

Figure 3.1: Real export and import of Bangladesh.



Data Source: World Development Indicators (Edition: April 2010), World Bank

Hence, the effectiveness of exchange rate policy of Bangladesh is important both for analysing the performance of these measures and for drawing out further policy implications. However, none of the existing studies investigate the effect of exchange rates polices on the balance of trade of Bangladesh. This study therefore aims at filling this vacuum. The paper particularly examines the impact of the real devaluation of the ‗taka' on the country's trade balance in both the long- as well as short-run. The study also empirically verifies the Marshall-Lerner condition and the J-curve pattern for the country.

As noted in Section 1.3, Rahman and Islam (2006) is the only existing study that estimates whether the J-curve or the S-curve is appropriate for Bangladesh. However, the study has several major shortcomings in estimation which motivates us to re-estimate the balance of trade and re-test the J-curve or the S-curve hypothesis for Bangladesh. We

employ an empirical model with a proper theoretical foundation where domestic real income and foreign real income are explanatory variables in addition to the real exchange rate. We use the real effective exchange rate (instead of bilateral _taka-dollar exchange rate') as the main control variable for estimation, thereby overcoming the shortcomings of Rahman and Islam (2006).

3.2 Nominal and Real Effective Exchange Rates

Although data for nominal effective exchange rates (*NEER*) and real effective exchange rates (*REER*) for developed and transition economies are readily available in the existing databases, however, they are not available for developing countries (see, for example, the International Financial Statistics (IFS) dataset of the International Monetary Fund (IMF)). In the case of Bangladesh, *NEER* and/or *REER* time-series data are not available even from existing domestic data sources. The study therefore constructs the nominal and the real effective exchange rates for Bangladesh. We construct the nominal and real effective exchange rates by using the following technique:

$$NEER_{jt} = \sum_{i=1}^{k} w_{it} E_{it} \qquad \textbf{(3.1)}$$

$$REER_{jt} = \sum_{i=1}^{k} NEER_{it} \left(\frac{P_{it}^{*}}{P_{jt}} \right) \qquad \textbf{(3.2)}$$

where, j implies reporting country; i trading partners (i = 1, … k), and t time;

P_{it}^{*} is price index of trading partners (the study uses consumer price index (*CPI*) or producers price index (*PPI*) if available, otherwise we use GDP deflator as a measure of price level). It is worth noting that the CPI and PPI are available only from 1991 for Germany; from 1987 and 2000 for China, and from 1982 and 1990 for Hong Kong,

respectively (see, the IFS dataset). There are some missing values for CPI of Kuwait and the UAE as well. However, the above mentioned countries are important trade partners for Bangladesh. Therefore, we use the GDP deflator as the proxy of foreign prices for these trade partners.

P_{jt} denotes domestic price index[12] and w_{it} is trade weight of partners. As discussed in Chapter two that there is no structural change of Bangladesh's exports and imports in terms of its trade partners, the study therefore uses a fixed trade weight over time.

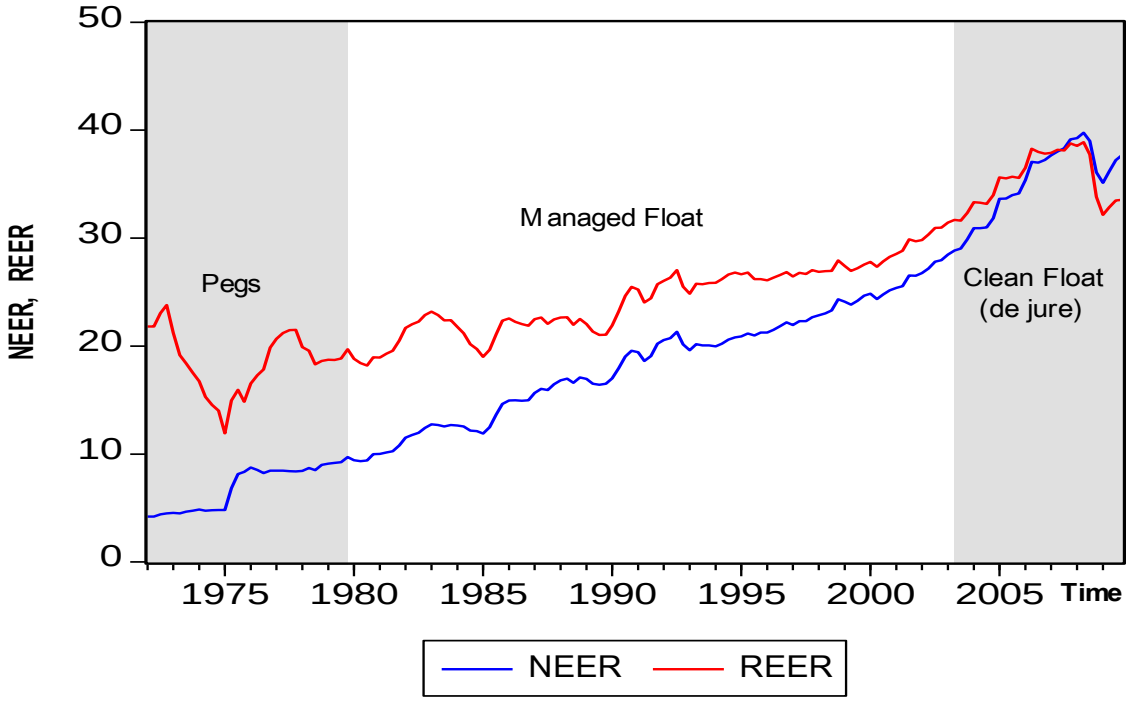
We use Bahmani-Oskooee's (1995) four step $REER$ index calculation method by employing the IFS data of the IMF. Trade weight of partners is calculated by using data of major trade partners of Bangladesh. The trade partners who explain at least 0.5 percent or more of either total export or total import trade of Bangladesh have been considered. Thus, the partners which explain less than 0.5 percent of total export or import trade flows have been ignored. After selecting all major trade partners (25 countries[13], which explains about 80 percent of Bangladesh's import and export trade are considered as major trade partners), we set the total trade weight is equal to one and then calculate the trade weight for each partners according to their trade share with Bangladesh, i.e., trade weights for each partner are calculated on the basis of partner's export and imports trade (combine) share with Bangladesh.

[12] PPI / WPI is not available for Bangladesh and CPI is available only from 1986, the study, therefore, uses GDP deflator for Bangladesh

[13] Australia, Belgium, Canada, China, France, Germany, Hong Kong, India, Indonesia, Italy, Japan, Korea, Kuwait, Malaysia, Netherlands, Pakistan, Saudi Arabia, Singapore, Spain, Sweden, Switzerland, Thailand, UAE, UK and USA.

The following Figure 3.2 shows the comparative variability of the nominal and real effective exchange rates of Bangladesh over time.

Figure 3.2: Real and nominal effective exchange rates in different exchange rate regimes of Bangladesh.



The two shaded areas in two edges of the figure show the officially announced extreme exchange rate regimes of the country, namely, the hard pegs and clean float. Figure 3.2 shows that there was the largest gap between nominal and real effective exchange rates in the hard pegs regime. It is worth noting that the Bangladesh economy was highly volatile in the early 1970s[14]. However, the gap between real and nominal exchange rates has been falling gradually once the economy has become relatively stable.

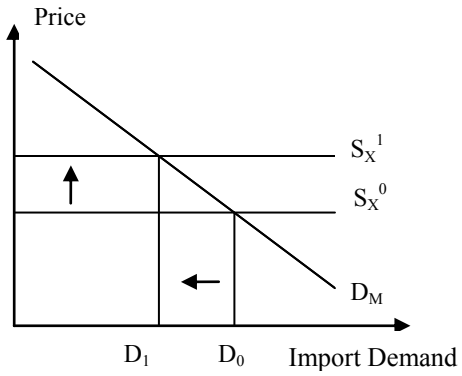
[14] Bangladesh was a newly independent country (after nine months of war with Pakistan); moreover, the oil shock in the early 1970s, a terrible famine in 1974 and a bloody military coup in 1975 took place in this period.

The remainder of the paper has been organised as follows. Section 3.3 includes the model specification, data and estimation of the study; Section 3.4 describes the empirical framework, and Section 3.5 contains the conclusions of the study.

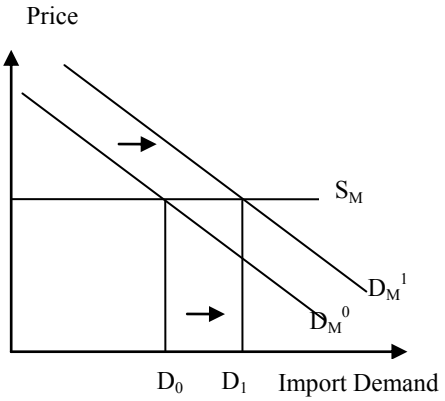
3.3 Model Specification, Data and Variables

As a small open economy, import prices of Bangladesh are given in world market and the prices are independent of the volume of imports. Thus, the demand for imports is influenced basically by domestic real income and the real exchange rate (*RER*).On the other hand, demand for exports depends mainly on: (i) relative prices of competing goods from the competing countries and (ii) aggregate demand of importers. For example, if the *RER* increases, the exports commodities become cheaper to importers which may contribute to increasing the demand for export. Therefore, it can be anticipated that an increase in the real exchange rate would improve the balance of trade. The following Figure 3.3 demonstrates the likely effects of change in the real exchange rate and real income on exports, imports thereby the balance of trade in a small open economy. It is worth mentioning that standard small country assumption suggests an elastic export demand function for developing countries; however, since most least developed countries (LDCs) specialize in exporting few specific commodities in which they attain some market power, the export demand curve is rather a downward sloping curve for LDCs (see, for example, Sehadji, 1998; Faini, Clavijo and Senhadji, 1992). Since about 80 percent Bangladesh‘s exports is explained by only the RMG industry, we assume a downward sloping export demand curve for Bangladesh.

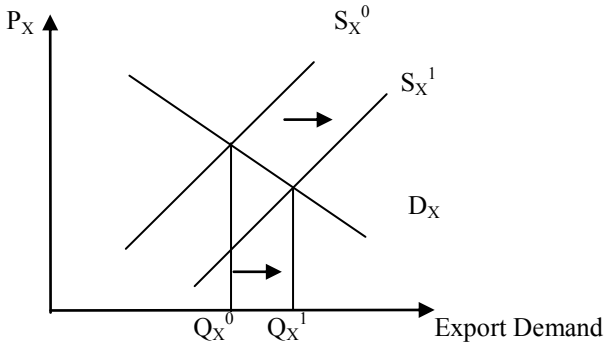
Figure 3.3: Impact of the exchange rate and domestic income on import and export demand of a small open economy.



(a) Increase in import prices due to increase in the REER which reduces import demand.



(b) Import demand rises due to the increase in the real domestic income.



(c) Increase in export demand due to increase in REER

The study attempts to empirically estimate the _two-country model‘ of trade by Rose and Yellen (1989) and Rose (1991) which are applied by empirical literature in both the developing (see, for example, Singh, 2002; Arora, Bahmani-Oskooee and Goswami, 2003; Hsing, 2008) and developed (see, for example, Rose and Yellen, 1989; Rose 1991; Bahmani-Oskooee and Brooks, 1999) countries context. Rose (1991) is a popular model for estimation of the trade balance model because it includes all basic determents of trade

balance in a simple framework. Most importantly, as our objective is to find the impact of the exchange rate on trade balance and as the exchange rate variable is one of the determinants in Rose and Yellen (1989) and Rose (1991) models, we find this model best suit our purpose.

The theoretical basis of our empirical model can be given as follows:

The quantity demand for domestic import basically depends on domestic income and relative prices of import.

$$M_d = f\left(RP_m, Y\right) \qquad \textbf{(3.3)}$$

where, $RP_m = \frac{E \times P_X^*}{P} = \left(\frac{E \times P^*}{P}\right) \times \left(\frac{P_X^*}{P^*}\right) = RER \times RP^*$, M_d is quantity demand for foreign goods, RP_m relative prices of import, Y domestic income, E nominal exchange rate, P_x^* foreign price for domestic imports, RER real exchange rate, RP^* foreign relative prices, and P and P^* are domestic and foreign prices, respectively.

Similarly, the demand for export can be defined as:

$$M_d^* = f\left(RP_m^*, Y^*\right) \qquad \textbf{(3.4)}$$

where, $RP_m^* = \frac{RP_X}{RER}$, M_d^* is foreign demand for imports, RP_m^* relative prices of imports abroad, Y^* foreign income and RP_x domestic relative prices of export.

Hence, the quantity of supply of export mainly depends on relative prices of exports.

$$X_S = f\left(RP_X\right) \qquad \textbf{(3.5)}$$

$$X_S^* = f\left(RP_X^*\right) \qquad \textbf{(3.6)}$$

where, X_S and X_S^* are export supply of home and export demand abroad respectively.

The equilibrium is determined by demand and supply, that is, $M_d = X_s^*$, *and* $M_d^* = X_s$.

Thus, real balance of trade in local currency terms can be written as:

$$B = RP_x \times M_d^* - RER\left(RP_x^* \times M_d\right) \qquad \textbf{(3.7)}$$

where, *B* is explained as the domestic net export in local currency.

Equation (3.7) can be express as the following functional form:

$$B = f\left(RER, Y, Y^*\right) \qquad \textbf{(3.8)}$$

It is worth noting that relative prices of export and import are implied in the real exchange rate $\left(RER\right)$.

A log-linear time series specification of the model (the testable model for this study) can be stated as follows:

$$InB_t = \beta_0 + \beta_1 InRER_t + \beta_2 InY_t + \beta_3 InY_t^* + \varepsilon_t \qquad \textbf{(3.9)}$$

where, $\ln B_t$, $\ln X_t$, $\ln M_t$ imply logarithm of balance of trade ($\ln X_t - \ln M_t$), export and import at time t, respectively. $\ln RER_t$, $\ln Y_t$, and $\ln Y_t^*$ are the logarithms of the real effective exchange rate, industrial product index of Bangladesh and trade weighted real GDP of trade partners. Exports, imports, industrial production index (proxy for domestic income/production) data come from the ‗World Development Indicators (Edition December 2010)' of the World Bank. The study constructs the trade weighted foreign income variable. We use the same trade weights for foreign income variable that we have used to construct the real effective exchange rate variable. The GDP data of trade partners' are also collected from the ‗World Development Indicators (Edition December 2010)' of the World Bank. All data for Bangladesh are in local currency term. The study uses annual data from 1976-2009 for Bangladesh. It is worth mentioning that we use annual data because quarterly or monthly data of some relevant variables are not available in the

existing data sources. The study uses industrial production index as a proxy of domestic income (production) because the ‗Trade Policy Review Report' (2006) of Bangladesh government (August 2006), the ‗Financial Sector Review (2006)', Bayes, Hossain and Rahman (1995), and Hossain and Alauddin (2005) suggest that since the 1980s the trade and the exchange rate policies of Bangladesh were driven mainly by the ‗export-led growth' and the ‗imports substitution' targets. Bangladesh imports mainly industrial products. Hence, by employing the industrial production index as one of the determinants of trade balance, we examine, whether industrial production significantly influence the trade balance of Bangladesh. It is worth noting that if a significant level of imports substitutions occurs, we may expect a positive sign for the coefficient of industrial production index in the trade balance model. This would suggest that imports substitutions significantly reduce imports demand of the country.

It is also worth noting that Bangladesh has been receiving substantial amount of ‗aid' and ‗remittance' from abroad. Hence, there may arise a question that why then this study has not included the aid and the remittance variables as the determinants of trade balance. This is because, firstly, ‗aid' is mainly a special or climactic issue for Bangladesh. When there is some large natural calamities (say, prolonged floods in 1988, 1998, 2007) which hit the economy substantially, the country receives major amounts of aid and concessionary finance from its donors, which comes as a large amount on the specific year (of disaster) and partly it is paid step-by-step later. Secondly, the aid and the remittance variables are found to be stationary at levels, i.e., I(0) series. Hence, we cannot include them with other non-stationary variables (i.e., I(1) series) in the cointegration framework.

As mentioned earlier, the theoretical notion suggests that exports and imports increase as the real income of the trade partners and domestic income rises respectively,

and vice versa. Hence, we could expect $\beta_2<0$ and $\beta_3>0$. On the contrary, imports may decline as income increases if real income rises due to an increase in the production of import-substitute goods and in that case we would expect $\beta_2>0$. The effect of movements in the real effective exchange rate on the balance of trade (β_1) is however ambiguous. β_1 is the focus of this study and it could be positive or negative. Generally, if real devaluation takes place, exports increase, imports fall as a consequence and thus it improves the trade balance. In that case we can expect $\beta_1 > 0$. However, if the J-curve pattern holds in the data, we would find that $\beta_1 < 0$ in the short-run and $\beta_1 > 0$ in the long-run.

3.4 Empirical Estimation

Generally macroeconomic time series variables are non-stationary in their levels, test for the existence of cointegration or long-run relationship which requires that the variables be integrated of the same order. Specifically, the standard cointegration tests such as the Engle-Granger and the Johansen cointegration methods require the series are of same and I(1) order of integration.

A simple autoregressive process (without drift) can be expressed as:

$$X_t = \rho X_{t-1} + \varepsilon_t; \quad \text{where, } \varepsilon_t \sim IN(0,\sigma^2) \qquad \textbf{(3.10)}$$

Now, if the coefficient of X_{t-1} is equal to 1, (i.e, $\rho = 1$), there is a ‗unit root', i.e. a non-stationary situation. In this case, if we take the first difference of X_t series we may find the series is now stationary, which is known as integrated of order 1, i.e. $\Delta X_t = X_t - X_{t-1} = \varepsilon_t$. The study therefore tests the unit root status of each variable.

3.4.1 Unit Root Tests

The order of integration can be tested by applying the standard unit root test statistics, such as the *Dickey-Fuller* (DF) test, the *Augmented Dickey-Fuller* (ADF) test, the *Phillips-Perron* (PP) test, the *Kwiatkowski-Phillips-Schmidt-Shin* (KPSS). Although the unit root can be detected by applying any of the DF, ADF, PP and KPSS test statistics, there are some shortcomings of the DF, ADF and PP tests. The basic DF statistic can test the order of integration of the following series:

$$X_t = \mu + \rho X_{t-1} + \varepsilon_t \quad \text{[with drift]; where, } \varepsilon_t \sim IIN(0,\sigma^2) \text{ [white noise]} \quad \textbf{(3.11)}$$

However, in real world, the majority of the economic time series have serially correlated residuals, which invalidates the independently and identically distributed disturbance term assumption (white noise), and the DF cannot deal with those types of time series.

The ADF and other above mentioned unit root test statistics, on the contrary, can handle with the lagged values of the dependent variable in the regression. The ADF estimates the following autoregressive model and test for the non-stationarity:

$$\Delta \ln X_t = \mu + (\rho - 1)\ln X_{t-1} + \sum \gamma_i \Delta \ln X_{t-1} + \varepsilon_t \text{; where } \varepsilon_t \sim IIN(0,\sigma^2) \quad \textbf{(3.12)}$$

If $(\rho - 1)$ is equal to zero, the series is considered as a non-stationary series at level. Here, the same critical values which are used for the DF statistic are applied.

However, the power of the ADF and the PP statistics are poor in comparing between $\rho = 1$ and $\rho = 0.97$ (for example) in the following autoregressive univariate model: $X_t = \mu + \rho X_{t-1} + \varepsilon_t$, especially if the sample size is small. On the other hand, the KPSS statistic is powerful in this regard. In this study, we employ the ADF and the KPSS test statistics to examine the unit root of variables and compare the results. The null hypothesis for the ADF test is, H_0: unit root; however, the null hypothesis for the KPSS test is, H_0: stationary.

Perron (1989) raises an issue of ‗structural break' in a series when we test for unit root process. Perron (1989) depicts that if there is structural break in a series due to some extraordinary economic events and if we fail to allow for an existing break, it leads us to a

bias unit root result. The paper suggests testing an exogenous and single structural break in unit root. Subsequently, Banerjee, Lumisdaine and Stock (1992), Zivot and Andrews (1992), Perron (1997), propose determining the break point endogenously. Since we used Bangladesh data from 1976 (we ignore data from 1972-1975 due to economic turmoil in this period which may lead to structural breaks), this study has not tested any structural break in unit root.

The test results of the ADF and the KPSS are as follows:

Table 3.1: Unit Root Tests

	Tests for I(0)				**Test for I(1)**			
	$\ln B_t$	$\ln REER_t$	$\ln Y_t$	$\ln Y_t^*$	$\Delta \ln B_t$	$\Delta \ln REER_t$	$\Delta \ln Y_t$	$\Delta \ln Y_t^*$
				ADF				
no trend	-1.40	-2.28	4.52	-0.47	-4.25	-4.93	-3.08	-4.12
with trend	-3.16	-1.87	-0.40	-2.91	-4.15	-5.73	-4.52	-4.21
				KPSS				
no trend	0.987	0.373	3.365	3.357	0.294	0.117	0.351	0.044
with trend	0.146	0.396	0.711	0.124	0.102	0.105	0.031	0.028

Note: The critical values for ADF are -3.65 (no trend),-4.26 (trend) at 1%, -2.96 (no trend) -3.56 (trend) *at 5% and -2.62 (no trend), -3.21 (trend) at 10% level of significance which is tabulated from Mackinnon (1996) one-sided p-values. The critical values for KPSS are 0.739 (no trend), 0.216 (trend) at 1% 0.463(no trend), 0.146 (trend) at 5% and 0.347 (no trend), 0.119 (trend) at 10% level of significance.*

The tests results of both the ADF and the KPSS suggest that all variables are non-stationary (with trend and without trend) at level; however, they are stationary at their first difference. In all cases 5% significance level is our standard level of significance.

We, then, estimate whether there is any long-run cointegration relation among the above mentioned variables as shown below.

3.4.2 Co-integration Tests

Engle and Granger (1987) first suggest that a linear combination of two or more non-stationary series may be cointegrated, and Engle and Granger (EG) propose a two-step cointegration test technique. We test the cointegration relation between trade balance, and exchange rate, domestic income and foreign income using EG method. The results of the EG cointegration test is given as follows (standard error in parentheses):

$$InB_t = -7.79 + 0.68InRER_t + 0.28InY_t + 0.11InY_t^* \qquad \textbf{(3.13)}$$

We obtain residuals from the above equation which can be given as follows:

$$\hat{\varepsilon}_t = InB_t + 7.79 - 0.68InRER_t - 0.28InY_t - 0.11InY_t^* \qquad \textbf{(3.14)}$$

The study then test the residuals for unit root by using the ADF test statistic. The t-ADF result is found to be -5.373 while critical values are -3.646 and -2.954 at 1% and 5% level of significance. Hence, the unit root test suggests that the residuals are stationary at level. Thus, the EG two-step procedure indicates that there is a long run cointegration relation between the variables of our interest.

The Engle-Granger cointegration test suggests that the real effective exchange rate, domestic industrial production and trade partners GDP are positively related to the trade balance of Bangladesh. If there is a one percent change in the real exchange rate, it improves the trade balance of Bangladesh by 0.68 percent. Industrial production is positively related to trade balance of the country. This is may be because an increase in industrial production of Bangladesh reduces the import or/and increase the exports of the

country due to the _import substitution' strategy of the country. Trade partners' GDP has a positive impact on trade balance of Bangladesh in the long-run, however, the magnitude of the trade partners GDP is relatively small.

However, the Engle-Granger method has several shortcomings such as being unable to identify multiple cointegrating vectors (see, for example, Banerjee et al., 1993) in a multiple regression framework and determining the choice of the endogenous variable to employ as a dependent variable in the model. By contrast, in the Johansen (1988, 1991, 1995) multivariate approach, all the variables are considered explicitly endogenous so that no arbitrary normalization has to be made without testing all models. Thus, the study employs the Johansen cointegration technique using *Trace* and *Maximum Eigenvalue* statistics. We consider a system given by $\ln B_t$, $\ln RER_t$, $\ln Y_t$ and $\ln Y_t^*$. The test for cointegrating ranks is given in Table 3.3 below.

Table 3.2: Johansen's cointegration test

Null hypothesis	Alternative hypothesis	Trace test		Maximal Eigenvalue test	
		Statistics	95% critical value	Statistics	95% critical value
$r = 0$	$r = 1$	72.95**	47.86	57.05**	27.58
$r \leq 1$	$r = 2$	15.90	29.79	10.98	21.13
$r \leq 2$	$r = 3$	4.92	15.49	4.28	14.26
$r \leq 3$	$r = 4$	0.64	3.84	0.64	3.84

Note: ‚r' implies the number of cointegrating vectors and critical values are from the MacKinnon-Haug-Michelis table (1999) at 5% level of significance.

Both the *„trace'* statistic and *„maximum eigenvalue'* test leads to the rejection of the null hypothesis of $r = 0$ (no cointegrating vectors) against the alternative hypothesis $r > 0$ (one or more cointegrating vectors) while the null of $r \leq 1$ against the alternative of $r > 1$ cannot be rejected at 5% level of significance. Hence, the result greatly simplifies the interpretation of the one cointegrating vector as a stable long-run relationship among $\ln B_t$, $\ln RER_t$, $\ln Y_t$ and $\ln Y_t^*$.

3.4.3 Test for Weak Exogeneity

Although the above cointegration tests suggest one cointegrating vector, they do not clarify for the dependent and explanatory variables in the model. The paper therefore tests whether trade balance ($\ln B_t$) is the dependent variable within the cointegrated model. The study therefore employs the _weak exogeneity' test (see, for example, Engle, Hendry, and Richard, 1983; and Johansen, 1992) by imposing general cointegration restrictions, which was required for efficient inferences in our single-equation error-correction model. The χ^2 based _weak exogeneity' test validates our restriction at 5% level of significance i.e., Chi^2(3) = 2.116 [0.549] and the test results can be expressed as the following equation:

$$InB_t = 0.28InRER_t + 0.34InY_t + 0.12InY_t^* \qquad \textbf{(3.15)}$$

Similar to the Engle-Granger procedure, the above long run equation suggests that the real effective exchange rate and domestic industrial production and trade partners GDP are positively related to the trade balance of Bangladesh. However, the coefficient of the real effective exchange rate is found to be smaller in the Johansen full information maximum likelihood estimation compare to the Engle-Granger test. The long-run effect of

domestic industrial production and foreign income is found to be positive and the magnitudes of the coefficients are similar to the magnitudes that we find in the Engle-Granger.

Therefore the cointegration tests results indicate that trade balance of Bangladesh positively and significantly depends on the real exchange rate in the long-run.

3.4.4 Error Correction Model

The short-run dynamics of the balance of trade of Bangladesh is also estimated following Hendry's *„general-to-specific'* modelling approach. The study employs the following *„general model'* to find a *„dynamic specific model'* -

$$\Delta \ln B_t = \alpha_0 + \sum_{i=1}^{3} \alpha_i \Delta \ln B_{t-i} + \sum_{i=0}^{3} \beta_i \Delta \ln RER_{t-i} + \sum_{i=0}^{3} \gamma_i \Delta \ln Y_{t-i} + \sum_{i=0}^{3} \delta_i \Delta \ln Y^*_{t-i} + \lambda EC_{t-1} \qquad \textbf{(3.16)}$$

Given that all variables are in their first difference, we allow a lag structure of up to three periods (on the basis of the 'sequential modified LR test' and 'final prediction error' criteria). Insignificant lags and variables are eliminated sequentially. We use the Engle-Granger residuals ($\hat{\varepsilon}_t = InB_t + 7.79 - 0.68InRER_t - 0.28InY_t - 0.11InY_t^*$) as the 'error correction term'. The simplified results are given as follows (standard errors are in parentheses):

$$\underset{}{\Delta \ln B_t} = \underset{(0.02)}{-0.013} + \underset{(0.065)}{0.23}\Delta \ln B_{t-1} - \underset{(0.28)}{0.80}\Delta \ln RER_{t-1} + \underset{(0.29)}{1.04}\Delta \ln Y_t - \underset{(0.11)}{0.61}EC_{t-1} \qquad \textbf{(3.17)}$$

The above dynamic estimate suggests that the first lag of the real effective exchange rate has a negative and significant effect on trade balance in the short-run. Therefore, if we compare the short-run ECM results with the long-run cointegration results, we find that in the long-run the real effective exchange rate improves the trade balance; however, in the short-run the exchange rate deteriorates the trade balance of Bangladesh. These findings perhaps indicate the J-curve phenomenon in Bangladeshi data. The ECM results also indicate that similar to the long-run the domestic production is positively related to the trade balance in the short-run. The coefficient of EC_{t-1} is negative, which is a feature necessary for model's stability. The speed of adjustment -0.61 implies a rapid adjustment back to the equilibrium.

Robustness Tests:

Diagnostic test statistics, actual and fitted graph and structural break tests are also employed to check robustness of the ECM model. The test results are given as follows:

Table 3.3: Robustness of the Error Correction Model

Diagnostic test [p-values are in parentheses]	
R^2	*0.81*
F-stat	*20.30***
AR 1-2 test:	*F = 0.455 [0.640]*
ARCH 1-1 test:	*F = 0.091 [0.766]*
Normality test:	*Chi^2 = 3.868 [0.145]*
RESET test:	*F = 1.148 [0.295]*

*Note:** implies statistical significance 5% levels respectively.*

The R^2 is 0.81 which implies that the estimated model is a good fit model. The F-test result indicates the overall significance of the model. The _diagnostic test statistics' are performed to check the stability of the _error correction model'. The autoregressive (AR) test examines up to 2nd order serial correction and cannot reject the null hypothesis that there is _no autocorrelation'. The autoregressive conditional heteroscedasticity, ARCH(1,1) test cannot reject the null hypothesis that there is _no heteroscedasticity'. The χ^2 based (Jarques-Bera) _normality test' implies that the error is normally distributed. Ramsey's regression error specification test (RESET) assures us that the linear formation of the model is appropriate.

The figure of actual and fitted values of trade balance (see, Figure-3.4) depicts the fitness of the model. The study graphically examines the _structural stability' test as well. Recursive beta coefficients and 1-step residuals test, break-point chow test and forecast chow test (see, Figure-3.5 and Figure 3.6) suggest that there is no structural break, which affirms the structural stability of the model.

Figure 3.4: Actual and fitted trade balance

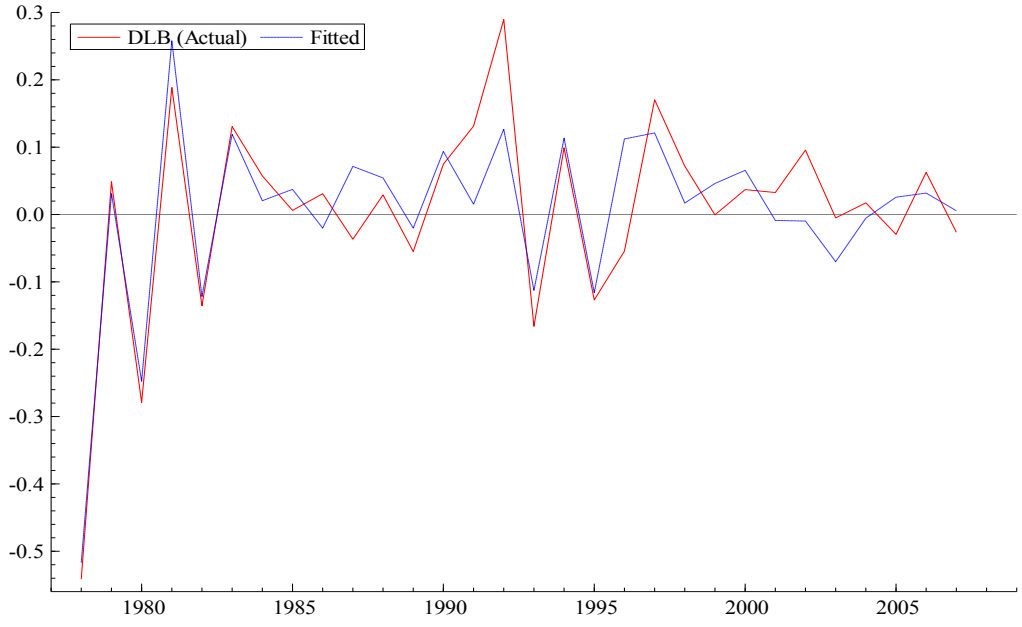


Figure 3.5: Recursive estimates of 'beta coefficients'.

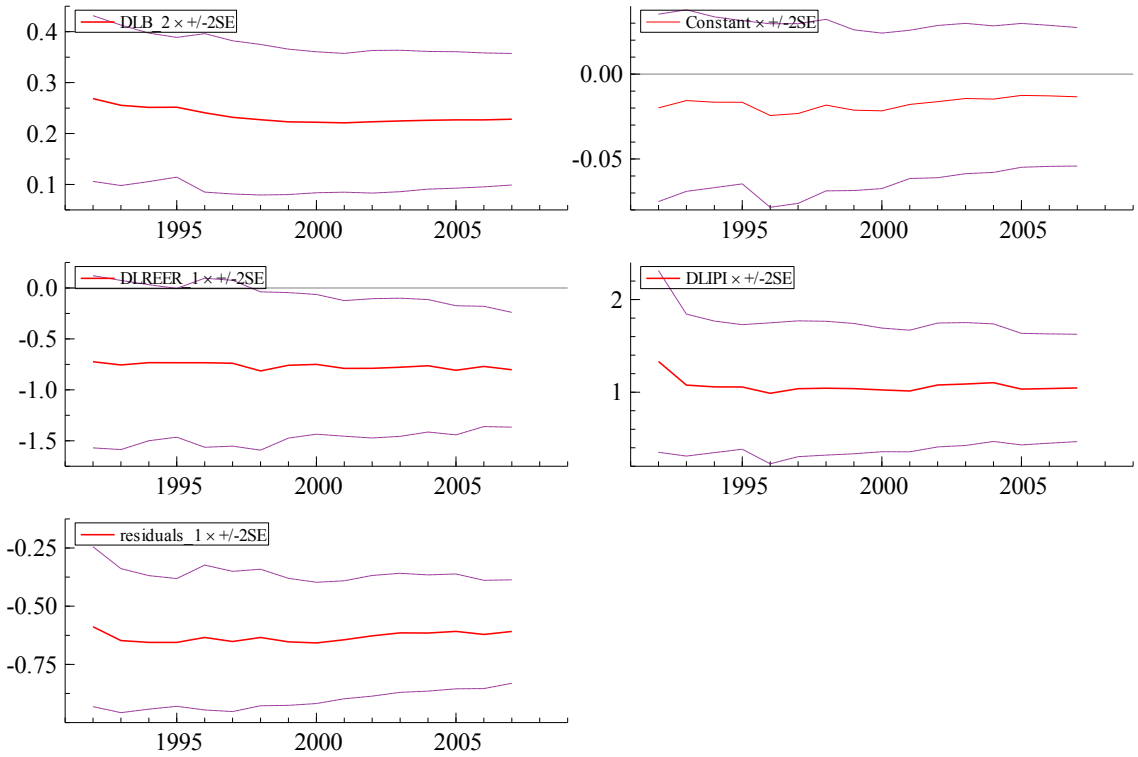
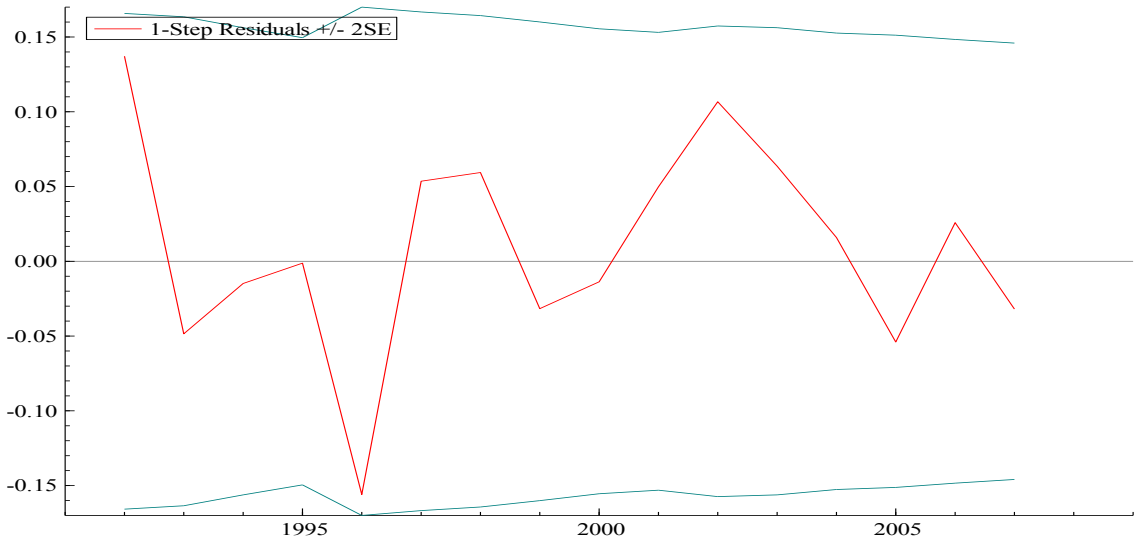


Figure 3.6: ***Structural instability tests***



3.4.5 The Marshall-Lerner Condition and the J-curve

We finally examine the Marshall-Lerner (ML) condition and the J-curve pattern for Bangladesh in the graphical VAR. Backus, Kehoe, and Kydland (1994), Senhadji (1998), Onafowora (2003) also investigates the ML condition using Impulse Response Function (IRF) and finds that the ML condition holds in the long-run. However, the above mentioned literature find that the responses of the trade balance to the terms of trade shock (see, Backus et al, 1994 and Senhadji, 1998) or exchange rate shock (see, Onafowora 2003) follow either the J-curve or the S-curve pattern. It is worth mentioning that Backus et al (1994), Onafowora (2003) and Senhadji (1998) examine the J-curve/S-curve hypothesis for developed, middle income and least developed countries, respectively. This

study examines the response of the trade balance to the change in real effective exchange rate of Bangladesh as well.

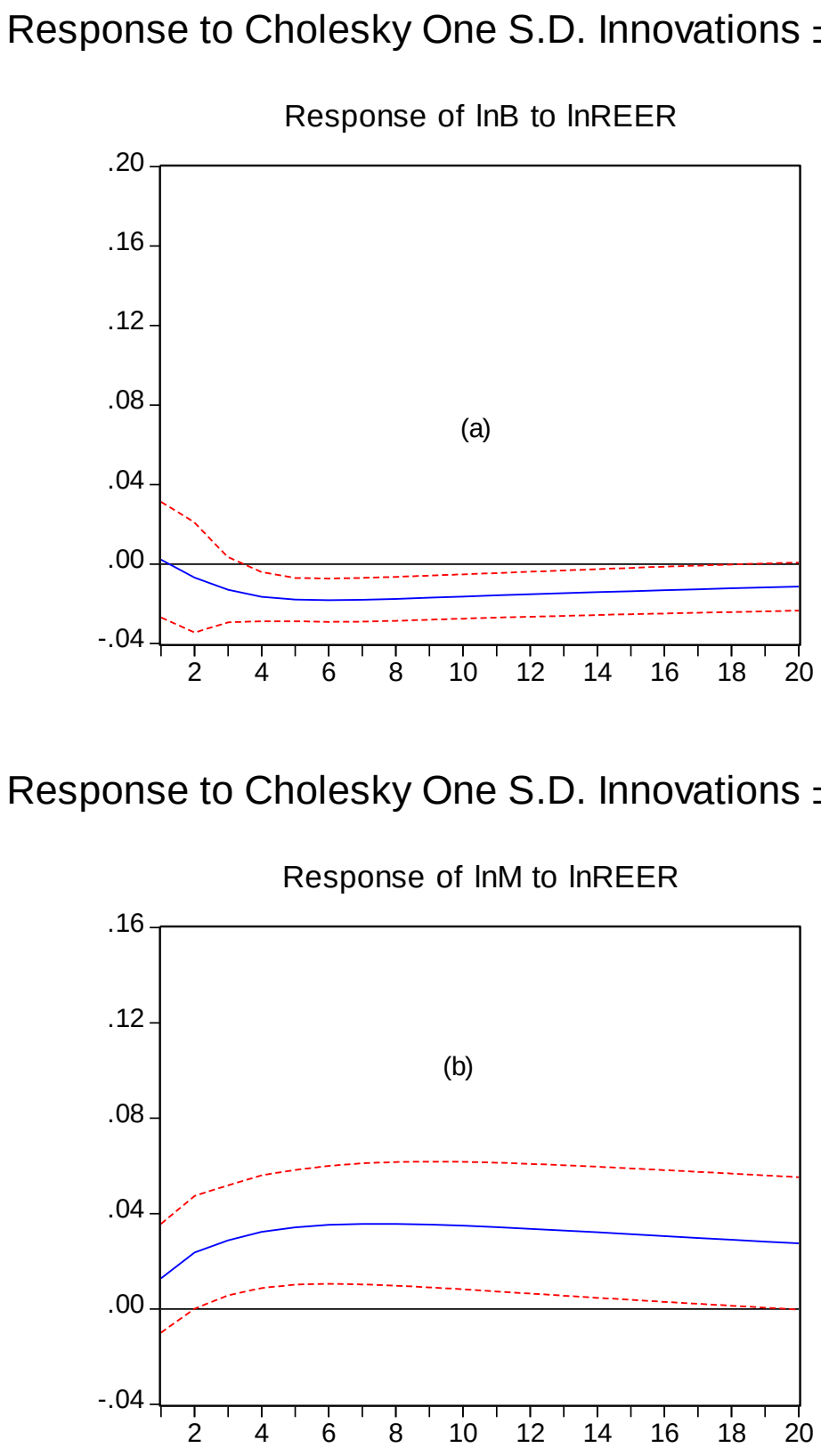
Zorzi, Hahn and Sanchez (2007) point out that —.. The use of a recursive identification scheme implies that the identified shocks contemporaneously affect their corresponding variables and those variables that are ordered at a later stage, but have no impact on those that are ordered before". Hence it is sensible to order the most exogenous variable first in case of the Cholesky decomposition. As, we examine the response of trade balance, imports and exports to the real effective exchange rate ($\ln REER_t$) shock, we order $\ln REER_t$ first.

The study uses quarterly data from 1980 – 2009 to find the impulse response of trade balance of Bangladesh to real effective exchange rate movements. We construct the real effective exchange rate variable in quarterly frequency using the equation (3.1) and equation (3.2). Data for quarterly exports and imports come from the IFS of the IMF. However, we collect import value index at annual frequencies from the world development indicators of the World Bank. The annual frequency data are interpolated into quarterly frequency. We then deflate the nominal exports and nominal imports to find the real exports and imports. All variables are in local currency unit.

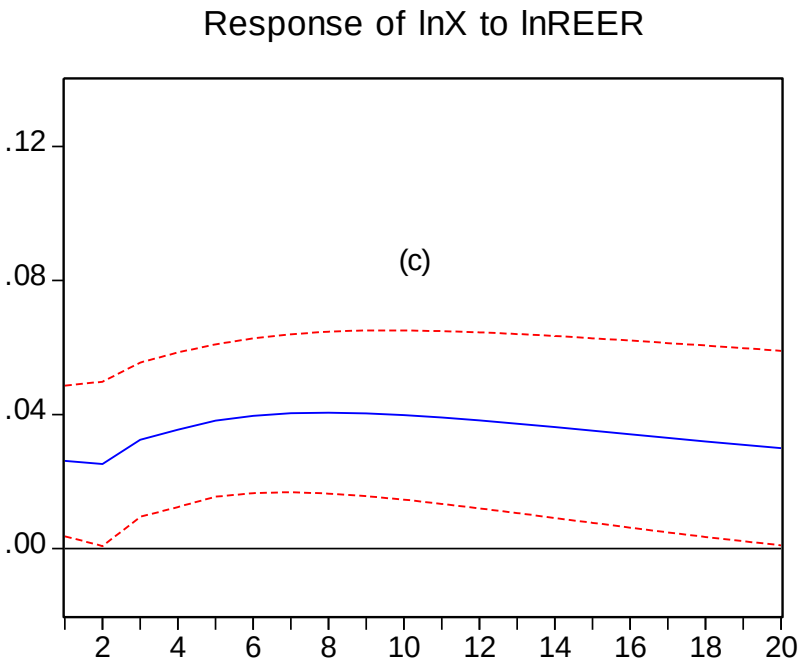
The impulse responses (the Cholesky decomposition) of trade balance and exports and imports are run separately to examine whether the J-curve phenomenon is the appropriate response of trade balance to real exchange rate shocks in Bangladesh's data. The significance level is shown by ± 2 standards error around the response functions.

The impulse responses are given as follows (only the relevant figures are presented below):

Figure 3.7: IRF of trade balance, imports and exports to exchange rate shock.



Response to Cholesky One S.D. Innovations ± 2 S.E.



The results demonstrate that real devaluation (see, for example, Islam 2003; Aziz 2003; Younus and Chowdhury, 2006) leads to an unexpected rise in imports (see, Figure 3.7 (a)). Export demand also falls initially, however, it is starts improving from the 2nd period. It seems from Figure 3.7(a), (b) and (c) that increase in exports overweighs the increase in imports after few periods which lead the trade balance curve to improve. The expected and consequential improvement in trade balance is observed in the long-run from cointegration relation (the EG and the Johansen) which implies that the ML condition holds in the long-run. Consequently, the impulse response analysis suggests that the trade balance of Bangladesh deteriorates immediately after devaluation and it improves afterwards. The (cointegration, ECM and impulse response function) combine results support the J-curve hypothesis. The reasons for the J-curve behaviour maybe explained as follows:

As is well known in the literature, the devaluation of a currency does not always necessarily improve the balance of trade for a number of reasons. First, if the Marshall-Lerner condition does not hold, devaluation cannot improve the balance of trade. Secondly, if the change of term of trade is given by the following elasticity approach:

$$\hat{t} = \hat{P}_X - \hat{P}_M = \left(\frac{\varepsilon_M \varepsilon_X - \eta_M \eta_X}{(\eta_X - \varepsilon_X)(\eta_M - \varepsilon_M)} \right) \hat{e} \qquad \textbf{(3.18)}$$

The trade balance will improve following a devaluation only if the product of demand elasticities ($\varepsilon_M \varepsilon_X$) exceeds the product of supply elasticities ($\eta_M \eta_X$). Thirdly, as Williamson (2005) stated that if a country finances its current account deficit by foreign loans, both the principal and the interest would increase in home currency terms with the undervaluation (devaluation/depreciation) of currency and therefore the advantage of devaluation would be eaten up by the repayments of its previous commitments. Finally, if there is interdependence between export and import markets, devaluation may not improve the balance of trade immediately due to the following reasons: (i) higher export generates higher incomes and the citizens may spend part of it on import, (ii) higher export demand may require more intermediate inputs to import and may deteriorate the balance of trade initially, (iii) devaluation may encourage higher investment by raising profits and hence investment goods may be imported for more investments to take place. The third and final reasons may be explained as the cause for the J-curve pattern of Bangladesh‘s trade.

More specifically, the main reasons behind the J-curve behaviour for Bangladeshi balance of trade, in our opinion, firstly, as a small country the production capacity of Bangladesh determines its export supply. Thus, when export demand increases following devaluation, the import demand of intermediate inputs of exporting industries are substantially raised. Due to shortage in production capacity it takes time to install the fixed

capital inputs in exporting industries and most of which are imported (see, for example, *Table 3.4*) from trade partners and thereby, raises the import demand immediately after devaluation. For instance, readymade garment (RMG) controls about 80 percent of Bangladesh‘s export earnings (see, Export from 1972-73 to 2009-10, Export Promotion Bureau, Bangladesh). _Textiles and textile articles‘ which explain about 60 percent[15] of total import costs of the country are used as the primary intermediate inputs in the RMG industry. The following table shows category-wise Bangladesh‘s imports over time:

[15] Import, by HSC, Key Indicators 2006-07, ADB

Table 3.4[16]: Sharewise total import of Bangladesh (%)

	Percentage of Total Import				Undervaluation
Year	Foods items (1)	Intermediate Inputs (2)	Oil, petroleum & other inelastic imports (3)	Total (1+2+3)	of exchange rate (Percentage)
1991	16.00	36.39	34.05	86.43	5.86
1992	15.31	40.19	29.99	85.49	6.43
1993	15.87	43.02	26.41	85.30	1.58
1994	12.79	45.78	24.73	83.30	1.63
1995	17.25	41.41	25.00	83.65	0.17
1996	18.67	42.02	23.71	84.39	3.76
1997	13.01	43.78	25.72	82.51	5.02
1998	16.01	43.44	23.81	83.25	6.87
1999	26.60	38.44	19.23	84.27	4.65
2000	16.78	40.65	24.85	82.28	6.23
2001	15.31	43.20	23.86	82.37	7.03
2002	14.54	42.64	24.52	81.70	3.73
2003	19.84	39.63	22.82	82.29	0.45
2004	19.01	41.06	21.96	82.03	2.34

[16] Calculated from Key Indicators 2006 (Bangladesh)-Asian Development Bank (www.adb.org/statistics)

3.5 Conclusion

The paper examines the impact of real devaluation of the currency on trade balance of Bangladesh. The study constructs the real effective exchange rate variable in both annual and quarterly frequencies to estimate the trade balance model. We also construct the trade weighted GDP of trade partners of Bangladesh. The Balance of trade, real effective exchange rate, domestic real income and foreign real income variables are found non-stationary at level, however, they appear to be stationary in first differences. The cointegration test confirms the presence of long-run relation between the real exchange rate and trade balance. The ‗weak exogeneity' test suggests that in the long run, trade balance of Bangladesh depends positively and significantly on the real exchange rate. The error correction model indicates that the real exchange rate has a significant negative impact on balance of trade of Bangladesh in the short-run. The Impulse Response Function indicates that the J-curve pattern hold in Bangladesh's data, that is, following a real devaluation, the balance of trade of Bangladesh falls initially in the short-run; however, it improves eventually. Estimated short-run ECM and long-run cointegration results also support the J-curve phenomenon.

All these findings imply that devaluation of currency seems to be an effective policy to make Bangladeshi product competitive in world market (i.e., growth in export) in the long run. However, as Bangladesh has to import a great deal of raw materials and intermediate goods for its key exporting industries (see, for example, Table 3.4), devaluation of currency increases the export demand (not export supply due to capacity constraint) at the outset. As a consequence, the increased export demand immediately increases the effective demand of import for capital goods. This therefore deteriorates Bangladesh's trade balance immediately after devaluation. It is worth noting that, we

estimate an import demand function of Bangladesh in the next chapter where we test whether the export demand is a significant determinant for import demand. If the hypothesis that – export demand is a significant determinant of import demand – is found significant in the next chapter, we would find another evidence for the J-curve pattern for Bangladesh.

CHAPTER FOUR

DETERMINANTS OF AGGREGATE IMPORT DEMAND: COINTEGRATION AND ERROR CORRECTION MODELLING[17]

[17] Presented in the 18th International Conference, International Trade and Finance Association, May 21-24, 2008, Lisbon, Portugal with conference support from the Department of Economics, University of Birmingham, UK. The earlier version of this paper is available in the conference website as a working paper.

ABSTRACT

The study focuses on the empirical modelling of the major determinants of aggregate import demand of Bangladesh. We examine some uncommon but empirically plausible determinants of import demand function for developing countries. The study also investigates the impact of trade liberalizations on import demand. We employ various cointegration techniques and the error correction mechanism to find the significant determinants of import demand both in the long- and short-run. Estimated results suggest that export demand is a significant determinant of import demand for Bangladesh. The other GDP components and relative prices of imports are also found to be statistically significant determinants of import demand both in the short- and long-run. „Trade liberalization' positively and significantly influences the import demand of the country.

Keywords: *Import demand, trade liberalization, cointegration, error correction mechanism.*

JEL Classification Code*: C22, F14, F41.*

4.1 Introduction

Historically Bangladesh has borne a large trade deficit which greatly financed through aid receipts and inflow of remittances from overseas workers. The country has to meet its growing food and other necessities demand for its increasing population through increased domestic production augmented by import.

Throughout the 1970s Bangladesh implemented an inward oriented nationalization policy which continued until the early part of 1980s. The strategy failed to achieve a desired and sustainable growth rate, and stabilise the price level. Hence, to attain the expected economic growth and a sustainable development, Bangladesh initiated the IMF suggested policy, called, the Structural Adjustment Facilities and the Extended Structural Adjustment Facilities in 1986 and 1989, respectively (see, Dutta and Ahmed, 1999). Under the structural adjustment package, economic policy was aimed at accelerating private investments, privatizing the nationalized industries, establishing budgetary discipline, reducing anti-export bias in the tax structure, rationalizing the tariff, quota and other import restrictions, and maintaining appropriate rates of interest, and initiating of a flexible exchange rate policy. As mentioned earlier, although trade liberalization has gradually taken place since the mid-1980s in this country, the policy gained its momentum from the early 1990s by a huge reduction in tariff rates, quantitative restrictions, and convertibility in exchange rates. The import figures for the country indicate that after implementing the import liberalisation policy in the 1990s onward, Bangladesh has been importing mainly foods, mineral & chemical products, textiles and textile articles, machinery and mechanical appliances, base metals and articles thereof, and transportation equipment. In addition to relative prices and domestic income, these import demands depend strongly on economic activities, population growth rate and export demand of the country.

As mentioned in Chapter 2, Bangladesh has shifted from a pegged to managed floating regime in 1979. Since then the country has been pursuing an active exchange rate policy and almost all of the announced policies are nominal exchange rate devaluations (see, for example, Aziz, 2003; Islam, 2003; Younus and Chowdhury, 2006). The principal objectives of the announced devaluation policies of Bangladesh are to maintain competitiveness of Bangladeshi products in the world markets, and maintain a viable external account position. This indicates that the enhancement of export is the prime target of exchange rate policy of Bangladesh. However, in the previous chapter we have shown that any exchange rate policy of Bangladesh, first affect the import demand and then the export demand thereby the trade balance of the country. As a consequence, the J-curve pattern seems appropriate in Bangladesh‘s trade.

The study therefore estimates the import demand function for Bangladesh considering the export demand as a principal determinant, in addition to, relative prices and domestic income. It is worth mentioning that the existing literature has tested the relative prices and domestic income variables as the determinants of import demand and found them to be significant for both developed and developing countries. However, few studies (Giovannetti, 1989 is the exception) have tested export demand as one of the determinants of import demand. The rationale of testing for this additional determinant of import demand is explained as follows.

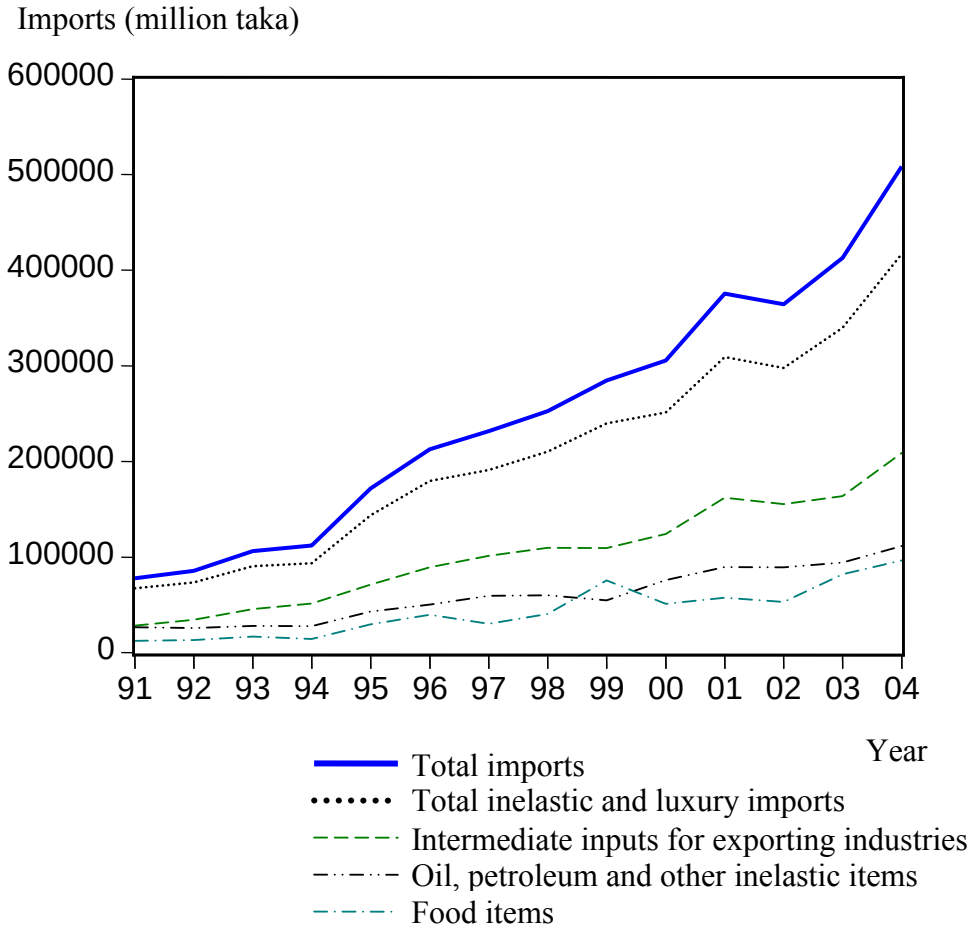
As a small open economy the production capacity of Bangladesh is an important issue for its expected amount of export supply. It is worth noting that a devaluation of currency leads to an increase in export demand (but not necessarily the export supply at first stage) and thereby increases the import demand of intermediate/capital goods for exporting industries. Moreover, due to the reduction of tariff, quota and other quantity

restrictions coupled with an export-led growth strategy of Bangladesh, devaluation of exchange rate leads to a huge import demand for machineries and raw materials by exporting industries. This suggests that any increase in export demand due to an undervalued exchange rate strategy raises import demand of the country. As mentioned earlier that readymade garment and footwear, which control about 80 percent of total export earnings of Bangladesh (see, Export trend 2009-10, Export Promotion Bureau, Bangladesh), requires the _textiles and textile articles‘ (capital goods) for production. On average, import cost of _capital goods‘ explains more than 50 percent of total import costs of Bangladesh (see, for example, Import, by HSC, Key Indicators 2006-07, ADB) and _textiles and textile articles‘ alone explains 75 percent of total RMG earnings (see, Siddiqi, 2004). Thus, devaluation of the currency is supposed to increase the export demand of RMG industries, which leads to an increase in the demand for _textiles and textile articles‘ and related machineries in the first place. However, at present there is no empirical study, which investigates whether the export demand is a significant determinant for import demand of the country. It is worth mentioning that if export demand is found to be a positive and significant determinant of import demand function, we will find supporting evidence for the J-curve hypothesis (see, Chapter 3 of the thesis) for Bangladesh.

It is also worth noting that Bangladesh economy imports a large portion of: (i) necessary goods (see, Table 3.4) which include machinery and mechanical appliances, oil and mineral products, and foods, and (ii) luxury goods (Islam and Hassan, 2004) which include luxury car, luxury bus, and electronic products etc. from its trade partners. Devaluation of the currency can neither retard rich people from buying luxurious goods nor reduce the demand for necessary goods. Moreover, import demand for foods and other necessaries shows increasing trend over time, maybe due to a rapid growth in population of

the country (which may be explained by GDP). Table 3.4 indicates that the inelastic import demand explains about 84 percent of total import of Bangladesh. Of which the share of food items, capital goods for exporting firms and other inelastic imports are about 17, 42 and 25 percents, respectively. A break down of imports by commodity type is presented in the following Figure 4.1.

Figure 4.1: Commodity types-wise imports



Data Source: Key Indicators 2006 (Country: Bangladesh), ADB.

Consequently, relative prices of imports and domestic income level can also be important determinants of import demand of the country. Nevertheless, existing theoretical

and empirical literature suggest to include the relative prices and domestic real income in an import demand function.

The study therefore focuses on the empirical modelling of the major determinants of import demand of Bangladesh. We do not only estimate the commonly used determinants of import demand in the existing literature, but test some uncommon determinants such as final expenditure components (including export demand) also. Moreover, the study investigates whether trade liberalization plays any significant role in import demand. The majority of the developing countries import intermediate inputs and technologies for their exporting industries, and pursue a pegged or managed floating exchange rate arrangement. Hence, the findings of this study could be explained as a general finding for developing countries.

The remaining sections are organized as follows: In Section 4.2 we conduct a literature review; Section 4.3 presents data, the theoretical framework and estimation; Section 4.4 illustrates empirical results; and Section 4.5 concludes the study.

4.2 Literature Review

Basically, there are two types of existing literature on import demand function. (i) The studies which attempt to identify the conventional determinants of aggregate import demand and (ii) the studies which suggest some unconventional determinants for import demand, instead of or in addition to the traditional ones. There are varieties of findings in term of number of significant determinants as well as their elasticities. Most of the literatures show a tendency to investigate just the long-run cointegration relation, not the short-run dynamics.

Hossain (1995), Emran and Shilpi (1996), Dutta and Ahmed (1999), Islam and Hassan (2004), Sinha (2001), Mah (1997), and Bahmani-Oskooee and Rhee (1997) find that real income and relative prices are the basic determinants of the import demand for a developing country. Almost all of the above studies except Sinha (2001) find that the income elasticity is positive and very close to the conventional wisdom, namely, unity for developing countries in the long run. Hossain (1995), Emran and Shilpi (1996), and Arize and Osang (2007) find that in addition to the above mentioned determinants, foreign exchange variability (foreign exchange reserves) is also a significant explanatory variable for import demand.

Hossain (1995), Emran and Shilpi (1996), Dutta and Ahmed (1999), and Islam and Hasan (2004) estimate the import demand function for Bangladesh and illustrate that real income is a positive and significant determinant for import demand of the country in the long-run. The income elasticity of import has been shown to be more than unity in all of the above studies. Dutta and Ahmed (1999), and Islam and Hassan (2004) demonstrate that all the coefficients such as real GDP, relative prices except foreign exchange reserves have shown the expected sign (positive and negative, respectively) and significance in the long-run. Both studies incorporate an openness dummy (dummy is equal to 0 from 1974 to 1991 and 1 from 1992 to 1994) to capture the import liberalization policy, and openness policy is found insignificant for import demand of the country.

Sinha (2001) demonstrates that both the price and the income elasticities of import demand are inelastic for India, Japan, the Philippines, Sri Lanka and Thailand. The study finds a negative and significant income elasticity of import demand for Sri Lanka and this finding is criticised by Emran and Shilpi (2001). Emran and Shilpi (2001) suggest that the traditional model in Sinha (2001) is ill-suited to estimating the elasticity parameters.

Instead of real GDP, Emran and Shilpi (2001) proxy the expenditure on home goods consumption for the real income variable and incorporate foreign exchange reserves as one of the determinants of import demand. The estimated results indicate that long-run income elasticity for Sri Lankan imports is positive and close to unity. Dutta and Ahmed (2004) find that for India import demand is largely explained by real GDP and is less sensitive to relative prices. Mah (1997) and Bahmani-Oskooee and Rhee (1997) suggest that the relative prices elasticity of import demand is very low (-0.003 and -0.08 respectively) in Korean case. However, Mah (1997) and Bahmani-Oskooee and Rhee (1997) provide conflicting results in the case of the income elasticity of Korean import demand. Unlike Mah (1997), Bahmani-Oskooee and Rhee (1997) state that real income largely explains (elastic) the import demand of Korea. Mah (1997) also concludes that the exchange rate policy of Korea is ineffective in determining its import demand. Carone (1996) demonstrates that the US income elasticity of import is very high (+2.48), while relative prices elasticity is (-0.38) very low. Hence, the above mentioned literature overall suggest that real income and relative prices are significant determinants for import demand; however, the elasticities of the determinants vary across countries. Some studies also find an unexpected signs for coefficients in the import demand function.

In unconventional import demand function estimation, Senhadji (1998) suggests a current activity variable, ($GDP_t - X_t$) rather than GDP_t for an aggregate import demand model estimation. The study estimates the structural import demand functions for 77 countries using time-series non-stationarity technique. The study demonstrates that the short-run and long-run income elasticities are, on average, approximately 0.5 and close to 1.5, respectively (with few exceptions).

Xu (2002) argues (also suggested by Sheffrin and Woo 1990, Obstfeld and Rogoff 1994, and Ghosh 1995) that to define the long-run behaviour of import demand, a ‗national cash flow' variable ($GDP_t - I_t - G_t - EX_t$) rather than the GDP_t is necessary and sufficient along with a relative prices variable and a time trend. Tang (2003 and 2005) suggests that along with the traditional variables the GDP minus exports, national cash flow: (GDP-I-G-EX), expenditure on investment goods, and export expenditure are significant determinants for both China and Korea. Giovannetti (1989) proposes the final expenditure components such as final consumption expenditure, $FCE = C + G$ (where, C is private consumption expenditure, G is government expenditure), expenditures on investment goods (EIG) and exports (X) variables, instead of GDP, as determinants of import demand. Alias and Tang (2000) show that final consumption expenditure, investment expenditure, export, and relative prices are the basic determinants of import demand. Khan and Knight (1988) view ‗foreign exchange reserves' to be one of the important determinants for developing countries' imports. Emran and Shilpi (1996) suggest and apply the foreign exchange reserves variable as a determinant of aggregate import demand of Bangladesh. Hossain (1995) argues that Bangladesh's import demand (food-grain) depends not only on domestic production but on real foreign exchange reserves too. Arize and Osang (2007) find that foreign exchange reserves is a significant determinant of import demand both in the short- and long-run.

From the discussion above we find that basically two set of determinants of aggregate import demand of developing countries are proposed by the existing literature. Part of the literature includes relative prices, real income and foreign exchange reserves as the determinants of import demand function. Another set of studies estimate an import demand function employing the final expenditure components, instead of real GDP, as

explanatory variables. However, existing studies on Bangladesh's import demand function estimate only the traditionally applied import demand function. Among them Emran and Shilpi (1996), and Hossain (1995) employ foreign exchange reserves (in addition to traditional determinants) as an exceptional determinant for Bangladesh. None of the existing studies estimates the import demand function taking the GDP components as explanatory variables (suggested by Giovannetti, 1989). This study, therefore, estimates an unconventional import demand for developing countries and attempt to find the significant determinants of import demand in both the long and short run. Details about the empirical model and estimation techniques in our study are given in the following section.

4.3 Model, data and estimation

The simple and widely used and traditional aggregate import demand function (see, for example, Khan and Rose, 1975; Carone, 1996; Dutta and Ahmed, 2004; Mah, 1999) takes the following theoretical form:

$$M_t = f(Y_t, RP_t); \qquad \text{where } f_1 > 0 \ f_2 < 0 \qquad \textbf{(4.1)}$$

M_t is quantity demand for import at time t; Y real income; RP relative prices (the ratio of import prices and domestic price); f_i is the expected partial derivatives; where i=1, 2.

However, we empirically estimate the following import demand function. Our empirical model includes the final expenditure components instead of a single real income variable (proposed by Giovannetti, 1989). Export demand, which is our main focus, is one of the explanatory variables of import demand here. We include a trade liberalization dummy in the import demand function as well. The empirical model can be given as follows:

$$\ln M_t = \delta_0 + \delta_1 \ln FCE_t + \delta_2 \ln EIG_t + \delta_3 \ln X_t + \delta_4 \ln RP_t + \delta_5 Dum_{1992} + \upsilon_t \qquad \textbf{(4.2)}$$

where, M is volume of imports which is constructed by dividing the value of imports (current local currency price) by the import price index which is collected from the Statistical Bulletin of Bangladesh (SBB) of the Bangladesh Bureau of Statistics (BBS) , Y is real gross domestic product (constant GDP of Bangladesh at local currency price), $RP = \left(\frac{P_m}{P} \right)$ is relative prices of import, where, P_m is import price index, P is domestic price which is proxied by the consumer price index (collected from the BBS), FCE is (real) final consumption expenditure, which includes private consumption expenditure and government expenditure, EIG is (real) expenditures on investment goods, and X is (real) exports, and finally the trade liberalization of Bangladesh is captured by a binary dummy, where, dummy equals 0 (zero) upto 1991 and 1 (one) from 1992. It is worth noting that two basic structural adjustments in Bangladesh regarding the trade liberalization process have taken place in mid-1980s and late-1980s. However, Dutta and Ahmed (1999) suggest a structural shift dummy for trade liberalization to incorporate in Bangladesh‘s import demand function. Dutta and Ahmed (1999) demonstrate that the above mentioned structural adjustments effectively were felt by Bangladesh economy only from 1992. Besides, our study finds that there is a high degree of multicollinearity between GDP components and trade-GDP ratio, and GDP components are the explanatory variables in our import demand function. Therefore, although the trade-GDP ratio could be a potential proxy for trade liberalization, we employ a binary dummy variable in our estimation.

Consequently, in our empirical model (Model 4.2) the study examines whether the demand for export is a significant determinant of aggregate import demand function of Bangladesh.

Bangladesh has been receiving substantial amount of aids and remittances from abroad. Why then this study has not included ‗aid' and ‗remittance' as determinants of trade balance is may be a valid question. We have not included these two variables for the following reasons -

‗Aid' is mainly a special or climactic issue for Bangladesh. When there is some large natural calamities (say, prolonged floods in 1988, 1998, 2007) which hit the economy to a large extent, the country receives major amounts of aid and concessionary finance from its donors, which comes as large amount on the specific year (of disaster) and partly it is paid step-by-step later. Besides, the aid and the remittance variables are found to be stationary at level. So, we cannot include these variables with other non-stationary variables into the Engle-Granger or the Johansen cointegration structure..

It is worth noting that although this study estimates empirical models, we emphases on the theoretical basis of empirical models. For example, in this chapter we empirically test the Model 4.2 which is theoretically developed by Giovannetti (1989). Hence, we test the theoretical models which fit with the hypothesis that - the exports demand is a significant determinant of imports demand for LDCs particularly Bangladesh.

We use annual data from 1978 to 2008 because quarterly data for the relevant variables are not available in the existing data sources. Data come from the ‗World Development Indicators (Edition: April 2010) of the World Bank and the World Economic Outlook of the IMF (Edition: April 2010), the Economic Trends (various issues) published by the Bangladesh Bank, and the Statistical Bulletin of Bangladesh (various issues) published by the Bangladesh Bureau of Statistics (BBS). Note that all variables are in real terms and all data are in local currency.

4.4 Estimated Results

We first test the unit root of individual series using the Augmented Dickey-Fuller, the Phillips-Peron (PP), and the Kwiatkowski-Phillips-Schmidt-Shin statistics. We then carry out two different types of cointegration testing procedures namely, (i) the Engle-Granger's (1987) residual-based two-step procedure and (ii) the Johansen (1988) full-information maximum likelihood estimating technique. Finally, employing the error correction model, a specific parsimonious equation is derived from a general dynamic model.

4.4.1 Unit root tests

The study employs the PP, ADF and KPSS test statistics in order to examine the order of integration of each series. The tests results show that at 5% level of significance the following series: $\ln M_t$, $\ln RP_t$, $\ln Y_t$, $\ln FCE_t$, $\ln EIG_t$, $\ln X_t$, and $\ln R_t$ are non-stationary at level and stationary at first difference, i.e., they are I(1) series. The test results are presented in Table 4.1 below.

Table 4.1: Unit root tests

Series	ADF		PP		KPSS	
	level	1st difference	level	1st difference	level	1st difference
$\ln M_t$ (constant)	-1.502	-7.366 ***	-1.89	-7.883***	0.766**	0.387
(Constant & trend)	-3.467	-7.815 ***	-3.288	-14.498***	0.171**	0.190
$\ln RP_t$ (constant)	-1.627	-4.012 ***	-1.812	-4.012***	2.240***	0.658
(constant & trend)	-2.176	-4.983***	-2.176	-4.983***	2.499***	0.057
$\ln FCE_t$ (constant)	1.717	-8.347***	2.625	-8.267***	1.137***	0.369
(constant & trend)	-0.901	-4.352 **	-1.431	-22.972***	0.150**	0.145
$\ln EIG_t$ (constant)	0.556	-6.291***	0.550	-5.717***	0.776***	0.157
(constant & trend)	-1.194	-8.358***	-1.301	-8.358***	0.181**	0.082
$\ln X_t$ (constant)	0.489	-6.758***	1.053	-7.394***	13.35***	0.162
(constant & trend)	-3.267	-6.966***	-2.930	-9.606***	0.158**	0.056

Note: ***, ** and * denote significance levels at 1%, 5% and 10% respectively. Critical values for the ADF and PP tests are -3.71, -2.98 and -2.63 (constant); -4.36, -3.595, and -3.23 (constant and trend) at 1%, 5% and 10% level of significance respectively, which is taken from MacKinnon (1996) one-sided p-values. The null hypothesis for the ADF and PP tests is (same), H_0: Non-stationary. However, the null hypothesis for PKSS test is, H_0: Stationary. The critical values for the KPSS test are 0.739, 0.463 and 0.347 (constant); 0.216, 0.146 and 0.119 (intercept and trend) at 1%, 5% and 10% level of significance respectively. Critical values for this test statistic is taken from Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1).

4.4.2 Cointegration and Weak Exogeneity Tests

We use the ‗trace statistics' and the ‗maximum eigenvalue' statistics based Johansen multivariate cointegration testing system to test the cointegration relation among the variables in each model. Although, the ‗trace statistic' for the Model (4.2) shows more than one cointegrating vectors, the ‗maximum eigenvalue' statistic confirms one cointegration relation, where the ‗eigenvalue test' leads to the rejection of the null hypothesis of r = 0 (no cointegrating vectors), against the alternative hypothesis r > 0 (one or more cointegrating vectors) while the null of $r \leq 1$ against the alternative of r > 1 (two or more cointegrating vectors) cannot be rejected at 5% level of significance. Hence, we reject ‗no cointegration' but cannot reject a one cointegration relation for the Model (4.2). The ‗trace' and the ‗maximum eigenvalue' test results are given as follows:

Table 4.2: Johansen's multivariate cointegration tests

Null hypothesis	Alternative hypothesis	Trace test		Maximum Eigenvalue	
		Statistic	95% critical value	Statistic	95% critical value
Model (4.2): $\ln M_t ; \ln FCE_t ; \ln EIG_t ; \ln X_t ; \ln RP_t ; Dum1992$					
r = 0	r = 1	104.58**	79.34	45.56**	37.16
$r \leq 1$	r = 2	59.02**	55.25	26.72	30.82
$r \leq 2$	r = 3	32.31	35.01	18.10	24.25
$r \leq 3$	r = 4	14.21	18.40	14.19	17.15
$r \leq 4$	r = 5	0.02	3.84	0.021	3.84

*Note: **reject null hypothesis at 5% level of significance. ‗r' implies the number of cointegrating vectors and critical values are given from the MacKinnon-Haug-Michelis table (1999).*

We also use the Engle-Granger (1987) two-step procedure to test for cointegration. In the first step, the long-run equilibrium relations among variables are estimated by regressing import demand on the determinants explained in the Model (4.2) using OLS method (which is the 1st-step of the Engle-Granger). The study then obtains the residuals. It is worth mentioning that Engle and Granger (1987) suggest that if (in the second step) residuals are found stationary at level (i.e., I(0) order of integration), it implies a cointegration relation among the variables. We test for the _unitroot' of the residuals using the ADF statistic. The Engle-Granger residuals are found stationary in levels. The residuals are -4.01** at first lag and -5.22** at zero lag. Thus, we reject non-stationarity hypothesis of residuals in levels which indicates that there is a long-run cointegration relation. These (EG and Johansen cointegration test) results simplify the interpretation of the one cointegrating vector, as a stable long-run relationship among the variables. The results of the Engle-Granger's first-step (OLS) can be given as follows:

$$\ln M_t = -82.33 + 3.71 \ln FCE_t + 0.63 \ln EIG_t + 0.26 \ln X_t - 1.20 \ln RP_t + 0.08 Dum_{1992} - 0.15T$$

……. *(4.3)*

The study also imposes the _weak exogeneity' restrictions in the Johansen approach which confirms that import demand is appropriately an exogenous variable in the long-run, where, FCE, EIG, X, RP are explanatory variables (note, Dum_{1992} is openness dummy and _T ' stands for trend). The χ^2 based the _weak-exogeneity test' gives, $\chi^2 = 8.161$ [p-value = 0.086]. The results of the weak exogeneity test can be written as follows:

$$\ln M_t = 2.24 \ln FCE_t + 0.76 \ln EIG_t + 0.32 \ln X_t - 0.99 \ln RP_t + 0.01 Dum_{1992} - 0.10T$$

…… *(4.4)*

Estimated results demonstrate that the relative prices of import is negatively related with import demand and the coefficient of relative prices is approximately one in the long-run. The test results also depict that final consumption expenditures (private consumption expenditure and government expenditure), expenditures on investment goods, and exports are positively associated with aggregate imports demand. Both the Engle-Granger and the Johansen suggest that there is a positive relationship between export demand and import demand of Bangladesh. A one percent increase in export demand increases the import demand by approximately 0.32 percent. It seems from the cointegration tests results that there is a large positive impact of final consumption expenditure on import demand. Trade liberalization has a positive impact on imports demand of Bangladesh.

4.4.3 Error Correction Mechanism

The short-run dynamics of the unconventional import demand function which use the export demand as one of the determinants of import demand is estimated following Hendry's (1979) general-to-specific modelling approach. Given that all variables are in their first difference and using the appropriate lag structure, we derive the specific models from the following general model where the error correction term comes from the Engle-Granger residuals:

$$\Delta \ln M_t = a_0 + \sum_{i=1}^{1} a_i \Delta \ln M_{t-i} + \sum_{i=0}^{1} b_i \Delta \ln FCE_{t-i} + \sum_{i=0}^{1} c_i \Delta \ln RP_{t-i} + \sum_{i=0}^{1} d_i \Delta \ln EIG_{t-i} + \sum_{i=0}^{1} e_i \Delta \ln EIG_{t-i} + gEC_{t-1} + hDum_{1992} + itrend + u_t \quad \text{..... (4.5)}$$

The study sequentially eliminates the insignificant lags and variables from the general model. The parsimonious equation (4.6) which is derived from Model (4.5) is reported as follows (standard error is in parenthesis):

$$\Delta \ln M_t = \underset{(0.028)}{-0.115} + \underset{(0.567)}{2.65}\Delta \ln FCE_t + \underset{(0.352)}{0.85}\Delta \ln EIG_t + \underset{(0.068)}{0.21}\Delta \ln X_t - \underset{(0.104)}{1.15}\Delta \ln RP_t - \underset{(0.205)}{0.65}EC_{t-1}$$

$$R^2 = 0.91 \qquad F = 40.85^{**} \qquad DW = 1.84$$

…….. ***(4.6)***

The parsimonious equation (4.6) indicates that final consumption expenditures, expenditures on investment goods, export demand are positive and significant determinants of import demand, and relative prices of imports is a negative and significant determinant of import demand in the short-run. The coefficient of export demand is found to be positive and significant (+0.21) in the short-run as well. The elasticity is found to be smaller in the short-run compare to the long-run. Statistically, the coefficient of relative prices of import is equal to unity both in the long- and short-run (t-statistics are: -1.42 and -1.44 in the long- and short-run, respectively which suggest that we cannot reject the null hypothesis of unit coefficient of relative prices). The coefficient of EC_{t-1} appears to be negative, which is a feature necessary for model stability. The speed of adjustment back to the equilibrium is -0.65, which implies a very rapid adjustment similar to the speed of adjustment (-0.64) found in Alias and Tang (2000) for Malaysia.

Robustness tests:

The study tests the robustness of the dynamic model by employing diagnostic test statistics, and by plotting the actual and fitted import demand, recursive coefficients, and structural break tests. Diagnostic test results are as follows:

Table 4.3: Diagnostic test results of the ECM.

Diagnostic Test Results [p-value in parenthesis]	
AR 1-2 test	F = 0.30106 [0.7439]
ARCH 1-1 test	F = 0.36751 [0.5524]
Normality test	χ^2 = 1.1132 [0.5732]
hetero test	F = 0.51610 [0.8383]
RESET test	F = 0.024387 [0.8776]

Diagnostic test statistics suggest that the model that we employ to investigate the significant determinants for import demand function of Bangladesh is a stable model. The *AR* test examines up to 2nd order serial correction which suggest that there is no autocorrelation at 5% level of significance. The *ARCH* and *Hetero* tests suggest that there is no heteroscedasticity. The *Jarque-Bera* _normality test' indicates that residuals contain all the properties of classical linear regression model. The regression error specification (*RESET*) test suggests that linear specification of the empirical model is appropriate.

The study graphically tests the actual and fitted import demand, beta coefficients, and the stability of the model. Figure 4.3 suggests that the estimated model explains the changes of import demand accurately. Figure 4.4 plots the value of beta coefficients along with their ± 2 standard errors. All of them are within the standard errors for the entire period with very small movements which indicates the stability of the estimated model. Moreover, the 1-step residual test within ± 2 standard errors band, and the _1-step chow', the _break-point chow' and the _forecast chow' tests suggest the structural stability of the model (see, Figure 4.5).

Figure 4.2: Actual and fitted import demand.

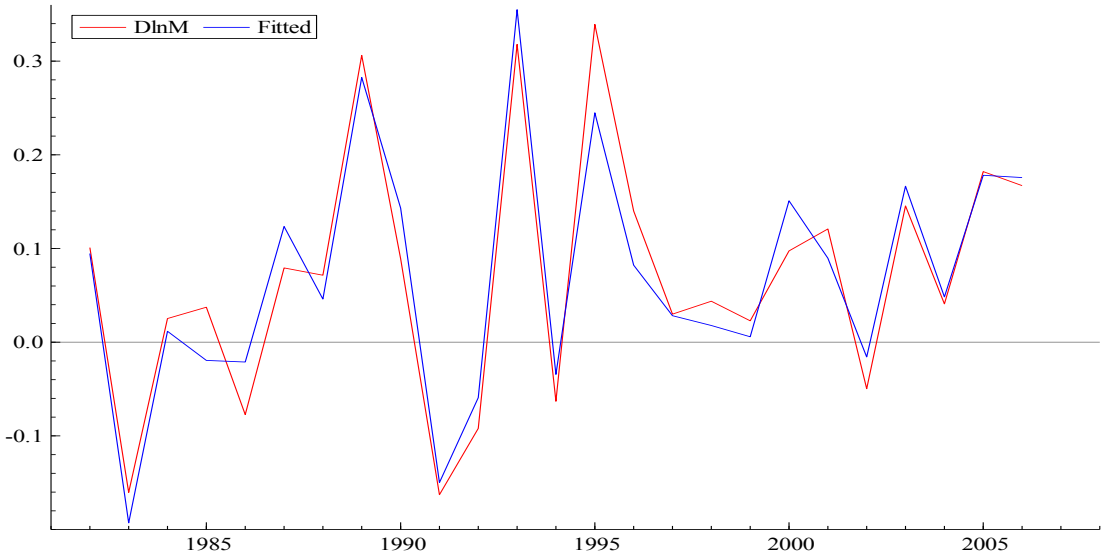


Figure 4.3: Beta coefficients.

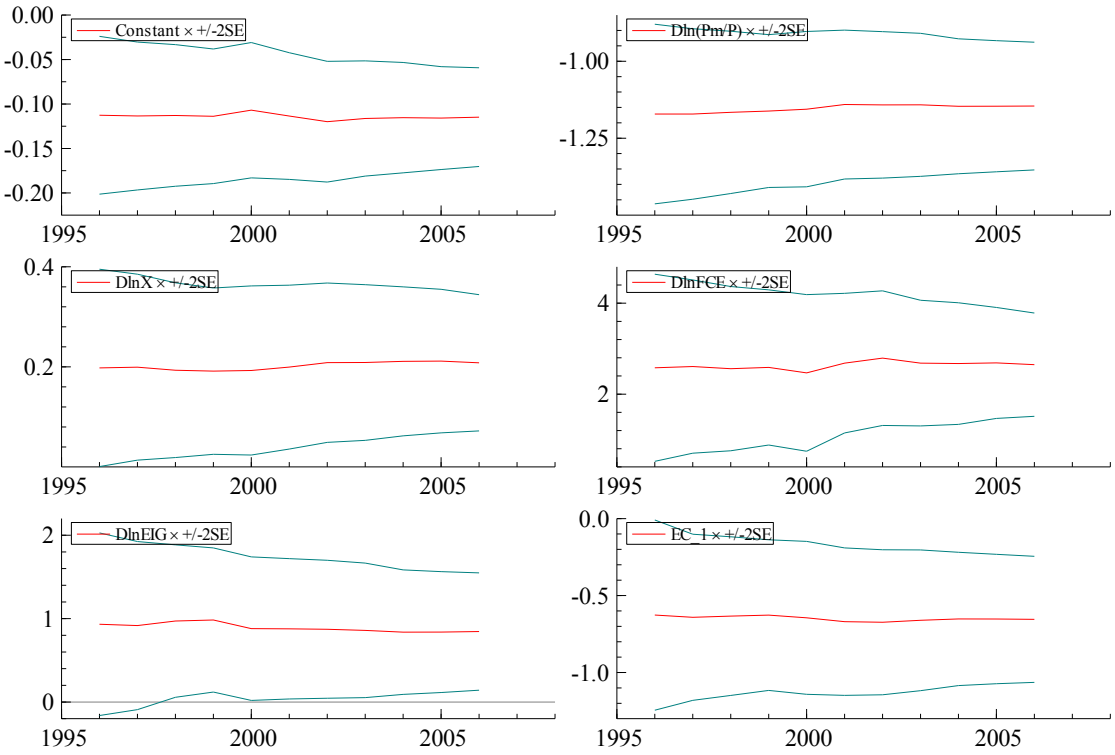
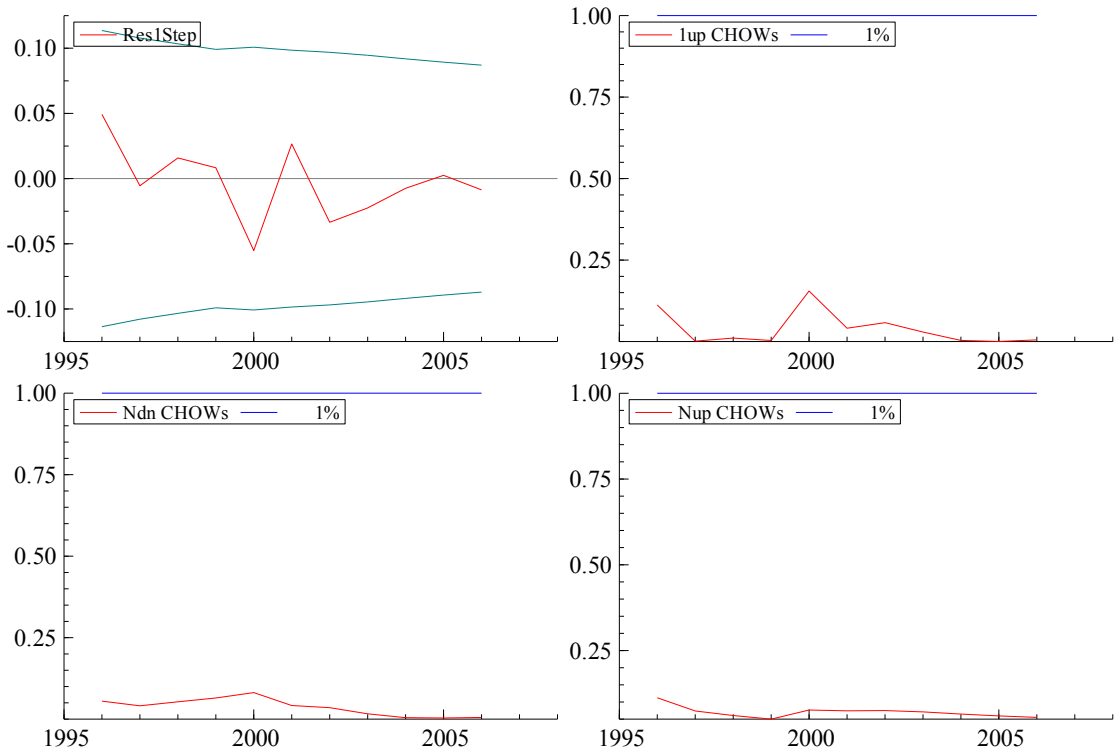


Figure 4.4: Structural instability tests.



4.5 Conclusion

Being a small open economy, Bangladesh requires import of capital goods for exporting industries to develop and grow. The study therefore estimates an empirical model employing a number of time series econometric techniques to identify whether real exports, in addition to relative prices and domestic income, is significant determinants of import demand for Bangladesh. We, instead of a combine _real GDP' variable, investigate the final expenditure components of GDP such as the final consumption expenditures, expenditure on investment goods, and expenditure on exports, separately as suggested by Giovannetti (1989). We employ the Engle-Granger (1987) and the Johansen (1988) co-integration techniques to estimate import demand function in the long-run. Subsequently, we derive a dynamic, parsimonious equation from the general model using an error correction mechanism.

The estimated results indicate that there is a long-run cointegration relation among the volume of imports, real GDP components (i.e., final consumption expenditures, expenditures on investment goods and export demand) and relative prices of import. Trade liberalization is found to be positive and significant in the long-run. The GDP components are positively while the relative prices are negatively and significantly associated with aggregate import demand of Bangladesh. These variables are found to be significant in the short-run as well.

Hence the estimated results suggest that import demand of Bangladesh depends on its exchange rate policy through its export demand. Devaluation of the *taka* increases import demand of capital goods for Bangladeshi exporting industries. Then it is transmitted to the export supply of the country which clearly indicates the capacity constraint in the export sector.

CHAPTER FIVE

EXCHANGE RATE PASS-THROUGH TO IMPORT PRICES AND DOMESTIC INFLATION[18]

[18] Paper presented in the '2009 Annual Conference', Scottish Economic Society, 27 - 29 April 2009, Perth, Scotland, and the '5th PhD Meeting', 16-17 January, 2010, City University London, organized by the Royal Economic Society with conference support by the Department of Economics, University of Birmingham. The 'Australasian Meeting 2009' (Econometrics Society), Australia; 'AIB Annual Meeting 2009', USA; the 'Hong Kong Economics Association' also accepted this paper for respective conferences. The first version of this paper is available in the conferences site.

ABSTRACT

The study investigates whether the conventional wisdom that, unlike in developed countries, exchange rate pass-through should be „œomplete' for developing countries. We estimate the exchange rate pass-through to import and domestic prices in the short-and long-run using both annual and quarterly data of Bangladesh. We construct the nominal effective exchange rates for imports at annual frequency and the nominal effective exchange rate at both annual and quarterly frequencies which are not readily available. The estimated results from the full sample demonstrate that the transmission of exchange rate movements is „complete' to import prices in both the short- and long-run. However, the „sœond stage pass-through' to domestic prices is found to be only „partial" and significant in both the short- as well as long-run. Trade openness significantly influences import and domestic prices of the country. The recursive VAR suggests that the response of domestic prices to exchange rate devaluation is positive and larger in the long-run compared to short-run.

Keywords: *Exchange rate pass-through, nominal effective exchange rate, trade openness, ECM, impulse response.*

JEL classification*: C22, E31, F42*

5.1 Introduction

Although there exists an extensive empirical literature on exchange rate pass-through (ERPT), very few papers have explored this issue from the perspective of developing countries. However, for developing economies, the investigation of exchange rate pass-through to import prices is an important issue for the following reasons. *First*, most of the developing countries have been pursuing an export-led growth strategy wherein exchange rates policy is expected to play a very active and key role. *Secondly*, most of the growing economies have to import technology and other intermediate inputs for their exporting industries. Given this, any exchange rate undervaluation leads to increase demand for exports which, in turn, increases the overall demand for imports at the same time. If viewed from this perspective, exchange rate pass-through to import prices becomes a significant area of study especially for developing countries. Not only that, as import prices is one of the principal channels through which the exchange rate affects domestic prices (see, for example, Olivei, 2002; Marazzi, Sheets and Vigfusson et al, 2005; and Mumtaz, Özlem, and Wang, 2006), the pass-through of exchange rate changes to domestic prices can be an important indicator for any country for that matter. These considerations may ultimately have implications for the appropriate outlook towards inflation-forecasting and monetary policy (Taylor, 2000; Marazzi et al, 2005) as well as the external policy of an economy.

By ‗exchange rate pass-through' we mean the percentage changes in the import and domestic prices (in local currency term) in response to a one percent change in the exchange rate. If the response is one-to-one, the pass-through is known as *'complete' ERPT*. However, if the pass-through is found less than one, it is known as *'partial' ERPT*.

The exchange rate is calculated by the amount of local currency exchanged for each unit of foreign currency.

The exchange rate has always been a very influential policy variable for developing countries. As mentioned earlier, Bangladesh, which is the country of our concern here, has been pursuing an active exchange rate policy from the time of the country‘s independence which is reflected in the frequently announced nominal exchange rate changes and exchange rate regime shifts by the Bangladesh Bank. On average there are about four exchange rate shocks in the economy every year. Now the question is: what are the principal objectives of those exchange rate policies?

Section 1.2, 1.3 and Chapter 2 indicate the objectives of continual exchange rate movements and exchange rate regime shifts of Bangladesh in detail. However, it is worth mentioning here that the key objectives of the Bangladesh Bank‘s exchange rate policy are to: maintain a viable external account position, maintain competitiveness of Bangladeshi products in the world markets, maintain stable internal price and encourage remittance inflow from expatriate wage earners. Hence, the effectiveness of exchange rate policy of Bangladesh is important both for analyzing the performance of these measures and also for drawing out further policy implications. This study therefore investigates whether exchange rate movements have any significant effect on trade prices, particularly import prices. The paper also examines exchange rate pass-through to domestic inflation to test whether the above mentioned third objective of the Bangladesh Bank for exchange rate policy is actually achieved.

Very few studies have looked into this area of research for Bangladesh. Hoque and Razzaque (2004); and Chowdhury and Siddique (2006) are the only exceptions who have studied exchange rate pass-through to export (commodity specific) and domestic prices

respectively. It is surprising to note that Chowdhury and Siddique (2006) find an insignificant exchange rate pass-through to domestic prices. None of the studies, whatsoever, investigate exchange rate pass-through to import prices for Bangladesh. Nevertheless, given the export-led-growth strategy, a study of exchange rate pass-through to import prices becomes an issue of great importance because Bangladesh imports about 60 percent (see, for example, Table-3.4) of the intermediate inputs for exporting industries (excluding the oil and petroleum import) which is many times higher if we include oil and petroleum imports. Thus, this study attempts to investigate the exchange rate pass-through to import prices.

In addition, inflation has becomes a big concern for Bangladesh in recent times. It has been consistently very high during 2000s. It was as high as 10.19 percent at the end of 2008. Average inflation has been almost 8 percent in the last five years which is considered as the longest cycle of rising inflation in the history of the country. Generally the rising trend of inflation persists 2-3 years (see, for example, Policy Paper 0901, Bangladesh Bank). The main factors which influence the domestic prices are, in general, the volatile industrial (see, Chowdhury and Siddique, 2006) and agricultural production, substantial population growth, political unrest, energy price shocks and, in particular, an unstable monetary and exchange rate policy, and import prices pass-through (see, for example, Mishkin, 2008; McCarthy, 1999). Examining exchange rate pass-through to domestic prices (second stage-pass-through) of the country is therefore important from this perspective as well.

Thus keeping in view the *de facto* managed floating exchange rate regimes in Bangladesh (IMF Annual Report 2008), this study aims at investigating exchange rate pass-through to import and domestic prices of the country. This paper also argues that

exchange rate, which in turn influences the import and consumer prices, can be affected by monetary policy (Mishkin, 2008) even if the country pursues a floating exchange rate system (which is claimed the actually pursued exchange rate regime by the Bangladesh Bank).

5.2 The literature

The existing literature suggests the following findings about exchange rate pass-through to import prices: (i) pass-through to import prices are incomplete for developed (see, Campa and Goldberg, 2005; Campa and Minguez, 2006; Zorzi, Hahn and Sanchez, 2007; Anderton, 2003; Yang, 1997; Mumtaz et al., 2006), developing (see, Mallick and Marques 2006) and emerging markets (see, Zorzi, Hahn and Sanchez, 2007); and (ii) the pass-through coefficient depends of firms‘ price setting behaviour (see, Mishkin, 2008; Dornbusch, 1987; Froot and Klemperer, 1989; Anderton, 2003; Campa and Goldberg, 2005; Marazzi et al., 2005) whether it is producer currency pricing (PCP) or local (consumer) currency pricing (LCP). It is worth mentioning that the pricing behaviour of firms is an important issue in international macroeconomics because the success of currency devaluation in increasing demand for a country‘s exports depends on whether prices are rigid in the producer‘s currency. However, devaluation policy fails to increase the demand for the country‘s export if firms‘ prices are rigid in the local currency.

Looking at pass-through to domestic prices, McCarthy (1999), Zorzi et al. (2007), Leigh and Rossi (2002), and Chowdhury and Siddique (2006) use a VAR model to estimate the exchange rate pass-through to consumers‘ and/or producers‘ prices for a set of industrial countries, emerging markets, Turkey, and Bangladesh, respectively. The findings are mixed. Both McCarthy (1999) and Zorzi et al. (2007) find partial pass-through to

domestic prices for industrialized and emerging markets, while the latter paper rejects the conventional wisdom that exchange rate pass-through is always considerably higher in ‗emerging' than in ‗developed' economics. Leigh and Rossi (2002) find a full exchange rate pass-through for Turkey, while Chowdhury and Siddique (2006) find that pass-though is insignificant for Bangladesh. It should be noted that Chowdhury and Siddique (2006) test the exchange rate pass-through to overall CPI and WPI (industrial plus agricultural sector). However, industrial products are the basic trade goods for Bangladesh. Hence, the industrial price index rather than overall PPI might be a good proxy for domestic prices.

In the light of findings of the existing empirical literature, our study therefore investigates: (a) whether exchange rate pass-through to import and domestic prices are ‗complete' for developing economies in the short- as well as long-run; (b) whether the pricing-to-market occurs for Bangladesh's import prices; (c) whether there is any significant differences between the exchange rate pass-through to consumer prices (CPI) and producer prices (PPI); and (d) whether trade openness plays any significant role in import and domestic prices of the country.

Although Dutta and Ahmed (1999) and Hossain and Allauddin (2005) suggest a binary dummy (for the year 1992) for ‗trade liberalization' of Bangladesh; however, this study includes the trade-GDP ratio as a proxy of ‗trade liberalization' because the liberalization process has gradually been taking place since early 1980s till date. As mentioned in Chapter 2, although actual liberalization process in Bangladesh began from 1986 by a significant reduction in tariff rates and quantitative restrictions, and the country has been proceeding toward trade liberalization since 1982 (World Bank suggested slow liberalization policy). This adjustment process has been completed in two decades through three phases (Razzaque et al, 2003). Two basic structural adjustments regarding the trade

liberalization process namely the Structural Adjustment Facilities and the Extended Structural Adjustment Facilities have taken place in Bangladesh in the mid-1980s and the late-1980s, respectively. Hence, we argue that trade-GDP ratio is a better proxy than a binary variable for trade liberalization. Moreover, we do not have the GDP variable or the GDP components as explanatory variables in the empirical model.

The remaining sections are organized as follows. Section 5.3 constructs and discusses variables and data. Section 5.4 provides the theoretical framework. Section 5.5 presents the empirical models. Section 5.6 shows empirical results and Section 5.7 concludes the study.

5.3 Data and Variables

In estimating the models, we use four complementary sources of data namely, the Bangladesh Bureau of Statistics (BBS), International Financial Statistics (IFS), Direction of Trade Statistics (DOTS), and World Development Indicators (WDI). The models are estimated by using data on the ‗unit price index' of imports which is collected from different volumes of the ‗Foreign Trade Statistics of Bangladesh' published by the Bangladesh Bureau of Statistics; the consumer price index (CPI) for middle income group of Dhaka City; and the wholesale price index (WPI) come from the ‗Monthly Statistical Bulletin– Bangladesh' published by the BBS; ‗exchange rates' are collected from the IFS published by the International Monetary Fund (IMF), and ‗world wholesale prices index' from the WDI of the World Bank. Trade weights are computed by using the data from DOTS of the IMF. We use annual data series from 1973-2007 and quarterly data from 1977q1-2006q4 for domestic prices (CPI and WPI/PPI). However, the study uses the annual data series from 1978-2007 for import prices pass-through estimation. It is worth

mentioning that the quarterly data for the import prices indices are not available in the existing data sources.

Chapter 3 constructs the nominal effective exchange rate ($NEER$). In this chapter, we construct the nominal effective exchange rate of import ($NEER^m$) for Bangladesh by employing the following method:

$$NEER_{jit} = \sum_{i=1}^{k} w_{it} E_{it} \qquad \textbf{(5.1)}$$

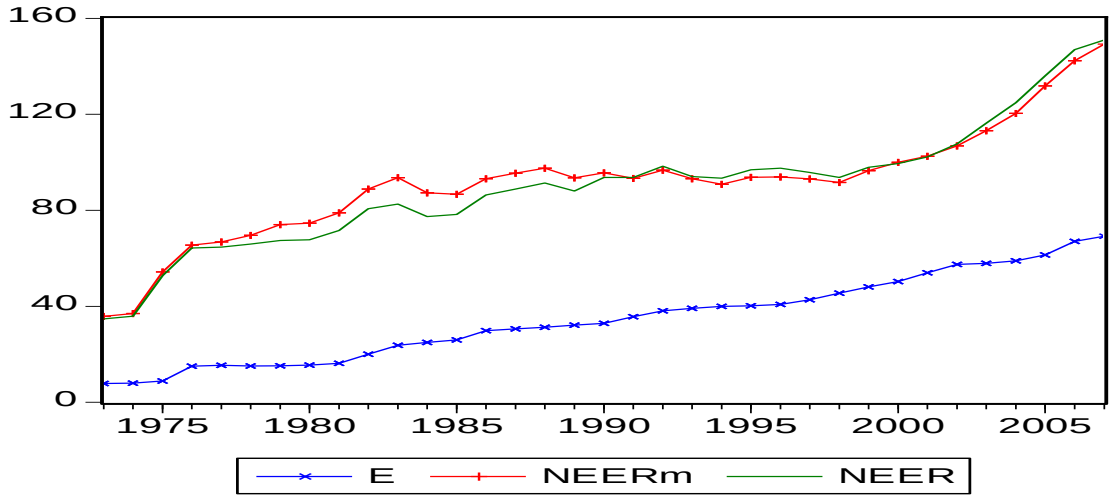
where, E is domestic currency per unit of foreign currency; j implies reporting country; i trading partners ($i = 1, \ldots k$), t time; and w_{it} is the trade weight of partners.

In constructing the $NEER$ variable we compute the trade weights of all significant trade partners (i.e., both import and export trade partners). However, the study uses only the import trade partners' weight in constructing the $NEER^m$. We evaluate the movements of import trade and total trade (import plus export) of Bangladesh and find that there is not a significant structural swing in the terms of trade of partners and trade share over the observed period. Hence, the study uses a fixed trade weight (which come from the average of bilateral trade, from 1972 to 2007, with partners) for both $NEER$ and $NEER^m$. The following diagram plots the nominal effective exchange rate ($NEER_t$), the nominal effective exchange rate for import ($NEER_t^m$) and the nominal exchange rate with respect US dollar (E_t). The $NEER_t^m$ includes almost 80 percent of total import weights. India (11.41%), China (9.39%), Japan (7.54%), Singapore (6.89%) and US (4.14%) are the major exporters to Bangladesh. In $NEER_t^m$ calculation the above mentioned countries get 14.89, 12.25, 9.84, 8.99, and 5.40 percent of total weights, respectively. In constructing the $NEER_t$ and $NEER_t^m$ we consider those trade partners which have, on average, no less than

0.5 percent trade share with Bangladesh. The plots of the $NEER_t^m$, the $NEER_t$ and the nominal exchange rate with US dollar (E) is presented in the following Figure 5.1.

Figure 5.1:

Nominal exchange rate of Taka with respect to US dollar (E), nominal effective exchange rate for import ($NEER^m$), and nominal effective exchange rate ($NEER$).



5.4 Theoretical Framework

5.4.1 Exchange rate pass-through to import prices

We empirically test a theoretically established import prices model (see, for example, Knetter, 1995; Bandt, Banerjee and Kozluk, 2008) to test the exchange rate pass-through to import prices. The theoretical model can be explained briefly as follows:

The import prices of a country j, P_{jt}^m are a transformation of the export prices of its trading partners, P_{jt}^x which can be written as:

$$P_{jt}^m = E_t P_{jt}^x \qquad \textbf{(5.2)}$$

where E_t implies the exchange rate (domestic currency per unit of foreign currency).

The export prices (producer's currency) can be expressed as the markup (MKU_t^x) over the marginal cost of exporters, (MC_t^x). Using the above idea and taking the logarithm of Equation (5.2) gives (lower case implies the logarithm of the variable):

$$p_t^m = e_t + mku_t^x + mc_t^x \qquad \textbf{(5.3)}$$

Assuming an industry specific fixed effect (ψ) and exchange rate sensitivity (η) for the markup variable we can obtain the markup term as follows:

$$mku_t^x = \psi + \eta e_t \qquad \textbf{(5.4)}$$

Thus, (combining Equation 5.3, and Equation 5.4) import prices can be written as:

$$p_t^m = \psi + (1+\eta)e_t + \alpha_0 w_t^x \qquad \textbf{(5.5)}$$

where, w_t^x is production cost of exporting firm (in producer's currency).

The component $\beta = 1+\eta$ needs to be tested to examine the exchange rate pass-through to import prices. If $\eta = 0$, exchange rate pass-through is "complete" $(\beta = 1)$ and producers currency pricing occurs. However, if $\eta = -1$, there is zero exchange rate pass-through $(\beta = 0)$ and only the local currency pricing (LCP) take place. This implies that the exporters fully adjust their product prices in mark-up to the fluctuation of exchange rates. If the pass-through coefficient is less than one, $(0 < \beta < 1)$ which indicates the inequality $-1 < \eta < 0$ holds, the pass-through is called "incomplete" or "partial". As mentioned earlier, the conventional wisdom is that exchange rate pass-through to import prices is full for developing countries but partial for the developed economies due to a pricing to market (PTM) behaviour of exporters to developed markets (to increase market share). This is one of the propositions we wish to test within the context of Bangladesh's data.

5.4.2 Exchange rate pass-through to domestic prices

The model of the exchange rate pass-through to domestic prices comes from the simple theoretical setting of the law of one price (LOP). When there are (i) perfect competition in domestic and foreign goods markets, (ii) no domestic or international transports cost, and (iii) no trade barriers to trade, the price of traded goods in home and abroad can be expressed as:

$$P = E \times P^* \qquad \textit{(5.6)}$$

where, P is the price of the goods at home expressed in domestic currency term, P^* is the price of goods in foreign country measured in foreign currency and E is the nominal exchange rate (amount of domestic currency per unit of foreign currency). Now, taking log and the first difference of Equation (5.6) yields:

$$\Delta \ln P = \Delta \ln E + \Delta \ln P^* \qquad \textit{(5.7)}$$

5.5 The Empirical Models and Estimation

Although Sargan (1964) first introduced an _ECM' type model, it has become a very popular specification for dynamic equations since Davidson, Hendry, Srba, and Yeo (1978) was published. However, we use a similar specification of the _error correction model' employed in Heffernan (1997)[19] to estimate exchange rate pass-through to import and domestic prices both in the short- and long-run.

[19] Heffernan (1997) develops a model which is similar to the ECM approach (which captures both short and long-runs in a single equation model) to estimate British interest rate pass-through. This method allows us to estimate both short- and long-run exchange rate pass-through. Moreover, the Johansen FIML requires large number of observations to produce appropriate results; however, developing countries, unfortunately, suffers from data availability problem. Heffernan (1997) may be the best approach to estimate both the short- and long-run in this regard. The disadvantage of Heffernan (1997) is that one has to compute the non-linear long-run coefficients differently, which is possible to compute by using the Delta Method. It is worth noting that

First we assume a simple hypothesis about the long run (see, Equation 5.5) that import prices are a linear function of exchange rate, foreign prices, trade liberalization, and a stochastic error. i.e.,

$$P_t^m = a + bE_t^m + cP_t^* + dTGDP_t + y_t \qquad \textbf{(5.8)}$$

where, $TGDP$ is _trade as percentage of GDP' which is a proxy for trade liberalization, y_t is the error at t time.

Thus,

$$y_t = P_t^m - a - bE_t^m - cP_t^* - dTGDP_t \qquad \textbf{(5.9)}$$

Here, it is supposed that growth of P_t^m is negatively related to magnitude of y_t. Hence, to obtain the empirical value of a, b, c and d we estimate the following testable model for the exchange rate pass-through to import prices (also see, Equation 5.5):

$$\begin{aligned}\Delta \ln P_t^m = {} & \alpha_0 + \alpha_1 \ln P_{t-1}^m + \alpha_2 \Delta \ln E_t^m + \alpha_3 \ln E_{t-1}^m + \alpha_4 \Delta \ln P_t^* + \alpha_5 \ln P_{t-1}^* \\ & + \alpha_6 \Delta \ln TGDP_t + \alpha_7 \ln TGDP_{t-1} + \varepsilon_t\end{aligned} \qquad \textbf{(5.10)}$$

where P_t^m is the import prices at time t, E_t^m is nominal effective exchange rate ($NEER_t^m$); P_t^* is cost of production which is proxied by the world wholesale price index, which was converted into local currency unit, i.e., $P_t^* = NEER_t^m \times PPI_t^w$ (similar to Marazzi et al, 2005). Given that there is no standard variable which can be considered as the best proxy for the marginal cost of production of foreign firms, we use Marazzi et al, (2005)'s specification of this variable. $TGDP_t$ is trade openness variable which is proxied by trade-GDP ratio. It is worth noting that the study incorporates the trade-GDP ratio as a proxy of trade liberalization in the model to captures any structural adjustments which have taken

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almost all literature (except, Bandt et al, 2008) estimate the exchange rate pass-through in the short-run and therefore these literatures estimate only a first difference model using mostly OLS. However, we investigate both the short- and long-run exchange rate pass-through by using relatively new and modern technique.

place in the observed time period. It is customary to assume that trade liberalization has a negative effect on import prices because trade restriction (tariff, quota) increase the domestic price of imported commodities. Hence, if trade liberalization is found to be a significant phenomenon for Bangladesh, both α_6 and α_7 in equation (5.10) will come up with negative signs. In the equation (5.10) we employ a proxy for trade liberalization, which is a continuous variable and which can capture the marginal effect of trade liberalization. α_2 is the pass-through coefficient in the short run. However, in the long-run the pass-through coefficient can be calculated by dividing minus α_3 by α_1. This is because, in the long-run steady-state,

$$\Delta \ln P_t^m = \Delta \ln E_t^m = \Delta \ln P_t^* = \Delta \ln TGDP_t = 0;$$

Then, we find,

$$-\alpha_1 \ln P_t^m = \alpha_0 + \alpha_3 \ln E_t^m + \alpha_5 \ln P_t^* + \alpha_7 \ln TGDP_t$$

Hence, $b = -(\alpha_3/\alpha_1)$ is the long-run exchange rate pass-through to import prices and the constant, coefficient of foreign prices and coefficient of trade openness variable can be derived by following measures:

$a = -(\alpha_0/\alpha_1)$

$c = -(\alpha_5/\alpha_1)$, and

$d = -(\alpha_7/\alpha_1)$

Similarly, the testable model for domestic prices (see, Equation 5.7) can be expressed as follows:

$$\begin{aligned}\Delta \ln P_t^d &= \gamma_0 + \gamma_1 \ln P_{t-1}^d + \gamma_2 \Delta \ln E_t + \gamma_3 \ln E_{t-1} + \gamma_4 \Delta \ln P_t^* + \gamma_5 \ln P_{t-1}^* \\ &\quad + \gamma_6 \Delta TGDP_t + \gamma_7 \ln TGDP_{t-1} + \varsigma_t\end{aligned} \qquad \textbf{(5.11)}$$

where, P_t^d is domestic price (either CPI of middle income group of Dhaka city or WPI); E_t is nominal effective exchange rate ($NEER_t$) and γ_2 and $-(\gamma_3/\gamma_1)$ are the pass-through coefficients in the short-run and long-run, respectively; and P_t^* is foreign prices. It is worth noting that if the pass-through is complete and law of one price holds, then $\gamma_2 = 1$, $\gamma_4 = 1$, $-(\gamma_3/\gamma_1) = 1$, and $-(\gamma_5/\gamma_1) = 1$, and all other coefficients are insignificant. If the trade liberalization is found to be a significant phenomenon for import prices, we may assume that trade openness would reduce inflation (the second stage pass-through) as well; i.e., we expect negative and significant γ_6 and γ_7 in the Model (5.11).

The study also constructs and uses the weighted foreign price index (using any of the available price indices, prioritizing PPI/WPI, CPI and GDP deflator in succession) for Bangladesh‘s import which does not change the results. The study reports the estimated results of regressions which are obtained by using the ‗world wholesale price index‘ as a proxy of foreign prices.

5.6 Estimated Results

Before estimating the ‗error correction model‘, the study tests for ‗unit root‘ and cointegration. We test for ‗non-stationarity‘ of each series employing the ADF, PP and KPSS statistics and the results are given as follows:

Table 5.1: Unit root tests

Series	ADF		PP		KPSS	
	Level	1st Difference	Level	1st Difference	Level	1st Difference
$\ln P_t^m$ (drift)	-1.806	-3.281	-1.942	-5.879	1.491	0.250
$\ln P_t^m$ (none)	3.456	-4.050	3.715	-4.130	-	-
$\ln P_t^*$ (drift)	-1.136	-2.560	-2.040	-2.614	0.942	0.402
$\ln P_t^*$ (none)	1.189	-1.658	3.531	-1.672	-	-
$\ln P_t^{CPI}$ (drift)	0.413	-4.732	-2.252	-4.737	1.714	0.663
$\ln P_t^{CPI}$ (none)	2.149	-3.565	3.240	-3.553	-	-
$\ln P_t^{PPI}$ (drift)	-2.397	-10.632	-2.415	-21.292	1.690	0.583
$\ln P_t^{PPI}$ (none)	2.147	-6.071	3.041	-3.931	-	-
$\ln NEER_t^m$ (drift)	-3.240	-3.942	-3.121	-3.993	1.321	0.343
$\ln NEER_t^m$ (none)	1.695	-5.879	2.496	-3.312	-	-
$\ln NEER_t$ (drift)	-2.790	-4.090	-2.682	-4.148	1.502	0.269
$\ln NEER_t$ (none)	2.984	-2.214	2.588	-3.430	-	-
$\ln TGDP_t$ (drift)	-0.928	-8.045	-0.622	-8.788	1.382	0.116
$\ln TGDP_t$ (none)	0.817	-2.885	1.313	-7.851	-	-

Note: Critical values for ADF and PP tests are -3.679, -2.968, and -2.623 (with drift), and -2.639, -1.952, and -1.611 (without drift) at 1%, 5% and 10% level of significance, respectively. It is reported from Mackinnon (1996). Critical values for KPSS test are: 0.739, 0.463 and 0.347 at 1%, 5%, and 10% respectively. It is reported from Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1).

Hence, the above test results suggest that all series are non-stationary at level and stationary in first differences. The study then tests for cointegration of the import prices, consumers prices and producers prices models. The Johansen FIML method is a popular cointegration technique and we test for cointegration using the FIML technique. The test results are given as follows:

Table 5.2: Cointegration tests

Null hypothesis	Alternative hypothesis	Trace test		Maximal Eigenvalue test	
		Statistics	95% critical value	Statistics	95% critical value
$\ln P_t^m, \ln NEER_t^m, \ln P_t^*, \ln TGDP_t$					
$r = 0$	$r = 1$	51.534**	47.856	24.562	27.584
$r \leq 1$	$r = 2$	26.971	29.797	14.527	21.132
$r \leq 2$	$r = 3$	12.444	15.495	12.442	12.265
$r \leq 3$	$r = 4$	0.003	3.841	0.003	3.841
$\ln P_t^{CPI}, \ln NEER_t, \ln P_t^*, \ln TGDP_t$					
$r = 0$	$r = 1$	88.621**	63.876	49.126**	32.118
$r \leq 1$	$r = 2$	39.495	42.915	17.285	25.823
$r \leq 2$	$r = 3$	22.211	25.872	14.446	19.387
$r \leq 3$	$r = 4$	7.764	12.518	7.764	12.518
$\ln P_t^{PPI}, \ln NEER_t, \ln P_t^*, \ln TGDP_t$					
$r = 0$	$r = 1$	76.683**	55.246	47.998**	30.815
$r \leq 1$	$r = 2$	28.685	35.011	15.909	24.252
$r \leq 2$	$r = 3$	12.775	18.398	11.115	17.148
$r \leq 3$	$r = 4$	1.660	3.841	1.660	3.841

Note: ‚r' implies the number of cointegrating vectors and critical values are from the MacKinnon-Haug-Michelis table (1999) at 5% level of significance.

Thus, Table 5.2 suggests that import prices, the exchange rate, foreign prices and trade openness are cointegrated in the long-run. Similarly, both consumer and producer prices are also found cointegrated with foreign prices, exchange rate and trade liberalization variables. The study, finally, uses the ECM approach to estimate the exchange rate pass-through to import and domestic prices in both the short- and long-run which is given in the following section (5.6.1).

5.6.1 ECM and Delta method

The ‗unit-root' and cointegration tests allow us to estimate the error correction model. The study, therefore, estimates the ECM for the import prices and domestic prices models. We then use the delta method which gives us the values for the long-run non-linear coefficients and the respective standard errors. Estimated results for the Model (5.10) and Model (5.11) are reported in the Table 5.3:

Table 5.3: Exchange rate pass-through to import, consumer and producer prices

Variables	Coefficients (standard error in parenthesis)		
	Import Prices (1978 – 2007)	**Consumer Prices (1974-2006)**	**Producer Prices (1974-2006)**
Cons.	0.622	0.642**	0.947***
	(0.662)	(0.316)	(0.329)
$\ln P_{t-1}^{M}$	-0.70***	-	-
	(0.174)		
$\ln P_{t-1}^{D}$	-	-0.355***	-0.486***
		(0.144)	(0.147)
$\Delta \ln E_t$	0.818***	0.46***	0.421***
	(0.343)	(0.136)	(0.145)
$\ln E_{t-1}$	0.546***	0.141	0.248*
	(0.217)	(0.149)	(0.146)
$\Delta \ln P_t^*$	-0.478	0.278	0.188
	(0.310)	(0.198)	(0.218)
$\ln P_{t-1}^*$	0.318***	0.215***	0.254***
	(0.080)	(0.079)	(0.072)
$\Delta \ln TDGP_t$	-0.273*	-0.321***	-0.371***
	(0.153)	(0.061)	(0.066)
$\ln TGDP_{t-1}$	-0.391***	-0.185**	-0.291***
	(0.113)	(0.087)	(0.105)
R^2	0.59	0.82	0.81
$F-test$	4.05***	16.22***	15.08***
DW	2.49	1.86	1.71

*Note: ***, **, and * imply significance at 1%, 5% and 10% level respectively. E_t is $NEER^m$ for import and NEER for consumer and producer prices. The diagnostic test statistics affirm that there are no autocorrelation (ARCH LM test), no heteroscedasticity (White Heteroscedasticity Test) and no structural break (CUSUM) in the data, and also the error term is normally distributed (Jarque-Bera test).*

Table-5.3 depicts that the exchange rate pass-through both to import and domestic prices are significant and positive. The pass-through coefficient for import prices is +0.82 in the short-run which implies that if the exchange rate increases (devalues/depreciates) by one percent the import prices increases by 0.82 percentage point. Pass-through to consumer and producer prices have been found significant and, +0.46 and +0.42 respectively in the short-run. The results also indicate that we cannot reject the _œomplete‘ exchange rate pass-through to import prices in the short-run. However, we reject the _œomplete‘ pass through to both the consumer and producer prices in the short-run. Trade liberalization has significant negative effect on import and domestic prices in the short-run.

As mentioned above, the study uses the _*Delta Method'* to estimate the exchange rate pass-through in the long-run. It is worth noting that we obtain the coefficient values and standard errors from estimation; however, t-statistics are calculated manually. The study restricts whether the coefficients are significantly different from zero and the findings are as follow.

Table 5.4: Long-run exchange rate pass-through and results from the Delta method

Pass-through to	**Coefficient**	**Value**	**Standard Error**	**t-statistic**
Import prices	$-(\alpha_3/\alpha_1)$	0.782	0.208	3.749
Consumer prices	$-(\gamma_3/\gamma_1)$	0.396	0.287	1.379
Producer prices	$-(\gamma_3/\gamma_1)$	0.509	0.183	2.777

The estimated results demonstrate that exchange rate pass-through to import prices and producers prices are significant in the long-run. However, exchange rate pass-through

to consumer prices is insignificantly different from zero. We also find that $d = -(\alpha_7/\alpha_1)$ is negative and significant in the long-run (which is not shown here).

The study then tests whether the pass-through to import and producers prices are ‗complete' in the long-run. T-statistic results cannot reject the ‗complete' pass-through for import prices, while the exchange rate pass-through to producers' prices is found only partial in the long-run (which is calculated from Table 5.4). All results are summarized as follows:

Table 5.5: Test results for the 'complete' or 'partial' exchange rate pass-through.

Pass-through to-	Short-run pass-through	Long-run pass-through (using Delta method)
Import Prices	Positive, complete and significant	Positive, complete and significant
Consumer Prices	Positive, partial and significant	Positive, partial but insignificant
Producer Prices	Positive, partial and significant	Positive, partial and significant

Note: Table 5.5 can be found from Table 5.3 and Table 5.4. Significance level is computed at 5% level.

The ‗*t*-statistic' cannot reject the hypothesis that the coefficient of the nominal effective exchange rate for import prices equals ‗unity', which implies that exchange rate pass-through to import prices is *‗complete'* in the short- and long-run. Hence, η in equation (5.5) is equal to zero and which suggests that there is no pricing-to-market behaviour for Bangladesh's import, which is an expected outcome for a small open developing economy like Bangladesh, and this finding confirms the conventional wisdom

that for a small country import there is hardly any evidence of pricing-to-market behaviour by the exporting firms.

However, the test statistic rejects the null hypothesis of unit coefficient of nominal effective exchange rate ($NEER_t$) for consumer and producer prices both in the short- and long-run, which implies that exchange rate pass-through to domestic prices is only *„partial"* for Bangladesh. Our study therefore differs with the findings of Chowdhury and Siddique (2006) – „exchange rates do not have any significant impact of domestic prices of Bangladesh". Hence, the conventional wisdom about the complete exchange rate pass-through for developing countries has not been proved appropriate for Bangladesh once both step pass through (from exchange rate to import prices and then from import prices to domestic prices) are taken into account.

We view that the results of exchange rate pass-through to WPI (which shows a significant and partial exchange rate pass-through in the short- and long-run) to explain Bangladesh's exchange rate pass-through to domestic prices, is more plausible. This is because CPI of the middle income group of Dhaka city is used as a proxy of consumer prices in our regression which may not be a well-representative proxy for domestic prices.

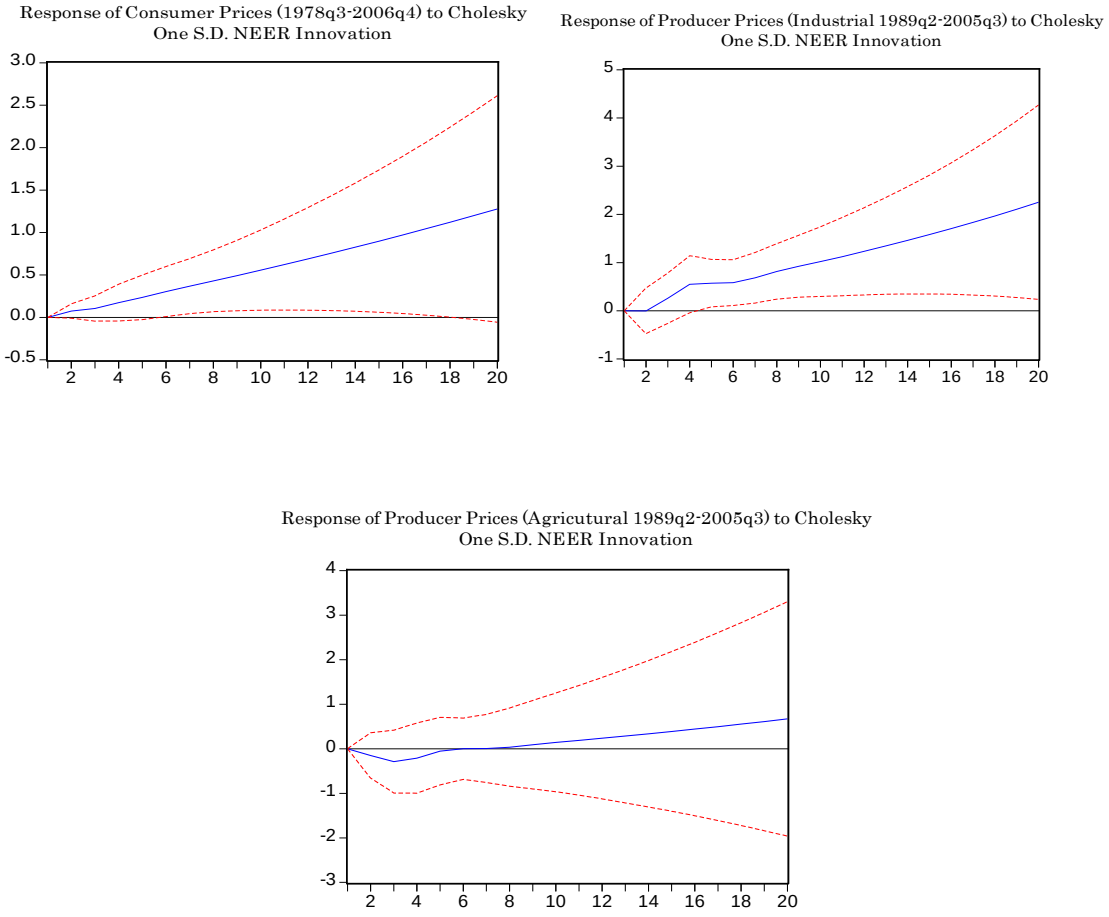
Finally, the estimated results demonstrate that the trade openness has a significant and negative impact on import prices and inflation both in the short- and long-run. Hence, trade liberalization policy of Bangladesh, overall, shows a positive impact on import demand. This also reduces domestic inflation.

5.6.2 Impulse Response

In order to take a closer look at the dynamic responses of Bangladesh economy to external shocks, we employ recursive VAR estimation (suggested by McCarthy, 1999) and Cholesky decomposition techniques (response to Choleskys S.D. Innovations ± 2 S.E.) using quarterly data for consumer prices (1977q3-2006q4) and wholesale prices (1988q2-2005q3). Secondly, we use the VAR estimation technique (Chowdhury and Siddique, 2006 also uses the same technique) to test and justify our previous findings that exchange rate pass-through to inflation is not insignificant which is an opposing view to Chowdhury and Siddique (2006). Moreover, we are interested in investigating whether there is any significant difference between the exchange rate pass-through to consumer prices (CPI) and producer prices (PPI). It is worth noting that quarterly data for import prices are available upto 1991q4 in the IFS statistics of the IMF, and quarterly import prices data do not exist in Bangladeshi data sources (the BBS constructs only the annual import price index) as well. Hence, we estimate the impulse response function using the above mentioned available data. Four lags have been set in the VAR for quarterly data and a constant is the only exogenous variable. Before estimating the VAR we test the non-stationarity of each series. All series are found I(1) (see, Table-5.6 in Appendices).

The study then employs the recursive VAR to find the impulse response of domestic prices to exchange rate shocks. The estimated results are presented as follows:

Figure 5.2: Impulse responses of consumer and producer prices to exchange rate shocks.



The response of both consumer (CPI) and producer prices (PPI- Industrial) to the exchange rate devaluation are positive and larger (see, Figure 5.2) in the long-run compared to the short-run. Although the industrial producer prices show a significant positive response, the agricultural producer prices (PPI- Agricultural) show an insignificant response to the exchange rate fluctuations.

5.7 Conclusion

Using both annual and quarterly data we investigate whether the conventional wisdom saying that unlike developed countries, exchange rate pass-through should be ‗complete' for developing countries, is appropriate for Bangladesh or not. We construct the annual nominal effective exchange rates for imports at annual frequency, and nominal effective exchange rate at both annual and quarterly frequencies. We then estimate pass-through regressions for import, consumer and producer prices using the ‗error correction mechanism' suggested by Heffernan (1997). The study employs the ‗Delta method' to estimate the long-run pass-through coefficients. We use the recursive VAR and the Cholesky decompositions technique to estimate the impulse response of domestic prices to exchange rate variability. The paper finally examines whether trade openness has any significant role in import prices and inflation.

The estimated results from the full sample demonstrate that the transmission of exchange rate changes is significant and ‗complete' to import prices both in the short- and long-run. However, exchange rate pass-through to domestic prices is found to be only ‗partial' in the short as well as long-run. The following important implications can be drawn from the above results:

First, the exchange rate is an effective policy variable for Bangladesh. It has a ‗complete' effect on import prices. Thus if there is any undervaluation in the exchange rate, the import prices increase ‗one-to-one' which is supposed to reduce the import demand of the country. However, as a large share of Bangladesh's importing is due to food items, intermediate inputs for exporting firms, oil, petroleum and other inelastic goods, the exchange rate undervaluation can merely increase the import prices; however, it may not significantly reduce the import demand of the country (see, for example, Aziz, 2010).

Secondly, the second stage pass-through (i.e., exchange rate pass-through to domestic prices) is found positive, significant and ‗partial'. The size of the effect is 0.42 and 0.51 in the short- and long-run, respectively. This implies that exchange rate movements significantly influence the inflation of the country. As mentioned earlier that Bangladesh frequently changes its exchange rate, and undervaluation occurs more than four times, on average, in a year. Hence, the magnitudes of pass-through imply that one percent devaluation in exchange rate increases the domestic prices by 0.42 and 0.51 percent in the short and long–run, respectively. Hence, frequent devaluation of the exchange rate may be one of the reasons for Bangladeshi high inflation.

The estimated results also suggest that ‗trade openness' significantly reduces import prices and domestic prices of the country both in the short and long-run. Thus, increasing demand for ‗intermediate goods' for exporting firms coupled with the ‗trade liberalization' policy may be the reason for increasing trends of Bangladesh's import demand too.

The recursive VAR implies that the response of domestic prices to exchange rate devaluation is positive and larger in the long-run compared to the short-run. This is an opposing result to Chowdhury and Siddique (2006). As mentioned earlier that Chowdhury and Siddique (2006) find insignificant exchange rate pass-through to domestic prices for Bangladesh which may be due to the fact that their study estimates the exchange rate pass-through to overall CPI and WPI.

CHAPTER SIX

IS THERE EXCHANGE RATE HYSTERESIS IN UK IMPORTS FROM SOUTH ASIA[20]

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ABSTRACT

The study finds partial support for the hysteresis hypothesis in UK imports from the South Asian developing countries in both the short- as well as long-run. This is in accordance with the evidence presented by Parsley and Wei (1993), Giovannetti and Samiei (1995), and Martinez-Zarzoso (2001). Dixit (1989a and 1989b) parameterize the idea that up to a certain level of exchange rate movements, new firms do not enter or incumbents do not exit their export market. According to Baldwin (1986 and 1988) and Dixit (1989a and 1989b) this „hysteresis in international trade' occurs due to „sunk entry costs' of firms. However, in this study the hysteretic effect is found significant even beyond the „sunk cost'. Recursive estimates reveal that „large' depreciations significantly reduce UK imports from Bangladesh; however, „large' appreciations do not increase the imports by equal magnitude. This asymmetry is different from the type of asymmetric behaviour assumed for US trade deficit in the 1980's.

Keywords: *Hysteresis hypothesis, sunk cost, Delta method, recursive estimate.*

JEL Classification*: C22, F31, F32*

6.1 Introduction

Baldwin (1986) first formally introduced the idea of ‗hysteresis' - ‗history matters' property - in international trade. The study is motivated by the puzzling behaviour of US trade in the 1980's. The real dollar appreciated almost 40 percent in 18 quarters starting from the third quarter of 1980. However, beginning from February 1985, the (real) dollar depreciated between 75 and 100 percent by the second quarter of 1987 (see, Baldwin 1988a). However, the US continued to experience a persistent trade deficit in the 1980's. This dollar fluctuation and its impact on the US trade balance produced puzzling behaviour. According to Baldwin, although the appreciation of the exchange rate passed-through the real price of import approximately one-for-one, the depreciation could not enhance the import prices to an expected level. Clearly there was *pricing-to-market* (PTM) behaviour by the foreign exporters. However, Baldwin (1988a) pointed out that the PTM is an implication; it is not an explanation for hysteresis in the US trade. Baldwin (1988b) argued that the ‗*sunk cost'* - the cost of enterprise which cannot be recovered even in the long-run - was the reason for the PTM behaviour of foreign firms. Subsequently Dixit (1989a and 1989b) modelled the sunk cost and parameterized ‗*hysteresis*' in terms of exchange rate fluctuations. Baldwin and Krugman (1989) also presented a theoretical basis of hysteresis in international trade and the equilibrium exchange rate.

In international trade, a temporary real exchange rate shock should have only a temporarily affect on trade prices and trade volumes. The size of the impact depends on the size of exchange rate shock. However, if the market entry cost is sunk, a temporary exchange rate shock may have a persistent (i.e., hysteretic) effect on trade prices and quantities which is defined as ‗hysteresis' in international trade (see, for example, theoretical literature of Baldwin (1986), Baldwin (1988b), Baldwin and Krugman (1989),

Dixit (1989a), Dixit (1989b), Baldwin and Lyons (1994), and Roberts and Tybout (1997), and empirical literature of Bean, 1987 (UK exports); Baldwin, 1988a (US aggregate non-oil imports); Parsley and Wei, 1993 (US imports from Canada and Japan); Anderton, 1999 (UK manufacturing trade); Giovannetti and Samiei, 1995 (the US, German and Japanese manufacturing exports); Martinez-Zarzoso, 2001 (Spanish exports to different EU countries); and Campa, 2004 (exports of Spanish manufacturing firms).

Empirically Bean (1987), Baldwin (1988), Anderton (1999), and Campa (2004) find that hysteresis is a significant phenomenon in international trade. However, Giovannetti and Samiei (1995), and Parsley and Wei (1993) find only partial support for the hysteresis hypothesis. Parsley and Wei (1993) employ a hysteresis variable (called _phase‘) in the import demand model of Rose and Yellen (1989); however, the study casts doubt on the validity of hysteresis in US imports. Martinez-Zarzoso (2001) finds that the hysteresis effect is a commodity and country specific phenomenon.

Similar to Martinez-Zarzoso (2001), this study also shows that hysteresis is a country and commodity specific phenomenon. In addition, we point out that _sunk costs‘ (which is traditionally considered as the reason for hysteresis in international trade) is not found to be a significant reason for hysteresis. It is worth mentioning that this study employs both the single hysteresis dummy (which was used in Parsley and Wei, 1993 to construct the hysteresis variable) and the double dummy (for large appreciation and large depreciation in importer‘s currency) to find the specific effects of large appreciation and large depreciation on import demand. However, we conclude that the double dummy approach is the appropriate method for the hysteresis hypothesis testing.

6.1.2 The Hysteresis Hypothesis

Currency depreciation usually decreases imports of a country. Therefore if there is a large depreciation in domestic currency there should be a large fall in import demand. This is because some of the existing foreign firms find their business unprofitable and they exit the market. As a result, the supply of import falls. On the contrary, when the reverse situation appears and the exchange rate returns to its previous position due to appreciation; foreign incumbents remain active but no new potential foreign entrant enters the market. Hence, a temporary shock in exchange rate shows an irreversible effect in international trade. This asymmetric behaviour in international trade is known as the _hysteresis' hypothesis. This asymmetry may also occur in the opposite direction, i.e., large appreciations increase imports sharply; however, if the reverse situation arises, there appears an insignificant fall in imports (which is considered as the reason for the US and UK trade deficit in the 1980's).

However, what causes this hysteresis? Existing studies suggest that _sunk costs' is the reason for hysteresis. Dixit (1989a and 1989b) parameterize the sunk cost in terms of _large' appreciation and depreciation of exchange rates. Dixit suggests that there is a _no-entry-no-exit' band of exchange rates for foreign firms. Precisely, new firms do not enter or incumbents do not exit foreign market up to a certain level of exchange rate movements which is the _no-entry-no-exit' band of exchange rate.

Nonetheless, to test whether _hysteresis' occurs due to _sunk costs', exchange rate variations need be found _larger' in magnitude because in case of _smaller' movements in exchange rate, any entry for new firms or exit for existing firms are not cost effective due to sunk entry costs. The _larger' term can be defined as _longer time period' or/and _bigger in magnitude' (see, for example, Parsley and Wei, 1993). This study, however, captures

both criteria of _larger' term to estimate the hysteresis in international trade. The following figure provides an idea about why and how the sunk cost matters in international trade.

Figure 6.1: Import and exchange rate relation in presence of hysteresis.

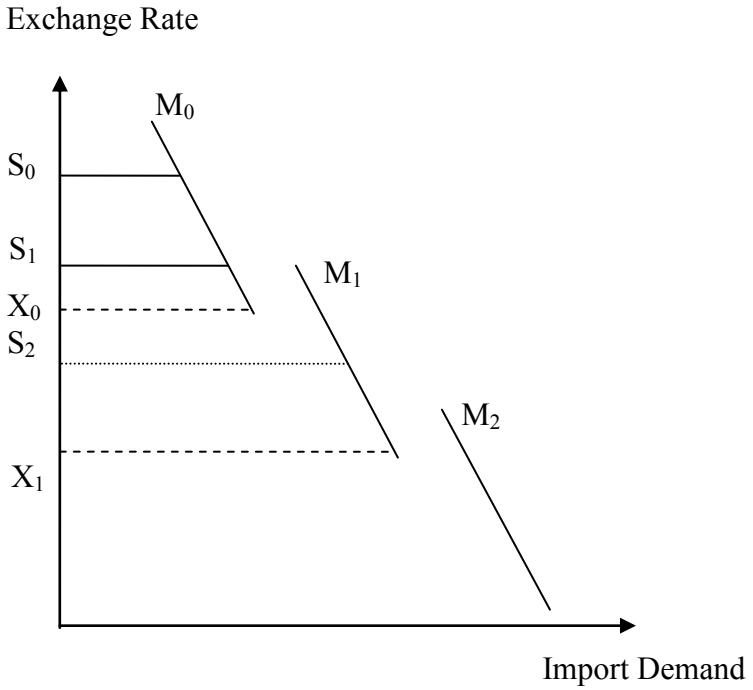


Figure 6.1 shows that any exchange rate movement between S_0 and S_1 does not influence a foreign firm to enter into the export market due to sunk entry costs. Foreign firms enter into the market only if appreciation in importer's currency persists a longer time period or larger in magnitude. This _longer time' and _larger magnitude' of exchange rate movements (in importer's currency) are vital for firms to find their total revenue larger than total costs (including sunk entry costs). However, in this situation (i.e., movement between S_0 and S_1), only the existing firms adjust to the increased import demand which causes movements along the existing import demand curve (see, for example, Parsley and Wei, 1993). On the contrary, any exchange rate movement from S_0 to S_2 (large appreciation in importer's currency) influences new firms to entry into the market. In this situation foreign goods become cheaper to domestic consumers (importers). As a result,

demand for import (at home) increases. This causes a shift of import demand schedule from M_0 to M_1. Therefore, it is clear from discussion above, that only a sufficiently _large' exchange rate movement can shift the import demand curve due to sunk costs.

Similarly, any exchange rate movement from X_1 to S_2 (which is not a _large' (sufficiently) depreciation for shifting of import demand curve) cannot shift the import demand curve from M_1 to M_0. In this situation existing firms continue their supply (along the supply curve) because they have already incurred sunk costs. Existing firms exit the export market only when it is very costly for them (for example, move from X_1 to S_1).

Let us now assume that there is an exchange rate band (due to sunk costs) for foreign firms' to take a decision whether they would enter or exit a foreign market. Let us further suppose that the upper exchange rate threshold of the band is s_t^u and the lower exchange rate threshold is s_t^l. Assuming that the current exchange rate is e_t, foreign firms' entry and exit decision can be explained with the following derivation:

Exit:	$e_t > s_t^u$	
No-entry-no-exit:	$s_t^u > e_t > s_t^l$	***(6.1)***
Entry:	$e_t < s_t^l$	

Here, the _no-entry-no-exit' band (which we call the _middle band') captures sunk costs relating to appreciations and depreciations. Thus, if the exchange rate (e_t) moves between the lower band s_t^l and upper band s_t^u no new firms enter and no existing firms exit the market due to sunk entry costs. Hence, following a depreciation and an appreciation in importer's currency there would be a decrease and an increase in import

demand respectively only when the exchange rate exceeds the upper band (large depreciation in importer‘s currency) or less below the lower band (large appreciation in importer‘s currency) of the exchange rate threshold. Now suppose that hysteresis occurs due to sunk costs. Hence, only a sufficiently large exchange rate movement, which is either equivalent to or larger than sunk costs, can influence a foreign firm to take an entry or exit decision.

We know that all foreign firms initially have to bear some fixed and non-returnable (even in the long-run) entry costs such as administrative costs, contract costs, and advertisement costs to enter a new export market. We also know that exchange rate movement can influence import demand of a country through relative prices. Thus, if the exchange rate pass-through to import prices is positive and significant (theoretically anticipated situation), we can expect that any appreciation can reduce import prices and thereby increase import demand of a country and vice versa. Now suppose that a foreign firm entered into an export market. Further suppose that export price of foreign firm (import prices of home) has fallen (risen) due to depreciation of the importer‘s currency. In this circumstance, the foreign firm has to calculate the balance of the price fall and its sunk costs. If the price fall is larger than sunk costs the foreign firm would exit the market. If price fall is smaller than sunk costs, the foreign firm will stay in the market and wait for appreciation of importers currency. This is because, if the foreign firm exits the market now, it will have to bear sunk costs again to enter the same market in a favourable situation (appreciation of importers currency). Hence, up to a certain level of exchange rate movement, foreign firms remain silent in its status. In a binary variable framework, we therefore construct a no-entry-no-exit (the middle band) which represents the above situation. Thus, if the exchange rate appreciates less than the lower limit of the middle

band or depreciates more than the upper limit of the middle band, the foreign firms can take their entry or exit decision easily. This is because the affect of the large enough exchange rate shocks can overweigh the sunk costs of foreign firms. Hence, sunk costs are captured by the middle band in our study. Nonetheless, there should not be a hysteresis in trade due to sunk costs if we can capture the middle band effect of the exchange rate by a dummy variable where the dummy equals zero for the middle band. In a dummy variable framework, we therefore can capture the sunk cost effect by setting (sunk costs related) the middle band equal to zero and otherwise to one.

Thus, although a small appreciation or depreciation in exchange rate may not induce foreign firms to enter into or exit from the foreign market due to sunk costs, a _larger' movement influences them to do so. Therefore, if we can allow for sunk costs and its associated band (by setting the middle band equal to zero) and if still there exists the hysteresis effect, then the hysteresis cannot be explained solely as a sunk cost effect.

If we find that a large appreciation (less than the lower limit of the middle band) has a positive and significant effect and a large depreciation (which depreciates the domestic currency to more than the upper limit of the middle band) has a negative and significant effect on import demand, then this would indicate that there was no asymmetric behaviour (no hysteresis) in trade, after allowing for sunk costs. However, if either appreciation or depreciation (but not both) leads to an insignificant trade effect, this would indicate hysteresis. Nevertheless, this asymmetric effect is not due to sunk costs of foreign firms.

6.1.3 Rationale of the Study

Our study is interesting for the following four reasons. Firstly, the existing empirical literature investigates the hysteresis hypothesis using some indirect measures. For example, Baldwin (1988) attempts to find the reasons for persistent US trade deficit in the 1980‘s. The study finds that, although there was a large depreciation following a substantial appreciation in dollar, the US trade deficit was persistent. Subsequently, the study examined how the real exchange rate and break points (due to large movements of the exchange rate) influenced import prices. The study, however, did not investigate the effect of large appreciation and depreciation on import volume. Instead, the paper regressed import prices on exchange rate. Actually, the study observed (not estimated) US import demand on the basis of the impact of large exchange rate movement on import prices. This may be regarded as indirect estimation of the hysteresis hypothesis and can more accurately be regarded as test for _exchange rate pass-through‘ rather than as test for hysteresis. Moreover, the study forecast import prices using only the real exchange rate as a regressor. Nonetheless, the study fails to find any strong evidence of the hysteresis hypothesis from either the _beachhead‘ or the _bottleneck‘ structural models. The study declares that "…we have failed to find a single, simple micro story that can fully account for the puzzling behaviour of the macro data…”.

Anderton (1999) showed that the effective exchange rate of UK rose by 30 percent between 1979q1-1981q1, and that the appreciation had been totally reversed by the end of 1983. However, the UK trade deficit still remained. The study therefore tested the hysteresis hypothesis using a *_multiplicative dummy’* constructed by multiplying the relative prices with annual dummy. An annual intercept dummy (relating to the large exchange rate movements) was constructed such that the dummy equalled 1 (one) for a

specific year and zero otherwise. The study then argued that the elasticity of the multiplicative dummy would indicate whether the size of elasticity varies with large exchange rate movements.

It is worth noting that relative prices can be an appropriate measure for hysteresis test if there is _omplete' exchange rate pass-through to import prices. For example, if the exchange rate pass-through is partial or insignificant, any exchange rate shock can partially or cannot at all influence the relative price of imports, respectively. However, Anderton (1999) did not test the exchange rate pass-through of UK import prices. Moreover, the study found evidence of hysteresis in three out of six industrial imports; and two out of six industrial exports which is not sufficient evidence to generalize the statement that hysteresis is a significant phenomenon in the UK's trade. However, the study concludes that hysteresis was a significant story in the UK's trade performance.

Bean (1987) also attempted to test the hysteresis effect in the UK export demand equation. The study finds a statistically significant level effect of relative prices $\left(p^* - p\right)_t$ on the UK's exports. However, the error-feedback term, $\left(x - x^*\right)_{t-1}$ in the UK's export demand equation is found to be smaller in magnitude (statistically insignificant) compared to the coefficient on relative prices. [Here, x is the (log) volume of British non-oil visible export and x^* is consumption of foreign products by the rest of world which is proxied by the US GNP]. The study therefore pointed out a statistically significant level effect of relative prices and very small and insignificant coefficient for relative exports suggests a hysteretic effect in the UK exports. This is again rather a conjecture about the hysteresis in trade than a direct test for the hysteresis hypothesis.

In this study, however, we apply a dummy variable approach to test the hysteresis hypothesis which is a direct measure for the hysteresis hypothesis.

Secondly, South Asian countries have been trying an export-led growth policy from around the mid-1980s which is reflected by the frequent movement in their exchange rates and exchange rate regime shifts (see, for example, Table 6.11 in Appendices). However, none of the studies until now has examined whether the trade flows of these countries are responding according to the theoretical anticipation. It is worth mentioning that the United Kingdom is one of the major trade partners of South Asian countries. We know that UK imports are equivalent to the bilateral export from its partners. This study attempts to investigate the presence of hysteresis in bilateral aggregate and disaggregate imports of the United Kingdom from South Asian countries. In other words, this is a test for the hysteresis hypothesis for South Asian exports from its demand side. The study has chosen the UK as the recipient country also because of availability of data.

Thirdly, Dixit (1989a and 1989b) postulated that firms' entry and exit decisions depend on the magnitude of exchange rate movements. Dixit parameterized a threshold level for _sunk entry costs'. Building on this idea, we use a dummy variables approach to estimate sunk costs related hysteresis. In addition, we allow for flexibility in threshold levels which capture a common or a firm specific and/or time variant _sunk costs' which is also suggested by Dixit (1989a and 1989b).

Finally, existing empirical literatures estimate the hysteresis hypothesis for highly developed countries such as Parsley and Wei (1993), and Baldwin (1988b) estimate for the United States; Bean (1987), and Anderton (1999) for the United Kingdom; Giovannetti and Samiei (1995) for the United States, Germany and Japan; Martinez-Zarzoso (2001); and Campa (2004) for Spain. None of the existing literature estimates the hysteresis hypothesis for developing countries. However, developing countries are more concerned about their

exchange rate policy and the current account balance than developed countries. The study therefore aims at filling the vacuum.

This paper employs a dummy variable approach to estimate the exchange rate hysteresis in South Asian exports. Our study tests both the short and long-run effect of large exchange rate movements on bilateral trade. We also examine whether the theoretical view that - _sunk œosts‘ is the reason for hysteresis - is appropriate.

The remaining sections are organized as follows: Section 6.2 discusses exchange rate movements, trade flows and the hysteresis dummy construction method. Section 6.3 provides the data, methodology and estimation. Section 6.4 discusses the estimated results. Section 6.5 concludes the study.

6.2 The Hysteresis Threshold

Our discussions about exchange rate movements and exchange rate hysteresis in international trade indicates that the effect of depreciation following a successive depreciation is different from the effects of depreciation following a consecutive appreciation. This can be described as follows:

First, we define s_t as a successive change in exchange rate, which is measured as follows:

$$s_t = \sum_{i=0}^{\tau} \Delta e_{t-i} = e_t - e_{t-\tau-1} \qquad \textbf{(6.2)}$$

where Δe_t is first difference of exchange rate, (the exchange rate is calculated domestic currency per unit of foreign currency) and τ is number of periods.

Then we construct the hysteresis dummy d_t in the following way,

$$d_t = \begin{cases} 1 & \text{if } \Delta e_t > 0 \text{ and } s_t > 0 \\ -1 & \text{if } \Delta e_t < 0 \text{ and } s_t < 0 \\ 0 & \text{otherwise} \end{cases} \qquad \textbf{(6.3)}$$

Hence, the dummy d_t is 1 if both the first difference (Δe_t) and cumulative change (s_t) in exchange rates are in positive direction; d_t is -1 if both are in negative direction and d_t is 0 (zero) if they are in opposite directions. If the current change and cumulative change are in opposite direction it indicates that the depreciation or the appreciation is not sufficiently _large'. As a result, we include this type of movement as the middle band (i.e., the _no-entry-no-exit' band) of exchange rate.

The following figures (Figure 6.2(a), Figure 6.2(b), Figure 6.2(c) and Figure 6.2(d)) show the _break points' (due to _large' real exchange rate shocks) in bilateral exchange rates of UK with its South Asian counterparts. Note that _break points' are calculated using the following method:

$$Break\ Point^{21} = d_t \times \Delta e_t \times s_t \qquad \textbf{(6.4)}$$

The study calculates the break points and plots them just to observe whether there are large appreciations and depreciations in the UK bilateral exchange rates (against the _Taka' and the _Rupæs') over time. However, we have not employed the _break points' in our empirical models.

The following Figure 6.2 (a) suggests that in the managed floating regime of Bangladesh's exchange rate, there seem to be many _large' depreciations of the pound sterling compare to appreciations. However, between 2003 (*de jure* _free floating' regime of Bangladesh's exchange rate) and late-2007, many _large' appreciations occurred in UK currency. Sterling again starts depreciating from the _credit crunch' period onwards. This is also noticeable from the figure (see, Figure 6.2 (a)) that the size of depreciations of sterling is larger at the time of financial crises compared to the other periods.

In the case of India and Pakistan, there seems to occur a kind of cyclical movements (see, Figure 6.2(b) and Figure 6.2(c)) in the UK bilateral exchange rates. The pound first depreciates, then appreciates and then depreciates again against the Indian and Pakistani Rupees. The size of depreciations at the financial crisis period is different (exceptionally larger) compared to the other periods. In the case of Sri Lanka, sterling appreciations, overall, have been more than depreciations (Figure 6.2(d)).

Hence, many large appreciations and depreciation of pound sterling against the South Asian currencies occur in the sample period which gives us the opportunity to test the hysteresis hypothesis in bilateral trade between the UK and its South Asian trade partners.

[21] See, for example, Parsley and Wei (1993).

Figure 6.2(a): 'Large' real appreciations and depreciations of Pound Sterling against Bangladeshi 'taka'.

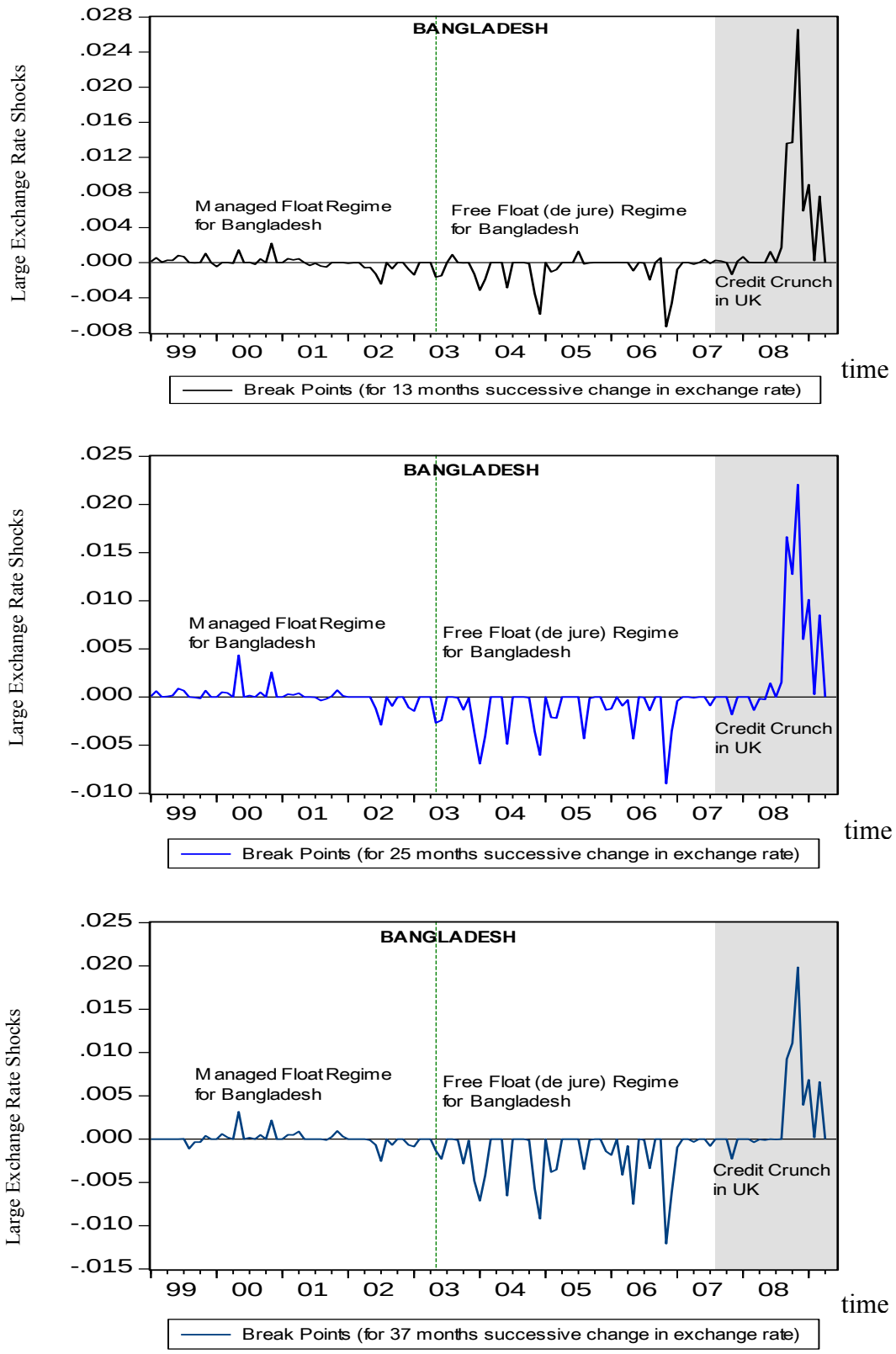


Figure 6.2(b): 'Large' real appreciations and depreciations of Pound Sterling against Indian 'rupees'.

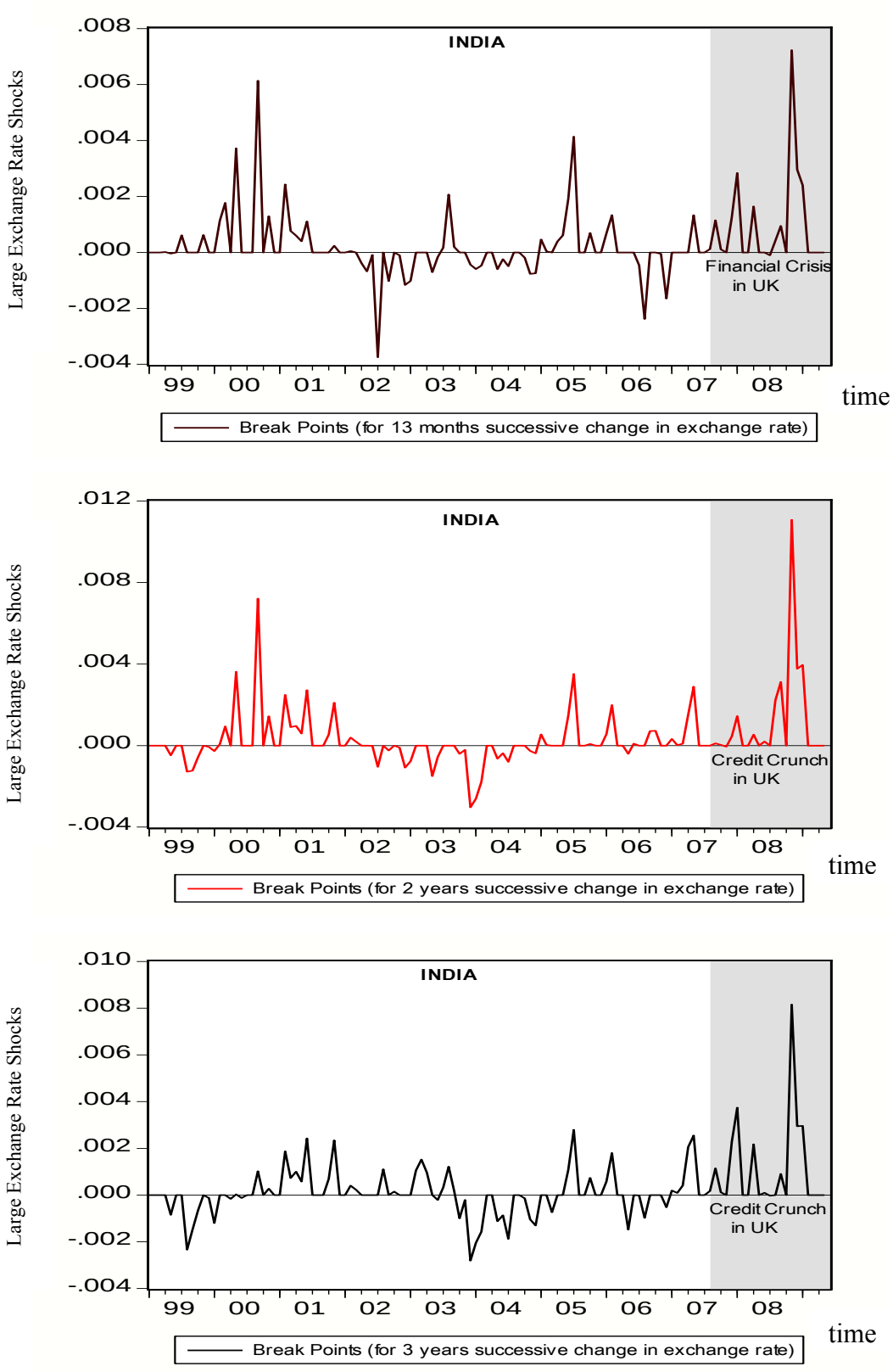


Figure 6.2(c): 'Large' real appreciations and depreciations of Pound Sterling against Pakistani 'rupees'.

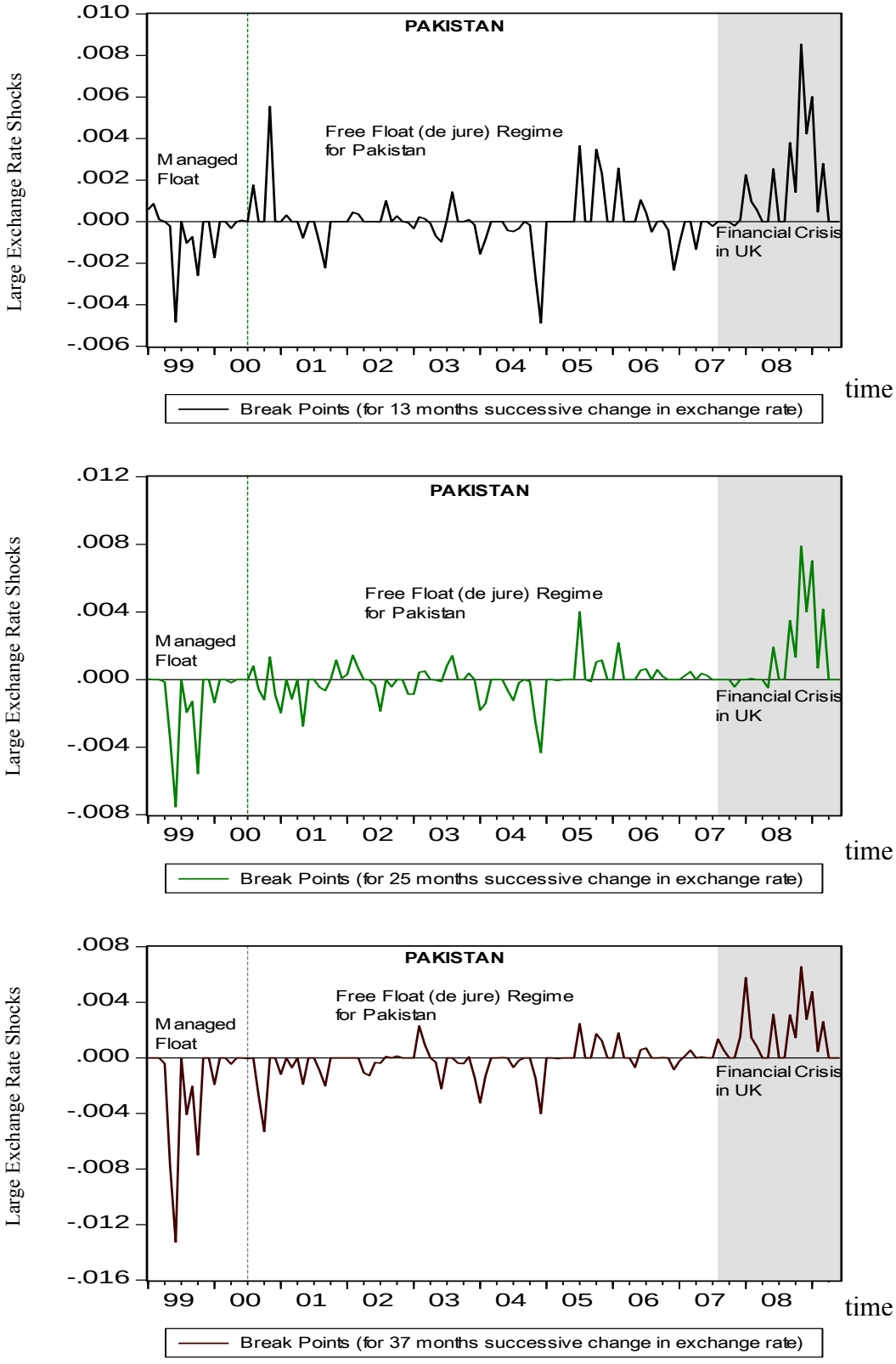
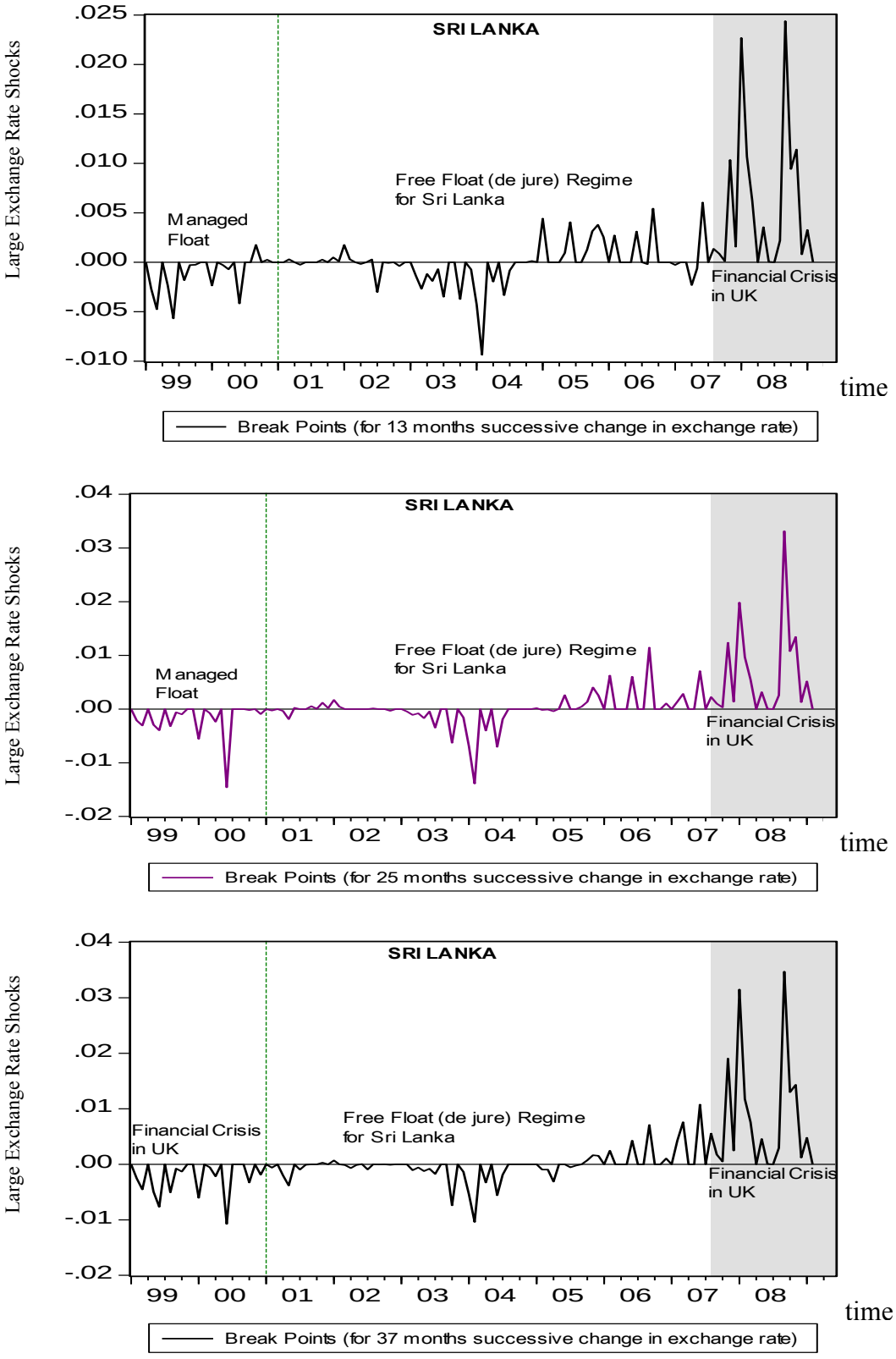


Figure 6.2(d): 'Large' real appreciations and depreciations of Pound Sterling against Sri Lankan 'rupees'.



The hysteresis hypothesis predicts that the coefficient of the hysteresis dummy would be negative and significant in an import equation. This is because any appreciation after a cumulative appreciation leads to an entry of exporting firms into its import market and therefore the import supply schedule shifts outward. Thus, if the hysteresis is a significant phenomenon, one can expect the sign of the coefficient of dummy would be negative and significant. On the other hand, depreciation after a successive depreciation will shift the import supply schedule inward which would again produce a negative coefficient of the dummy. Hence the combine effect would be negative and significant if we cannot reject the hysteresis hypothesis. However, as we argue below that this hysteretic effect has not occurred due to sunk costs.

Figure 6.3: Hysteresis beyond the sunk cost effect.

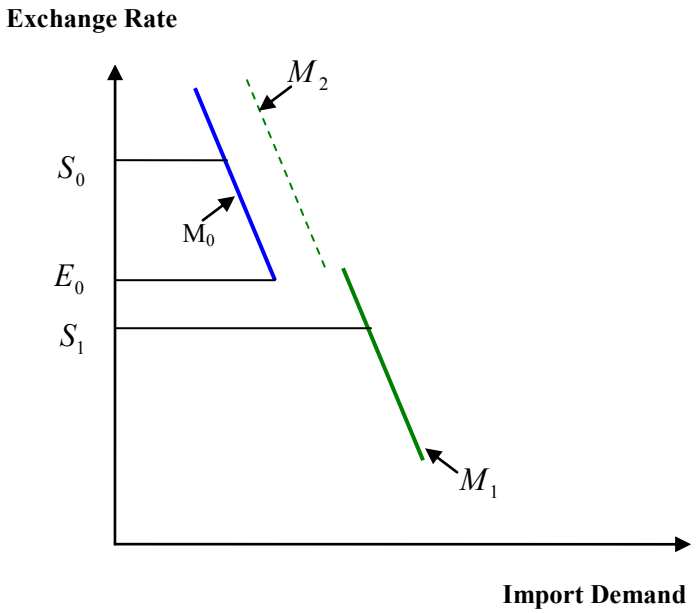


Figure 6.3 explains the actual situation. We know that any exchange rate movement from S_0 to E_0 cannot shift the import schedule from M_0 to M_1 due to the sunk cost

effect. However, suppose that the exchange rate moves from S_0 to S_1 (i.e., exceeds sunk costs effect which is captured by the middle band of the hysteresis dummy). Consequently, the import schedule M_0 shifts to M_1. However, in a reverse situation (i.e., when exchange rate moves from S_1 to S_0) if M_1 does not shift back to M_0 (may be it shifts back to M_2); then there will be hysteresis in trade. However, this cannot be explained as a sunk cost effect because the sunk cost was captured by zero value of hysteresis dummy. The sunk cost does not have any special effect.

A ‗large' appreciation in importers currency induces foreign firms to enter into the market and the opposite situation arises when there is a ‗large' depreciation. However, if the impact of depreciation is smaller in magnitude than the impact of appreciation, there would be hysteresis in international trade and there would be trade deficit as well. In this situation, import schedule shifts from M_1 to M_2 (see, Figure 6.3). It does not go back to its previous level, M_0. However, this situation cannot be shown by the above mentioned ‗single dummy approach'. This is because if the value of the single dummy is found negative and significant it would not indicate whether there is an asymmetric outcome from large appreciations and equally large depreciations. This dummy also cannot indicate the magnitude of the asymmetry. More precisely, it would not be clear from the ‗single dummy approach' whether the effect of appreciation is more than the effect of depreciation or the other way around. This is because we observe only the overall negative and significant effect from the single dummy. The shortcomings of the ‗single dummy approach' lead us to construct a ‗double dummy approach' of the hysteresis hypothesis.

We therefore construct a double dummy approach namely, depreciation (d_t^A) and appreciation (d_t^D) dummies to examine hysteresis beyond the sunk-cost effect. It is worth noting that we still take the sunk cost effect into account while constructing the dummies.

The study constructs d_t^A and d_t^D for appreciation and depreciation respectively using the following techniques:

$$d_t^D = \begin{cases} 1 & \text{if } \Delta e_t > 0 \text{ and } s_t > 0 \\ 0 & \text{otherwise} \end{cases} \qquad \textbf{(6.5)}$$

and

$$d_t^A = \begin{cases} 1 & \text{if } \Delta e_t < 0 \text{ and } s_t < 0 \\ 0 & \text{otherwise} \end{cases} \qquad \textbf{(6.6)}$$

Here, the dummy, d_t^D equals 1 (one) if there is a large depreciation (depreciation after a cumulative depreciation) and dummy equals 0 (zero) if there is appreciation after a cumulative appreciation as well as if cumulative change and current change are in opposite directions. Similarly, dummy d_t^A equals 1 (one) if there is a large appreciation (appreciation after a cumulative appreciation) and dummy equals 0 (zero) otherwise. It is worth noting that there are three distinguishable characteristics of exchange rate movements (large appreciation, large depreciation and middle band) in equation (6.5) and (6.6) above which are captured by two dummies (large appreciation dummy and large depreciation dummy). Thus, there is no possibility of the _dummy variable trap', in this case.

In this study, current change means monthly changes and cumulative changes are captured by 13 months (1 year), 25 months (2 years), and 37 months (3 years) movements in exchange rate. We allow for variation in cumulative change because Dixit (1989b)

pointed out that the sunk cost might differ from firm to firm, from one commodity to another commodity'.

Now the question may arise, why one should consider a one year movement of exchange rate as a cumulative change. This is because when there is a free floating exchange rate regime, the exchange rate may vary every day and sometimes even more than once a day. As a result, both the demand and supply side can adjust in one year. We therefore argue that 13 months can be considered as long-run for exchange rate and trade relation.

As mentioned earlier, Dixit (1989a and 1989b) parameterize the proposition that up to a certain level of variation in exchange rates (a middle band), there is a _no-entry-no-exit' zone of trade for foreign firms due to sunk entry costs. However, empirically we may still experience the hysteresis in international trade even after overcoming the sunk cost related exchange rate effect. In this situation we may believe that hysteresis does not actually occur due to _sunk costs'. There may have some other explanations for hysteretic behaviour, which may include: (i) a partial exchange rate pass-through to trade prices and a sustainable decline in exchange rate pass-through over time, (ii) third-country effect (see, for example, Greenaway, Milner and Mahabir, 2008; Eichengreen, Rhee, and Tong 2004) – a price competition between large and small firms where the large firms have external economic advantages (i.e., low cost of production and spillover effect), (iii) dumping behaviour to capture a superior market (see, for example, The Economist, 11 February 2010). The above mentioned three circumstances may be further elaborated upon as follows:

First, the degree of *exchange rate pass-through* plays an important role in import and export trade. If the exchange rate pass-through is complete, any depreciation or

appreciation is reflected fully in the trade prices. However, the existing literature reveals that:

(i) there is an incomplete exchange rate pass-through to export and import prices in developed, developing and transition economies (see, for example, Campa and Goldberg, 2005; Campa and Minguez, 2006; Zorzi, Hahn and Sanchez, 2007; Anderton, 2003; Yang, 1997; Mumtaz et al., 2006; Mallick and Marques, 2006; Zorzi, Hahn and Sanchez, 2007; Ohno, 1989; Knetter, 1993; Gagnon and Knetter, 1995; and Bussière, 2007; Vigfusson et al., 2007); and

(ii) there is a sustainable decline in exchange rate pass-through over time (see, for example, Olivei, 2002; Marazzi et al., 2005; Ihrig et al., 2006; Mumtaz et al., 2006; Mallick and Marques, 2006). For instance, Marazzi et al. (2005) find that exchange rate pass-through steadily declines from above 0.8 in 1987 to 0.4 in the mid-1990s and further to 0.2 in the late-1990s in the US import prices. Therefore, a large appreciation, suppose 10 percent appreciation, in the late-1980‘s, could reduce import prices by 8 percent and thereby increase import demand (suppose) by eight percent; however, a large depreciation of equal magnitude in the late-1990s, could reduce import prices and import demand by only 2 percent. Thus, there may appear an asymmetric effect in trade which cannot be explained as the hysteresis due to sunk costs. This hysteresis occurs rather due to the partial exchange rate pass-through and the decline in exchange rate pass-through over time.

Second, suppose a bilateral trade of a particular commodity takes place between India and UK. A third country China, which has a comparative advantage (due to low costs) in production of the same commodity, is a new entrant in the export market. Further suppose that there is a large depreciation in UK currency which affects import prices fully (‗complete‘ pass-through). Therefore, many Indian firms find exports unprofitable and exit

from the UK market. However, almost all Chinese firms stay in the market with (maybe) reduced supply due to a fall in import demand. This happens because the cost of production is lower in China. After a certain time if the reverse situation arises (i.e., exchange rate appreciates), Chinese incumbent increases their supply as well as new Chinese firms‘ enter the market (due to both low cost and spillover effect in domestic industries). Hence, Indian firms‘ lose the UK market and cannot enter again even in a favourable situation (_large‘ appreciation).

Thus if we analyze the bilateral trade between UK and India in this situation, it shows that import supply of UK from India falls dramatically when there is a large depreciation and the situation does not reverse when there is a _large‘ appreciation. Hence, data would suggest us that there is a hysteresis in bilateral trade. However, the reason is not the sunk cost. This can be explained as a third-country effect.

Finally, in the real world, giant firms and respective government price their products to-market to achieve a greater market share and eventually capture a superior market. Precisely, there is a pricing-to-market behaviour in trade. Hence, when there is a large depreciation of currency, relatively small firms have to leave the market however, giant firms stay in the market using a *dumping* pricing technique and wait for a favourable situation. When the favourable situation appears the incumbents capture the market with increased supply and keep away the small firms from small economies. These small firms can never re-enter the market. Thus, a large depreciation eliminates small firms from export markets; however, a large appreciation cannot bring them back into the market. This is a real scenario for the firms of developing countries. Hence it seems that there is hysteresis in trade; which again is not because of sunk costs.

It is worth mentioning that this study investigates whether the hysteresis occurs due to sunk costs. If we find that there is hysteresis in trade but this is not due to sunk costs, we would assume that hysteresis could be due to any (or all) of the above mentioned reasons. Although we assume the above causes for hysteresis in trade, we have not tested them in this paper. Exploring the actual reasons for hysteresis in trade might be topics for further study.

6.3 Data, Methodology and Estimation

The study collects ‗Standard International Trade Classification' (SITC)-wise (see, Table 6.5 in Appendices) monthly aggregate and disaggregate bilateral import volumes and prices of UK from the trade statistics database of the HM Revenue & Customs, UK Government**,** for the periods between 1999m01 and 2009m4. We collect ‗producer price indices' (PPIs) of Bangladesh, India, Pakistan and Sri Lanka; ‗industrial production index' of UK (proxy for real income) from the ‗International Financial Statistics' of the International Monetary Fund. The study also constructs the UK bilateral real exchange rates using the data from the International Financial Statistics. The SITC-wise domestic PPIs of United Kingdom are collected from the OECD database. It should be mentioned that the SITC data are available for the UK total (bilateral) import, *SITC 0, SITC 6, SITC 7 and SITC 8* categories from Bangladesh; for total (bilateral) import, *SITC 0, SITC 1, SITC 2, SITC 4, SITC 5, SITC 6, SITC 7* and *SITC 8* categories from India; for total (bilateral) import, *SITC 0, SITC 2, SITC 5, SITC 6, SITC 7* and *SITC 8* categories from Pakistan; and for total (bilateral) import, *SITC 0, SITC 1, SITC 2, SITC 5, SITC 6, SITC 7* and *SITC 8* categories from Sri Lanka. The above series are found for the periods from 1999m01 upto

2009m08. However, PPIs are available only up to 2009m04 for Bangladesh, 2009m05 for India and Pakistan, and 2009m02 for Sri Lanka.

The study constructs the ‗real exchange rate' variables of UK with Bangladesh, India, Pakistan and Sri Lanka. The following (Figure 6.4) is the plot of real exchange rates (pound sterling per unit of Asian currencies). The figure shows that there are unusually large depreciations of pound sterling after July 2007 (shaded area) and this upward jump in exchange rate was happened during the financial crisis period.

Figure 6.4: Real exchange rate of UK with South Asian countries.

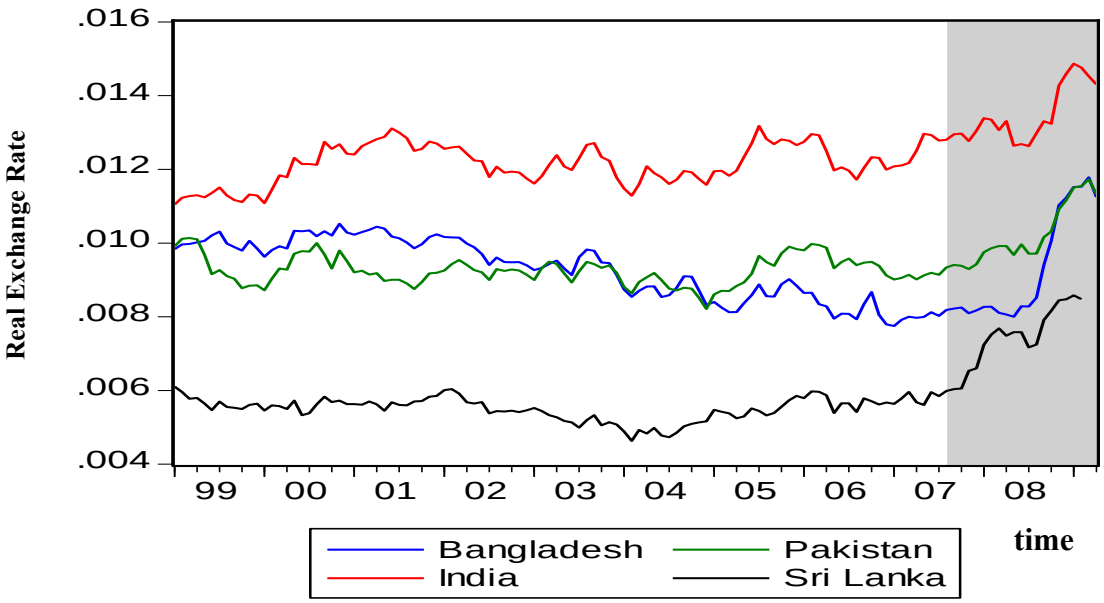
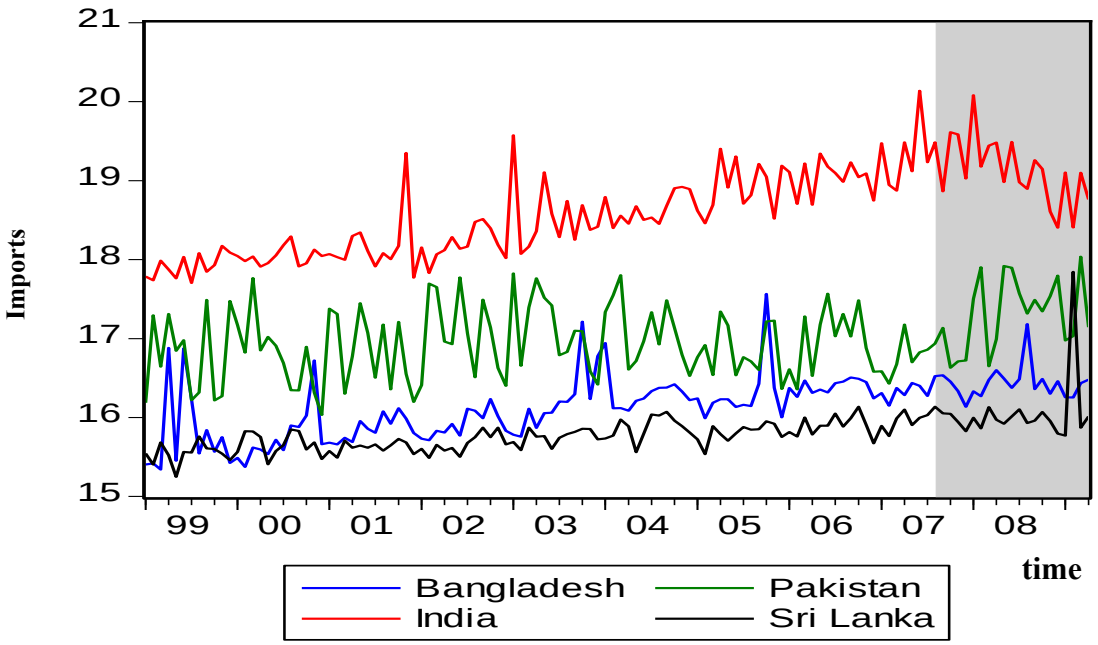


Figure 6.5 shows the logarithm of the volume of total import of UK from its South Asian trade partners. Although there were large depreciations of pound sterling at the time of financial crises (see, Figure 6.4), it seems that there is not the expected extent of fall in import volumes of UK from South Asia (see, Figure 6.5). It is also noticeable that,

although the volume of imports from India has shown a downward trend at the financial crisis period, this is not a big fall compared to the size of depreciation of pound sterling.

Figure 6.5: UK Imports from South Asia.



Rose and Yellen (1989), Rose (1990), Rose (1991) and other standard two-country trade literature assume that demand for imports depends negatively on relative prices (RP) and positively on domestic real income (Y). Hence, in the long-run we assume the following model for import demand (using the ‗single dummy approach', for instance):

$$\ln Q_{i,t}^{m} = \mu_i + \delta_i \ln RP_{i,t}^{m} + \lambda_i \ln Y_t + \psi_i d_t + u_t \qquad \textbf{(6.7)}$$

where , d_t is hysteresis dummy; u_t is the error at time t.

Thus,

$$u_t = \ln Q_{i,t}^{m} - \mu_i - \delta_i \ln RP_{i,t}^{m} - \lambda_i \ln Y_t - \psi_i d_t \qquad \textbf{(6.8)}$$

Hence, the growth of $\ln Q_{i,t}^{m}$ is negatively related to the magnitude of u_t. The empirical value of μ_i, δ_i, λ_i and ψ_i can be found from the following equation's (see, for example, Heffernan, 1997) estimation:

$$\Delta \ln Q_{i,t}^{m} = \alpha_i + \beta_i \ln Q_{i,t-k}^{m} + \gamma_i \Delta \ln RP_{i,t}^{m} + \phi_i \ln RP_{i,t-k}^{m} + \eta_i \Delta \ln Y_{i,t} + \kappa_i \ln Y_{i,t-k} + \theta_i d_t + \varepsilon_{i,t} \quad \textbf{(6.9)}$$

where, $Q_{i,t}^{m}$ is the UK import volume for $i(1, 2, 3, ...9)$ industry at t $(1999m01.....2009m04)$ time, $RP_{i,t}^{m}$ is the relative prices of import for UK (industry specific import prices divided by the industry specific domestic price, PPI), Y_t is the real income of UK proxied by the industrial production index, d_t is the hysteresis dummy. Subscript k is lag length which is set one because by using only the first lag of variables we can get rid of autocorrelation (Schwarz Information Criterion). The study initially estimates the equation (6.9) to find hysteretic effect in the UK import demand using the _single dummy approach'. We then use the _double dummy approach' in the equation (6.9) to figure out the specific effects of large depreciations (d_t^D) and large appreciation (d_t^A) in the UK currency. That means, we obtain two separate values for large depreciation and large appreciation in the _double dummy approach' instead of only one coefficient in the _single dummy approach' (from equation, 6.9). It is worth noting that we test the hysteresis hypothesis employing an intercept dummy, because we are interested only in the shifting of import demand curve (not movements along the curve) due to large exchange rate shocks. The estimated model by using the _double dummy approach' can be modified as follows:

$$\Delta \ln Q_{i,t}^{m} = \alpha_i + \beta_i \ln Q_{i,t-k}^{m} + \gamma_i \Delta \ln RP_{i,t}^{m} + \phi_i \ln RP_{i,t-k}^{m} + \eta_i \Delta \ln Y_{i,t} + \kappa_i \ln Y_{i,t-k} + \rho_i d_t^D + \pi_i d_t^A + \varepsilon_{i,t} \quad \textbf{(6.10)}$$

In double dummy case, if we find one of the dummies (either ρ or π) coefficient is negative and significant; however, the other dummy is insignificant, we conclude by saying that there is an asymmetry in the UK import demand in response to large appreciation and large depreciation i.e., there is hysteresis in the UK imports. In this case, we would argue that the asymmetry has occurred not due to sunk costs, because the middle band of the exchange rate threshold has captured the sunk cost effect (we have given the value for the _middle band' equals zero).

We obtain coefficients for the lagged variables and the first difference variables from estimation. The coefficients of first difference of the variables provide us the short-run estimates; however, we calculate the long-run coefficients from lagged variables by using the following method.

In the long-run steady state, $\Delta \ln Q_{i,t}^{m} = \Delta \ln RP_{i,t}^{m} = \Delta \ln Y_{i,t} = 0$; thus, the Equation (6.9)[22] can be written as (for the long-run):

$$-\beta_i \ln Q_{i,t}^{m} = \alpha_i + \phi_i \ln RP_{i,t}^{m} + \kappa_i \ln Y_{i,t} + \theta_i d_t \qquad \textbf{(6.11)}$$

Hence, in the long-run coefficients for the import demand function can be obtained as follows:

$$\mu_i = -\alpha_i / \beta_i ,$$

$$\delta_i = -\phi_i / \beta_i ,$$

$$\lambda_i = -\kappa_i / \beta_i , \text{ and}$$

$$\psi_i = -\theta_i / \beta_i$$

[22] we apply similar approach to calculate the long-run coefficients from model (6.10)

The study estimates Equation (6.9) and (6.10), and then derives the Equation (6.7) using the delta methods for both aggregate and disaggregate UK import demand. We estimate only the broad categories of imports from the SITC list (see, Table 6.5 in Appendices). The paper estimates the import demand equations using both the single dummy and the double dummy approaches. As mentioned earlier that we take one (13 months), two (25 months) and three (37 months) years of successive change into account when we construct the hysteresis dummy in order to capture the large appreciation and depreciation, as well as to capture any variations between firms and across countries. The study uses all of them in turn. However, we present the results for the dummy which is constructed by using 2 years (25 months) cumulative change of exchange rate. Nonetheless, if we used the one and three years successive changes in exchange rates (instead of 2 years successive change), we did not find any major difference in estimated results.

6.4 Estimated Results

Descriptive statistics of UK import volumes from South Asian countries which presents the basic data properties is presented in the Appendices (see, Table 6.6 (a), (b), (c) and (d) in Appendices). Subsequently, the study estimates the Models (6.9) and (6.10) which are explained as follows:

6.4.1 ECM and Delta Method

The *double dummy approach'* (depreciation and appreciation dummies) based estimation results in the short-run and long-run hysteresis of UK imports from Bangladesh, India, Pakistan and Sri Lanka are presented as follows. It is worth mentioning that the

study uses both the single and double dummy approaches; however, only the results for the double dummy approach (model 6.10) are presented in the text and the results for the single dummy approach (model 6.9) are given in Appendices (see, Table 6.7, Table 6.8, Table 6.9 and Table 6.10 in Appendices). The delta method is applied to test the significance level of the long-run parameters. It is worth noting that we obtained the standard error of long-run coefficients from the delta method; however, we calculate the t-value to find the significance level.

Table 6.1.1: ECM results for UK imports from Bangladesh

(Double dummy approach; p-value in parenthesis)

	C	$\ln Q^m_{i,t-1}$	$\Delta \ln RP^m_{i,t}$	$\ln RP^m_{i.t-1}$	$\Delta \ln Y_t$	$\ln Y_{t-1}$	d_t^D	d_t^A
Total	6.696	-0.1385	-1.063	-0.109	0.204	-1.032	**-0.073**	-0.025
	(0.000)	(0.000)	(0.000)	(0.051)	(0.312)	(0.000)	**(0.012)**	(0.323)
SITC 0	6.0185	-0.425	0.246	-0.046	0.826	-0.039	**-0.153**	-0.017
	(0.030)	(0.000)	(0.079)	(0.652)	(0.029)	(0.934)	**(0.003)**	(0.691)
SITC 6	6.123	-0.352	-0.915	0.029	0.311	-0.196	-0.059	-0.033
	(0.003)	(0.000)	(0.000)	(0.827)	(0.326)	(0.630)	(0.201)	(0.398)
SITC 7	13.105	-0.674	-1.191	-0.755	-0.308	-1.568	**-0.275**	0.070
	(0.034)	(0.000)	(0.000)	(0.000)	(0.765)	(0.227)	**(0.082)**	(0.583)
SITC 8	8.215	-0.151	-1.061	0.140	-0.031	-1.346	**-0.072**	-0.017
	(0.000)	(0.000)	(0.000)	(0.020)	(0.893)	(0.000)	**(0.030)**	(0.547)

Table 6.1.2: Results of the Delta Method for the Long-run UK import from Bangladesh.

(Double dummy approach; standard error in parenthesis)

SITC	C	$\ln RP_t^m$	$\ln Y_t$	d_t^D	d_t^A
Total	48.35**	-0.79**	-7.45**	**-0.53****	-0.18
	(10.71)	(0.36)	(2.34)	**(0.23)**	(0.19)
SITC 0	14.17**	-0.11	-0.09	**-0.36****	-0.04
	(5.39)	(0.24)	(1.09)	**(0.12)**	(0.10)
SITC 6	17.42**	0.08	-0.56	-0.17	-0.09
	(5.11)	(0.38)	(1.16)	(0.13)	(0.11)
SITC 7	19.44**	-1.12**	-2.32*	**-0.41***	0.10
	(9.17)	(0.22)	(1.94)	**(0.24)**	(0.19)
SITC 8	54.33**	-0.93**	-8.90**	**-0.48****	-0.11
	(11.69)	(0.34)	(2.53)	**(0.23)**	(0.20)

Note: *Delta method computed using analytic derivatives. ** and * reject the restrictions (H_0: parameter is equal to zero) at 5% and 10% level of significance.*

Estimated results indicate that all parameters except the coefficient of hysteresis obtain expected signs and significance levels for almost all SITC categories for all countries (see, for example Table 6.1.1, Table 6.1.2, Table 6.2.1, Table 6.2.2, Table 6.3.1, Table 6.3.1, Table 6.4.1 and Table 6.4.2 in the text; as well as Table 6.7, Table 6.8, Table 6.9 and Table 6.10 in Appendices). The large depreciation dummy (d_t^D) is found to be negative and significant for all available sectors of UK bilateral import from Bangladesh in both the short- and long-run (see, Table 6.1.1 and Table 6.1.2). Hence, the ‗double dummy approach' indicates that the depreciation dummy is negative and significant for almost all UK imports from Bangladesh (see, Table 6.1.1 and Table 6.1.2). However, the

appreciation dummy is insignificant for the all SITC categories. There emerge two implications from the estimated results above:

Firstly, the above findings imply that there is hysteresis in the UK imports from Bangladesh (i.e., depreciation of pound sterling shows a negative and significant effect; however, appreciations show an insignificant effect on the UK imports).

Secondly, the above findings also suggest that large depreciations reduce UK imports from Bangladesh. However, large appreciations in the UK currency cannot increase the UK imports from Bangladesh. Clearly, there is an asymmetric effect of large exchange rate shocks. This is not similar to the asymmetric effect assumes for the US imports in the 1980s. The asymmetry in the UK imports occurs may be due to the _third country effect' which is explained in section (6.2). It is worth mentioning that the appreciation and depreciation dummies capture the sunk costs effect by the exchange rate threshold. Hence, this hysteresis occurs beyond sunk costs effect.

The hysteresis dummy d_t^A (but not d_t^D) is found to be negative and significant for some UK imports from India. Precisely, the hysteresis (appreciation) dummy has been found negative and significant for UK total (bilateral) import, *SITC 0* and *SITC 8* imports from India in the short- and long-run. This is similar to the asymmetric effect assumes for the US imports in the 1980s. This occurs may be because Indian exports are not affected by the _third country effect' mentioned above.

On the contrary, the hysteresis dummy, d_t^D is found negative and significant for the *SITC 5* from Pakistan; and *SITC 2* and *SITC 5* from Sri Lanka in both the short- and long-run (see, Table 6.3.1, Table 6.3.2, Table 6.4.1 and Table 6.4.2). However, large appreciation dummies (d_t^A) are found to be insignificant for the same imports categories. Besides, large appreciation dummy (d_t^A) for the *SITC 6* imports of the UK from Sri Lanka

is found to be negative and significant. However, large depreciation dummy (d_t^D) is found to be insignificant for this category.

Hysteresis, therefore, is found as a significant phenomenon for all UK imports from Bangladesh. However, it is found to be a significant phenomenon for some UK imports from India, Pakistan and Sri Lanka. Hence, hysteresis can be explained as a country specific phenomenon.

Moreover, hysteresis, in case of the UK *SITC 5* (industry) imports, is found to be a significant phenomenon for both Pakistan and Sri Lanka. Hysteresis is a significant event in case of the UK *SITC 6* (industry) imports from Bangladesh and Sri Lanka too. Hence, hysteresis can be explained as a commodity specific phenomenon as well.

These are in accordance with the findings presented by Martinez-Zarzoso (2001). It is worth mentioning that Martinez-Zarzoso (2001) finds that the hysteresis hypothesis is a country and commodity specific phenomenon for Spanish exports to different EU countries. In few cases the signs of the dummies are unexpectedly positive (similar to Parsley and Wei 1993); however, they are insignificant.

When use the ‗single dummy approach' the study finds that the hysteresis dummy is negative and significant for *SITC 0* and *SITC 7* import of UK from Bangladesh (see, Table 6.7 in appendices); *SITC 5* and *SITC 6* import from Pakistan (see, Table 6.9 in appendices); and *SITC 2* and *SITC 5* import from Sri Lanka (see, Table 6.10 in appendices). As mentioned earlier that the effect of appreciation or depreciation in terms of magnitude is not clear from the ‗single dummy approach'; hence, we are not clear about the type of asymmetry from the above mention ‗single dummy' results.

Thus, we find that the double dummy approach is the appropriate technique for estimation of the hysteresis hypothesis.

It seems that in the long-run the UK GDP has negative impact on imports from Bangladesh. This suggests that if the UK income level rises, the country imports less from Bangladesh. This is may be because if the UK income level increases, it imports better quality products from Bangladesh‘s competitors.

Table 6.2.1: ECM results for UK import from India

(Double dummy approach; p-value in parenthesis)

SITC	C	$\ln Q^m_{i,t-1}$	$\Delta \ln RP^m_{i,t}$	$\ln RP^m_{i.t-1}$	$\Delta \ln Y_t$	$\ln Y_{t-1}$	d^D_t	d^A_t
Total	3.827	-0.164	-1.314	-0.281	0.567	-0.410	-0.012	**-0.056**
	(0.012)	(0.002)	(0.000)	(0.005)	(0.007)	(0.108)	(0.626)	**(0.056)**
SITC 0	2.998	-0.392	-1.155	-0.445	0.581	0.326	-0.031	**-0.133**
	(0.150)	(0.000)	(0.000)	(0.000)	(0.072)	(0.413)	(0.442)	**(0.004)**
SITC 1	7.535	-0.659	-1.576	-1.279	0.140	-0.942	-0.287	-0.018
	(0.375)	(0.000)	(0.000)	(0.001)	(0.924)	(0.618)	(0.124)	(0.931)
SITC 2	3.785	-0.201	-1.241	-0.405	0.115	-0.619	-0.022	-0.045
	(0.099)	(0.001)	(0.000)	(0.004)	(0.756)	(0.185)	(0.622)	(0.388)
SITC 4	4.503	-0.483	-0.265	0.117	1.1665	0.562	-0.114	-0.095
	(0.238)	(0.000)	(0.136)	(0.426)	(0.079)	(0.518)	(0.165)	(0.302)
SITC 5	4.849	-0.218	-1.090	-0.259	0.377	-0.519	0.040	-0.007
	(0.048)	(0.000)	(0.000)	(0.056)	(0.286)	(0.251)	(0.363)	(0.881)
SITC 6	6.289	-0.449	-1.142	-0.647	0.497	-0.268	-0.001	-0.006
	(0.000)	(0.000)	(0.000)	(0.000)	(0.018)	(0.288)	(0.983)	(0.841)
SITC 7	3.141	-0.193	-0.302	-0.408	0.177	-0.294	-0.054	-0.058
	(0.178)	(0.001)	(0.005)	(0.004)	(0.608)	(0.510)	(0.195)	(0.232)
SITC 8	3.911	-0.126	-1.105	-0.268	0.558	-0.551	-0.004	**-0.047**
	(0.000)	(0.003)	(0.000)	(0.048)	(0.000)	(0.003)	(0.830)	**(0.034)**

Table 6.2.2: Results of the Delta Method for the Long-run UK import from India.

(Double dummy approach; standard error in parenthesis)

SITC	C	$\ln RP_t^m$	$\ln Y_t$	d_t^D	d_t^A
Total	23.29**	-1.71**	-2.49*	-0.07	**-0.34***
	(6.73)	(0.25)	(1.44)	(0.16)	**(0.187)**
SITC 0	7.65**	-1.13**	0.83	-0.08	**-0.34****
	(4.75)	(0.17)	(1.03)	(0.105)	**(0.14)**
SITC 1	11.43	-1.94**	-1.43	-0.44	-0.03
	(12.92)	(0.48)	(2.87)	(0.28)	(0.32)
SITC 2	18.87**	-2.02**	-3.08	-0.11	-0.23
	(10.67)	(0.32)	(2.23)	(0.22)	(0.26)
SITC 4	9.32**	0.24	1.16	-0.24	-0.20
	(7.77)	(0.30)	(1.77)	(0.18)	(0.19)
SITC 5	22.28**	-1.19**	-2.38	0.18	-0.03
	(9.36)	(0.51)	(1.96)	(0.20)	(0.22)
SITC 6	14.01**	-1.44**	-0.60	-0.001	-0.014
	(2.65)	(0.11)	(0.56)	(0.058)	(0.07)
SITC 7	16.29**	-2.12**	-1.52	-0.28	-0.30
	(10.23)	(0.44)	(2.18)	(0.23)	(0.25)
SITC 8	30.97**	-2.12**	-4.36**	-0.03	**-0.37***
	(8.32)	(0.64)	(1.69)	(0.15)	**(0.19)**

Table 6.3.1: ECM results for UK import from Pakistan

(Double dummy approach; p-value in parenthesis)

	C	$\ln Q^m_{i,t-1}$	$\Delta \ln RP^m_{i,t}$	$\ln RP^m_{i.t-1}$	$\Delta \ln Y_t$	$\ln Y_{t-1}$	d^D_t	d^A_t
Total	3.406	-0.230	-0.995	-0.215	0.752	-0.083	0.026	0.009
	(0.019)	(0.000)	(0.000)	(0.001)	(0.000)	(0.709)	(0.287)	(0.712)
SITC 0	8.304	-0.491	-1.196	-0.552	0.587	-0.785	0.129	0.103
	(0.051)	(0.000)	(0.000)	(0.000)	(0.371)	(0.352)	(0.147)	(0.205)
SITC 2	10.694	-0.556	-0.229	-0.122	0.117	-0.849	-0.034	0.036
	(0.004)	(0.000)	(0.003)	(0.302)	(0.840)	(0.246)	(0.656)	(0.628)
SITC 5	3.081	-0.748	-1.619	-1.469	3.354	-0.0332	**-0.359**	-0.175
	(0.733)	(0.000)	(0.000)	(0.000)	(0.026)	(0.986)	**(0.0997)**	(0.357)
SITC 6	2.827	-0.311	-0.980	-0.167	0.896	0.313	-0.023	-0.012
	(0.066)	(0.000)	(0.000)	(0.055)	(0.000)	(0.195)	(0.386)	(0.632)
SITC 7	-1.806	-0.434	-0.156	-0.136	1.712	1.397	0.097	-0.006
	(0.759)	(0.000)	(0.005)	(0.076)	(0.085)	(0.258)	(0.445)	(0.961)
SITC 8	2.851	-0.157	-1.075	-0.190	0.779	-0.228	0.019	-0.009
	(0.011)	(0.001)	(0.000)	(0.065)	(0.000)	(0.248)	(0.413)	(0.653)

Table 6.3.2: Results of the Delta Method for the Long-run UK import from Pakistan.

(Double dummy approach; standard error in parenthesis)

SITC	C	$\ln RP_t^m$	$\ln Y_t$	d_t^D	d_t^A
Total	14.81**	-0.93**	-0.36	0.114	0.038
	(4.52)	(0.13)	(0.95)	(0.111)	(0.103)
SITC 0	16.91**	-1.12**	-1.60	0.26	0.21
	(7.72)	(0.13)	(1.65)	(0.19)	(0.17)
SITC 2	19.22**	-0.22	-1.53	-0.06	0.06
	(6.11)	(0.21)	(1.30)	(0.14)	(0.13)
SITC 5	4.12	-1.96**	-0.04	**-0.48***	-0.23
	(12.09)	(0.15)	(2.58)	**(0.29)**	(0.26)
SITC 6	9.11**	-0.54**	1.01	-0.07	-0.04
	(4.01)	(0.25)	(0.80)	(0.08)	(0.08)
SITC 7	-4.16	-0.313*	3.22	0.225	-0.014
	(13.79)	(0.168)	(2.97)	(0.299)	(0.279)
SITC 8	18.15**	-1.21**	-1.45	0.12	-0.06
	(6.39)	(0.47)	(1.28)	(0.15)	(0.14)

Table 6.4.1: ECM results UK import from Sri Lanka.

(Double dummy approach; p-value in parenthesis)

SITC	C	$\ln Q^{m}_{i,t-1}$	$\Delta \ln RP^{m}_{i,t}$	$\ln RP^{m}_{i.t-1}$	$\Delta \ln Y_t$	$\ln Y_{t-1}$	d_t^D	d_t^A
Total	5.990	-0.338	-0.821	-0.503	0.440	-0.459	0.008	-0.034
	(0.004)	(0.000)	(0.000)	(0.000)	(0.077)	(0.172)	(0.795)	(0.301)
SITC 0	8.537	-0.519	-0.692	0.034	0.475	-0.231	-0.015	-0.005
	(0.000)	(0.000)	(0.000)	(0.645)	(0.094)	(0.536)	(0.686)	(0.898)
SITC 1	2.869	-0.965	-0.394	-0.572	2.455	1.311	-0.127	-0.069
	(0.733)	(0.001)	(0.001)	(0.000)	(0.081)	(0.469)	(0.481)	(0.706)
SITC 2	3.766	-0.048	-0.748	0.032	0.486	-0.649	**-0.145**	-0.028
	(0.286)	(0.534)	(0.000)	(0.750)	(0.402)	(0.389)	**(0.1097)**	(0.697)
SITC 5	3.436	-0.872	-0.651	-0.676	0.462	0.846	**-0.258**	-0.053
	(0.324)	(0.000)	(0.000)	(0.000)	(0.415)	(0.249)	**(0.001)**	(0.483)
SITC 6	2.897	-0.519	-0.753	-0.671	1.191	0.336	0.008	**-0.074**
	(0.133)	(0.000)	(0.000)	(0.000)	(0.000)	(0.392)	(0.836)	**(0.076)**
SITC 7	1.692	-0.474	-0.484	-0.229	1.922	0.804	-0.007	-0.110
	(0.619)	(0.000)	(0.000)	(0.019)	(0.001)	(0.273)	(0.931)	(0.154)
SITC 8	6.073	-0.498	-0.938	-0.755	0.534	-0.081	0.011	-0.041
	(0.006)	(0.000)	(0.000)	(0.000)	(0.072)	(0.846)	(0.758)	(0.289)

Table 6.4.2: Results of the Delta Method for the Long-run UK import from Sri Lanka.

(Double dummy approach; standard error in parenthesis)

SITC	C	$\ln RP_t^m$	$\ln Y_t$	d_t^D	d_t^A
Total	17.73**	-1.49**	-1.35	0.02	-0.10
	(5.00)	(0.44)	(1.04)	(0.09)	(0.09)
SITC 0	16.45**	0.07	-0.44	-0.03	-0.01
	(3.16)	(0.14)	(0.71)	(0.07)	(0.07)
SITC 1	2.97	-0.59**	1.36	-0.13	-0.07
	(8.68)	(0.09)	(1.87)	(0.18)	(0.19)
SITC 2	66.51	-0.15	-11.88	-1.97	-0.98
	(113.44)	(1.85)	(24.39)	(3.45)	(2.20)
SITC 5	3.94	-0.78**	0.97	**-0.30****	-0.06
	(3.96)	(0.15)	(0.83)	**(0.09)**	(0.09)
SITC 6	5.59**	-1.29**	0.65	0.02	**-0.14***
	(3.59)	(0.17)	(0.74)	(0.08)	**(0.08)**
SITC 7	3.57	-0.48**	1.70	-0.01	-0.23
	(7.10)	(0.17)	(1.53)	(0.16)	(0.17)
SITC 8	12.18**	-1.515**	-0.16	0.02	-0.08
	(4.05)	(0.263)	(0.83)	(0.07)	(0.07)

Hence, estimated results reveal that: (i) hysteresis is a country and commodity specific phenomenon (i.e., for the UK imports from Bangladesh the hysteresis hypothesis is found to be overall a significant phenomenon; however, for the UK imports from India, Pakistan and Sri Lanka, we find a partially support of the hysteresis hypothesis). The hysteresis hypothesis is also found to be a significant event for few industries (such as the UK *SITC 5* (industry) imports from Pakistan and Sri Lanka; and the UK *SITC 6* (industry) imports from Bangladesh and Sri Lanka) irrespective of countries; (ii) large exchange rate movements of UK (or its trade partners) show an asymmetric trade effect for some countries and for some commodities even if we neutralize sunk costs effect; hence, empirically, sunk costs is not found a significant reason for hysteresis in international trade; (iii) hysteresis is a significant phenomenon in UK imports in the short-and long-run; (iv) types of hysteresis are different for different markets and commodities. For example, large depreciations reduce the UK imports from Bangladesh, Pakistan and Sri Lanka. However, large appreciations cannot significantly increase the UK imports from those countries. On the contrary, large appreciations increase the UK imports from India. However, large depreciations cannot significantly reduce the UK imports from India.

6.4.2 Recursive 'Hysteresis' Estimates

The study examines the movement of import demand in response to the large exchange rates shocks over time. Consequently, the study estimates recursive hysteresis of UK imports from Bangladesh with two standard error bands around the estimated coefficients using both the double dummy approach (see, Figure 6.6) and the single dummy approach (see, Figure 6.7 in Appendices). It is worth noting that we have presented the recursive estimate results only for the UK imports from Bangladesh (as an example).

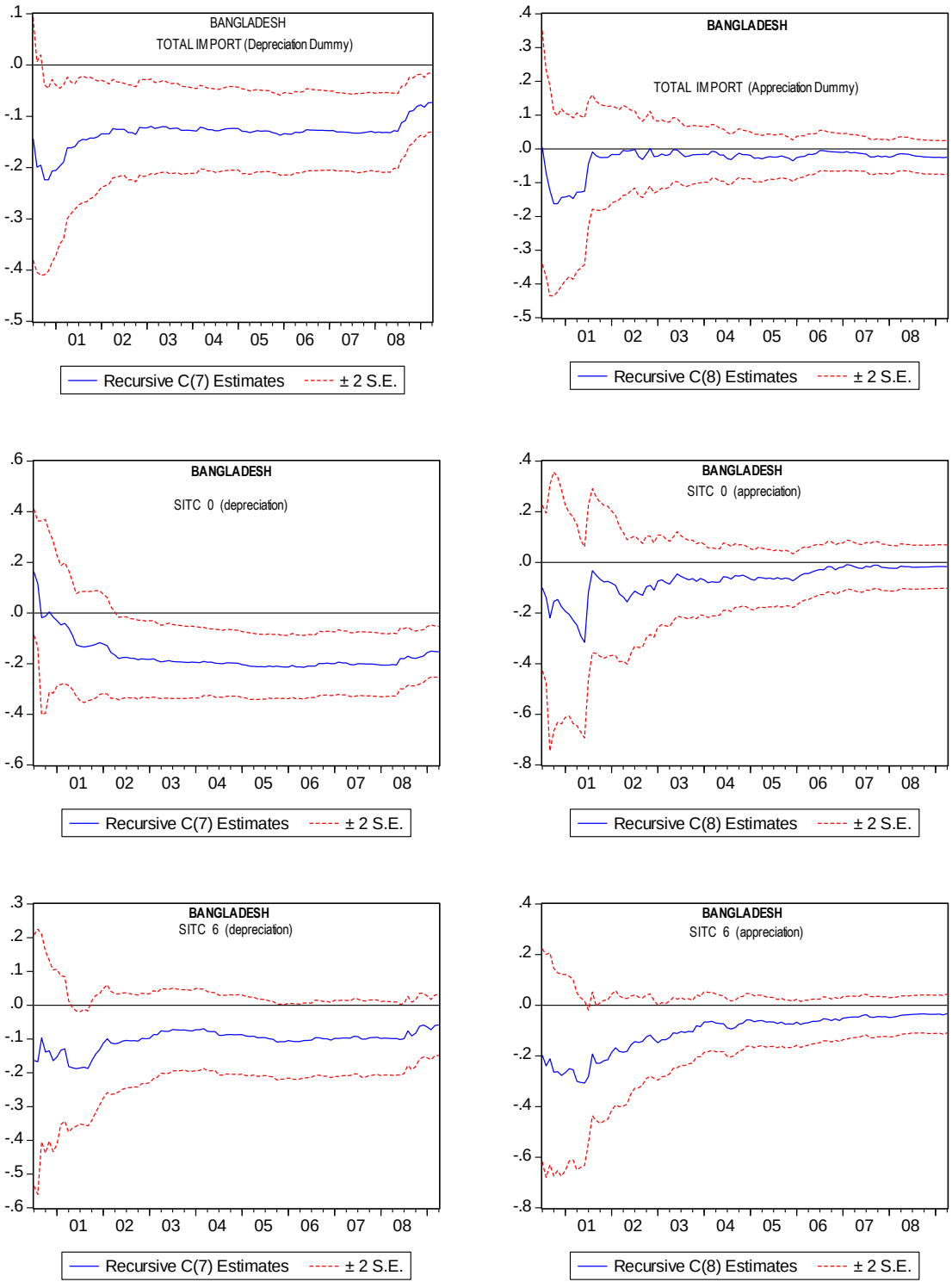
Recursive estimate results of the UK imports from other countries (for significant industries‘) are found in accordance to the estimated results presented in the Table 6.2.1, Table 6.2.2, Table 6.3.1, Table 6.3.2, Table 6.4.1 and Table 6.4.2; and Table 6.8, Table 6.9 and Table 6.10 in the appendices.

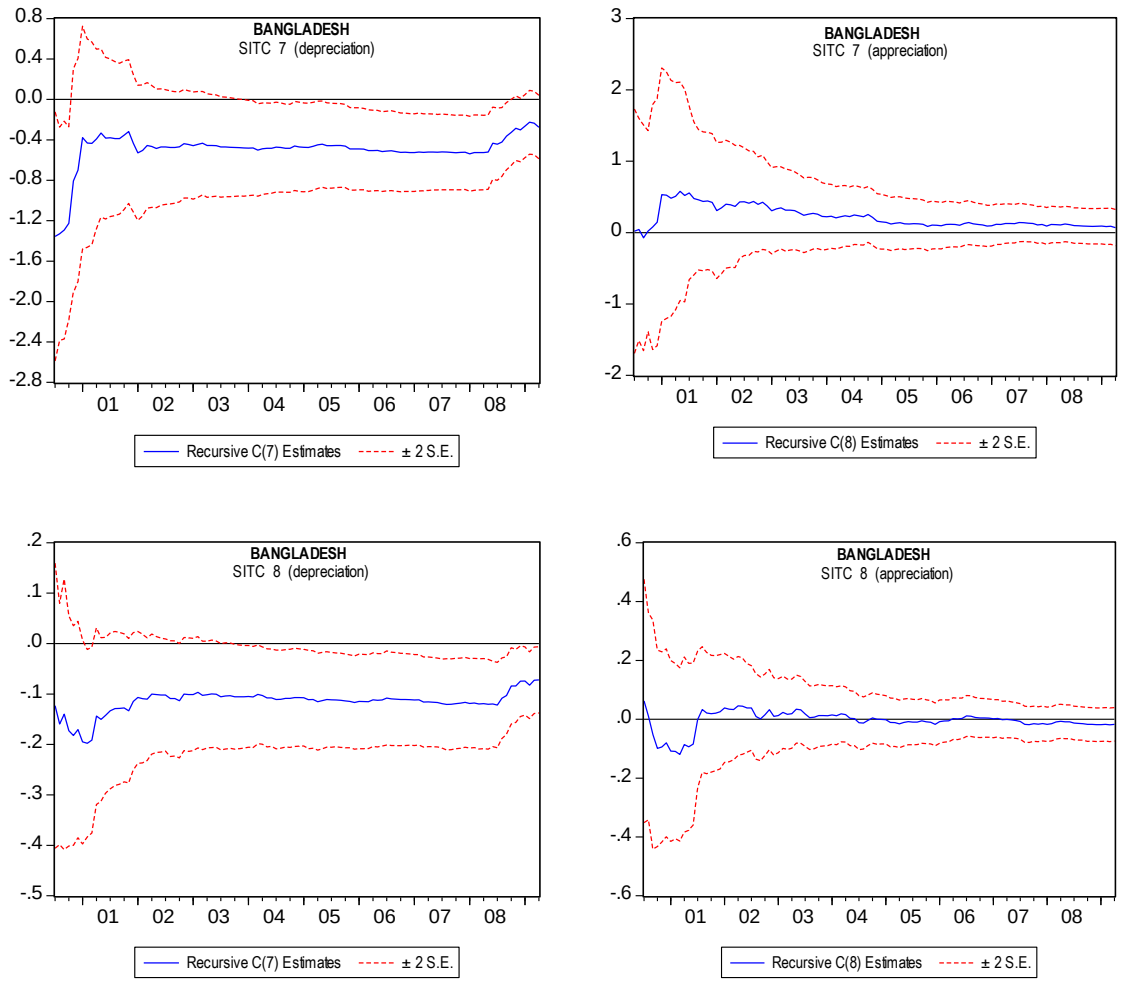
The results of the recursive estimates (using the single dummy approach) suggest that hysteresis in the UK (bilateral) total import, *SITC 7* and *SITC 8* are negative and significant over time (see, Figure 6.7 in Appendices). However, it is not clear from Figure 6.7, whether _large‘ appreciations or _large‘ depreciations or both have a significant effect on UK imports.

We, therefore, use the _double dummy approach‘ (see, Figure 6.6) and it becomes clearer from estimation that there is an asymmetric response to the large exchange rate shocks in the UK currency. The recursive hysteresis estimate indicates that a _large‘ depreciation significantly reduces UK imports from Bangladesh; however, large appreciations do not significantly increase the import demand (see, total imports, *SITC 0, SICT 7* and *SITC 8* in Figure 6.6). Hence, there is hysteresis in UK bilateral imports from Bangladesh. Nonetheless, the reason for hysteresis cannot be explained by sunk costs. Hysteresis occurs may be because of either or all of the three reasons which are mentioned in Section 6.2 of this study. SITC-wise recursive estimates of the hysteresis hypothesis for Bangladesh are given as follows:

Figure 6.6:

Recursive 'hysteresis' estimate for 'large' depreciation and appreciation. (double dummy approach; ± 2 standard error bands around the estimated coefficients).





Thus, from the above figure (Figure 6.6) we can conclude that large depreciations significantly reduce UK imports from Bangladesh, however, large appreciations do not bring those imports back fully. This asymmetric behaviour is different from the asymmetric behaviour assumed for the US trade deficit in the 1980s. It is worth noting here the findings of Baldwin (1986) with regard to the hysteresis in the US imports. Baldwin (1986) finds that a large appreciation increased the US imports; however, a large depreciation did not reduce US imports by the expected level. As a result, there was a persistent deficit in the US trade in the 1980s.

However, the asymmetry, which we come across for the UK imports from developing countries (like Bangladesh) is different from the asymmetry observed in the US imports in the 1980‘s. The probable reasons for the different types of asymmetry could be given as follows:

(i) Baldwin (1988) estimate (multilateral) aggregate US imports which include the US imports from both developed and developing countries‘, while this study estimates the hysteresis in the UK bilateral imports only from the developing countries. It is worth mentioning that the basic characteristics, in terms of capacity utilization, pricing behaviour, production costs, firms size of developing countries are different from those prevailing in developed countries. Hence, the response of developing countries firms to the exchange rate shocks are not necessarily the same as the response of developed countries firms.

(ii) Baldwin tests the hypothesis using the import demand function at the aggregate level; while we estimate bilateral industry specific import demand functions. Thus, our findings are more precise than the findings in Baldwin (1988).

6.5 Conclusion

Asian countries have been pursuing export led growth for the last two decades. These countries frequently devalue their currencies in order to increase the competitiveness of their products. Although the *de jure* exchange rate regime has been a free floating system for Bangladesh (May 2003), India (March 1993), Pakistan (July 2000) and Sri Lanka (January 2001), the IMF still define that the *de facto* exchange rate arrangements of these countries are still a kind of managed floating. However, irrespective of the actual exchange rate regimes, any movement in exchange rates might have some affects on their bilateral export and import. As this study tests the hysteresis hypothesis in bilateral and industry specific UK imports from those developing countries (Bangladesh, India, Pakistan and Sri Lanka), any exchange rate movements of those countries' currency will change the bilateral exchange rates with pound sterling.

Although existing empirical literature estimates the hysteresis hypothesis in international trade in the context of developed economies such as the US, UK, Germany, Spain and Japan; however, there is neither a unique technique for the hysteresis hypothesis testing nor a unique empirical finding emerged from those estimations.

The existing empirical studies also suggest that the US and UK trade deficit in the 1980's occurred due to hysteresis in international trade. Moreover, the existing theoretical and empirical literature assumes that the hysteresis occurs due to sunk costs. However, none of the studies can explicitly show that hysteresis occurs due to _sunk œosts'.

None of the literature has estimated whether the hysteresis hypothesis is a significant phenomenon for developing countries. However, hysteresis in trade might be a more important issue for developing countries. This is because most of the developing countries have been pursuing an active exchange rate policy and export-led growth strategy

wherein exchange rates policy is expected to play a very active and key role. We therefore estimate exchange rate hysteresis in the UK imports from selected South Asian countries namely, Bangladesh, India, Pakistan and Sri Lanka in both the short- and long-run. The study applies two different approaches (the ‗single dummy approach' and the ‗double dummy approach') to test the hysteresis hypothesis. We construct the hysteresis dummies assuming industry specific sunk costs as well. The study figures out the sign and magnitude of asymmetric behaviour using the ‗double dummy approach', which is not possible by using the ‗single dummy approach'. Hence, we suggest that the ‗double dummy approach' best estimates the hysteresis hypothesis. It is worth noting that this clear inference of the hysteresis hypothesis distinct our study from the existing ones.

Estimated results demonstrate that there is exchange rate hysteresis in all (industry level) UK imports from Bangladesh in the short- and long-run; however, there is partial support of hysteresis in the UK imports from India, Pakistan and Sri Lanka. We also find that hysteresis is an industry specific phenomenon. Hence, there is a mixed outcome of the hysteresis hypothesis test in our study. We therefore conclude that hysteresis is a country and commodity specific phenomenon. This is in accordance with the evidence presented by Parsley and Wei (1993), Giovannetti and Samiei (1995), and Martinez-Zarzoso (2001).

The study also suggests that the reason for hysteresis in international trade is not sunk entry costs. We find the evidence of hysteresis even beyond sunk costs effect. The study therefore indicates some potential reasons (see, section 6.2) for hysteresis in international trade.

The study also runs the recursive estimates to examine step-by-step change in the hysteresis coefficient of UK imports from Bangladesh. Estimated results suggest that large depreciations significantly reduce the UK imports from Bangladesh; however, this fall is

not reversed when the reverse situation appears. We find similar results for the UK imports from Pakistan and Sri Lanka. On the contrary, the estimated results suggest that large appreciations increase the UK imports from India; however, large depreciations cannot significantly reduce the UK imports from the country. This is in accordance to the finding suggested by Baldwin (1986). This is may be because; being a large exporter to the UK market, India strongly competes with its competitors. However, Bangladesh, Pakistan and Sri Lanka cannot manage to overcome the adverse effect from its competitors (like China).

CHAPTER SEVEN

CONCLUSION OF THESIS

7.1 Concluding Remarks

The thesis attempts to estimate the role of the exchange rate in the balance of trade, aggregate import demand, and import and domestic prices for Bangladesh. The research also tests the hysteresis hypothesis in bilateral trade.

Since Bangladesh‘s independence in 1971, similar to many other developing countries, it has been pursuing an active exchange rate policy. On average, Bangladesh‘s exchange rate is devalued approximately by 4 times in a year. The main objectives of the exchange rate policy are to rearrange resources to import substitutes and export oriented sectors and pursue an export-led growth. Hence, first of all, the study estimates the impact of exchange rate movements on the trade balance of Bangladesh and evaluate whether the objectives of exchange rate policy and its effectiveness are performing in the same direction.

Secondly, the key exporting firms of Bangladesh require their raw materials and intermediate goods which they import. The country therefore has shifted from inward-looking trade regime towards a liberalized market oriented regime since the mid-1980s in order to ease the imports of exporting firms. Bangladesh has adopted a trade liberalization policy since the early-1980‘s which it continues to do today. Although trade liberalization has been taking place from the mid-1980s, according to Dutta and Ahmed (1999), the impact of the policy has actually been felt by the economy from 1992 onwards. The study therefore estimates the import demand function, exchange rate pass-through to import prices and exchange rate pass-through to domestic inflation of Bangladesh in the short- and long run by including a trade liberalization variable in the models to test whether trade openness has any significant effect on Bangladesh‘s import volume, import prices and inflation.

Generally, theories suggest that aggregate import is determined by the relative prices and real income. However, in this study we argue that there are some country specific determinants of import demand for developing countries. Thus, the study estimates an empirical model including the export demand variable as an additional determinant in the conventional import demand function. It is worth noting that the non-traditional determinants have also been proposed by recent literature.

The existing literature suggests that the relative prices of imports is a significant determinant for import demand. It is worth mentioning that the relative prices of imports is the ratio of import price to domestic price and the import price is affected by exchange rate movements. How much the import price is affected by the exchange rate, depends on the exchange rate pass-through to import price. If the exchange rate pass-through to import prices is _complete', any exchange rate devaluation or revaluation would have a _full' effect on import price which would increase or decrease import price one-to-one (e.g., 1 percent devaluation would increase import price by 1 percent and vice versa). However, if pass-through is partial, any exchange rate movements would have only a _partial' effect on import price and thereby import demand. Hence the study also estimates the exchange rate pass-through to import price.

Although the monetary authority of Bangladesh has not been targeting _inflation', the country is always concerned about its high inflation rate. Generally, the price level of a country is affected by output level, aggregate demand, fiscal policy and monetary policy. External prices can also affect the domestic prices; especially, import prices affect domestic prices. As the exchange rate can influence the import prices, the domestic prices can be affected by exchange rate movements indirectly. This is called the _second-stage-pass-through' in international economics. Hence, to detect the actual reasons for higher

inflation in Bangladesh, it is important to test whether the exchange rate has a significant effect on domestic prices. If the exchange rate pass-through to domestic price is significantly high, the monetary authority would have to be careful about its exchange rate policy because the exchange rate policy would have an affect on domestic inflation. This study therefore estimates the exchange rate pass-through to domestic prices as well.

There is a common belief in international economics that devaluation/depreciation in the exchange rate leads to an increase in export demand and decrease in import demand. On the contrary, revaluation/appreciation in the exchange rate reduces export demand and increases import demand. However, this depends on the effectiveness of the exchange rate. It also depends on the magnitude of depreciations and appreciations. Recent literature suggests that even if the exchange rate movements influence export and import demand significantly in the expected directions, it does not necessarily influence the magnitude as expected. Subsequently, certain levels of appreciation can increase import demand up to a certain amount; it cannot reduce the import demand to the equal magnitude even if there is equal level of depreciation in exchange rate. Hence, appreciation and depreciation may not symmetrically affect the import volume. A temporary exchange rate shock may have persistence effect on international trade. This is known as ‗hysteresis' in international trade. It is believed that the US and the UK trade deficit in the 1980s long-last due to the hysteresis effect. This thesis therefore tests an important proposition of international economics called, the ‗hysteresis hypothesis'. We test the hypothesis in bilateral aggregate and disaggregate UK imports from Bangladesh, India, Pakistan and Sri Lanka.

The study employs a group of state-of-the-art time series econometric tests and techniques namely, ‗unit root' tests (which includes the Augmented Dickey Fuller, the Phillips-Perron, and the Kwiatkowski-Phillips-Schmidt-Shin), co-integration tests (which

includes Engle-Granger two-step procedure, and Johansen's full information maximum likelihood technique), error correction model, vector auto regression, impulse response function, recursive estimates, and the delta method. We use modern econometric packages namely, Eviews, OxMetrics, and Stata, which are suitable for time series estimations.

7.2 Major Findings of Thesis and Some Policy Implications

This study constructs overall nominal and real effective exchange rates at quarterly and annual frequencies, as well as the nominal effective exchange rate for imports and exports at annual frequency which are not readily available for Bangladesh. We plot the nominal and the real effective exchange rates which indicate that Bangladesh has been pursuing an active exchange rate policy since its independence and most of the exchange rate movements are devaluation of currency. Some structural shifts of the exchange rate over in the early 1970s are also noticeable from the figures (see, Figure 2.5, Figure 3.2, and Figure 5.1).

Secondly, we construct hysteresis dummies using bilateral exchange rates of pound sterling against Bangladeshi *taka*, Indian rupees, Pakistani rupees and Sri Lankan rupees. Bilateral _large' movements in the exchange rates called, _break point' are plotted in the Figure 6.2(a), Figure 6.2(b), Figure 6.2(c), and Figure 6.2(d) which indicate that there are many _large' appreciations and depreciations in the UK bilateral exchange rates against South Asian currencies. These figures also indicate that during the recent financial crisis period (2007m08-present), exchange rate movements have been unusually larger (see, for example, Figure 6.4) compared to other periods and all of these are large depreciations of pound sterling. It is therefore notable that after the _credit crunch' and during the recent

financial crisis period there have been unusually large movements in the exchange rates due to economic and financial turmoil.

Thirdly, the trade balance of Bangladesh is significantly determined by the real exchange rate (see, Chapter 3), and the trade balance is positively related to real exchange rate movements in the long-run. However, in the short-run the exchange rate negatively affects the trade balance of Bangladesh. Hence, we assume the J-curve pattern in the trade balance of Bangladesh. Domestic production and trade partners' incomes are also cointegrated with the trade balance of Bangladesh.

Fourthly, it is found from the impulse response functions that the J-curve phenomenon holds for Bangladesh. Subsequently, the trade balance deteriorates immediately after exchange rate devaluation, and it improves afterwards. This is because the import demand of Bangladesh positively responds to an exchange rate shock initially, and the exports is not increased (if not fall) in the short-run. Ultimately, the growth of export supply overweighs the growth of import demand and it improves the trade balance of Bangladesh.

Fifthly, aggregate import demand is significantly determined by not only the relative prices of import but also by the export demand and other GDP components of Bangladesh in the short- and long-run (see, Chapter 4).

Sixthly, exchange rate pass-through to import prices is found to be significant and _œomplete' both in the short- and long-run. Thus, any devaluation/depreciation and revaluation/appreciation of taka would reduce and increase the import prices, one-to-one, respectively. Subsequently, a one unit devaluation of the *taka* would increase import prices by one unit and vice-versa.

Seventhly, the *„second-stage pass-through'* i.e., exchange rate pass-through to domestic prices are significant but ‗partial' in both the short- and long-run. The study also suggests that exchange rate pass-through to ‗agricultural product prices' of Bangladesh is insignificant; however, pass-through to ‗industrial product prices' is positive and significantly different from zero. It is worth noting that Chowdhury and Siddique (2006) find an insignificant exchange rate pass-through to domestic prices. The reason for their insignificant results may be because Chowdhury and Siddique (2006) estimate the exchange rate pass-through to overall CPI and WPI. Actually, Bangladesh mainly imports manufacturing products from abroad and exchange rate pass-through to domestic prices is the second-stage pass-through which transmits from exchange rate to import prices (1^{st} stage) and then import price to domestic prices (2^{nd} stage). Hence, actual exchange rate pass-through to domestic prices are reflected in industrial product prices rather than overall domestic prices. It is worth mentioning that the overall domestic prices include both industrial and agricultural product prices. The study also estimates pass-through to overall CPI which is found to be insignificant (see, Chapter 5). When the agricultural and industrial wholesale price indices are used separately, the exchange rate pass-through to domestic prices is found to be significant for industrial wholesale price index (but not for agricultural wholesale price index) in both the short- and long-run. This finding implies that domestic inflation for industrial goods of Bangladesh is significantly affected by the exchange rate's depreciation and appreciation.

Eighthly, the study finds that trade liberalization plays a significant negative role in import price and domestic inflation of Bangladesh in the short- and long-run (see, Chapter 5). Trade liberalization positively affects the import demand of the country (see, Chapter 4). Hence, the trade liberalization policy improves consumer's welfare in Bangladesh.

Ninthly, the study finds a partial support of the exchange rate hysteresis in bilateral aggregate and disaggregate UK imports from South Asia. The hysteresis hypothesis is found to be significant phenomenon for all (aggregate and disaggregate) UK imports from Bangladesh (all Bangladesh's exports to the UK). However, hysteresis in found to be significant in few (not all) export goods of India, Pakistan and Sri Lanka (to the UK market). Hence, we conclude that hysteresis in the UK imports is a country specific phenomenon.

We also find the evidence of hysteresis in some specific industries irrespective of countries. Hence, hysteresis in our study is found as a commodity specific phenomenon as well. These findings are in accordance with the evidence presented by Parsley and Wei (1993), Giovannetti and Samiei (1995), and Martinez-Zarzoso (2001).

Tenthly, the study has not found any evidence in favour of the statement that – _hysteresis occurs due to sunk costs'. On the contrary, we have found evidence that _sunk costs' is not a significant reason for hysteresis in trade. For example, there is _hysteresis' in the UK imports from Bangladesh (for all *SITC*s), India (aggregate import, *SITC 0* and *SITC 8*), Pakistan (*SITC 5*) and Sri Lanka (*SITC 2*, *SITC 5* and *SITC 6*), even if we remove sunk costs effect. There may have some other reasons for hysteresis (see, Chapter 6, section 6.2), which include: (i) partial exchange rate pass-through and sustainable decline in exchange rate pass-through over time; (ii) price competitions between large and small exporters (see, for example, Greenaway, Milner and Mahabir, 2008; Eichengreen, Rhee, and Tong, 2004), and (iii) dumping behaviour[23] of some countries to capture a superior market.

[23] The Economist, 11 February, 2010

Finally, the study suggests that large depreciations significantly reduce UK imports from Bangladesh, Pakistan and Sri Lanka; however, large appreciations cannot significantly increase the UK import from these countries, which is different to the type of asymmetric behaviour assumed for the US trade deficit in the 1980's (see, for example, Baldwin, 1986). However, the type of hysteresis in the UK imports from India is found similar to Baldwin (1986). This has occurred may be because, Indian exports cannot be displaced by the _third country effect'.

7.3 Limitations of the Study

Generally, empirical researches encounter shortcomings of data availability and quality of data. As this research we use a developing country's data, the _availability and quality' issue may be stronger here. However, we have collected carefully, cross-checked, and prepared data for this research. In addition, the study uses both national and international data sources to check reliability of data.

Secondly, it is worth mentioning that in econometric estimations, especially, in the time series estimations, _degree of freedom' and _number of observations' are two vital issues. Bangladesh, similar to other developing countries, does not have a strong documentations record. It is worth mentioning that Bangladesh basically maintain data of annual frequency. Therefore, monthly and quarterly data are not available for the country. In some unusual cases, although monthly data are available, there are many missing observations in between the series. The study therefore mainly could use annual observations for estimating the models in the chapter three and four. Moreover, Bangladesh has become an independent country just in December 1971. Thus, number of observations in our study is rather small. However, we fulfil the minimum requirements in

every case. Chapter 3 and chapter 5 use both annual and quarterly data. Chapter 6 uses monthly data because data for this chapter is available in the UK data sources. As a result, the study has been able to uses 126 observations of monthly frequency for chapter six.

7.4 Agenda for Further Research

The study estimates the role of the exchange rate in the balance of trade, import demand, import pricing, and inflation. However, as Bangladesh targets an export-led-growth strategy, the determinants of export demand, and exchange rate pass-through to export prices are also important areas of research. However, very few studies have estimated the determinants of export demand and, to the best of our knowledge, none of the studies estimate the exchange rate pass-through to export prices at aggregate level. Future study may focus on these fields.

Secondly, this study estimates the hysteresis hypothesis in the context of developing economies. We also test whether hysteresis occurs due to _sunk costs‘ of firms. Some of the existing literature also empirically estimates the exchange rate hysteresis for some developed countries. Among them some studies demonstrate that there is evidence of hysteresis in international trade; however, none of the existing literature provides evidence for the statement that hysteresis occurs due to sunk costs. Nonetheless, the theoretical literature suggests that hysteresis occurs due to the sunk cost. However, this study casts doubt about the above reason for hysteresis in international trade. We propose some alternative factors which may be the actual reasons for hysteresis. Hence, it is useful to test the alternative factors which may cause the exchange rate hysteresis in international trade.

APPENDICES

Table 5.6 Unit root test results

Series	ADF		PP	
	level	1st difference	Level	1st difference
$\ln NEER_t$ (constant)	-0.093	-8.547	0.250	-8.401
$\ln CPI_t$ (none)	1.311	-2.960	3.386	-3.306
$\ln PPI_t^A$ (constant)	-1.490	-8.139	-1.588	-8.134
$\ln PPI_t^I$ (constant)	-2.288	-10.223	-2.651	-10.220

Note: $\ln PPI_t^A$ and $\ln PPI_t^I$ stand for PPI of Agricultural and Industrial sector respectively. Critical values for ADF and PP tests are -3.56, -2.92 and -2.60 (intercept); and -2.59, -1.94 and -1.61 (no intercept/trend); at 1%, 5% and 10% level of significance respectively, which are taken from MacKinnon (1996) one-sided p-values. Null hypothesis for ADF and PP tests are (same), H_0: Non-stationary.

Figure 6.7: Recursive 'hysteresis' estimate (single dummy approach; ± 2 standard error bands around the estimated coefficients).

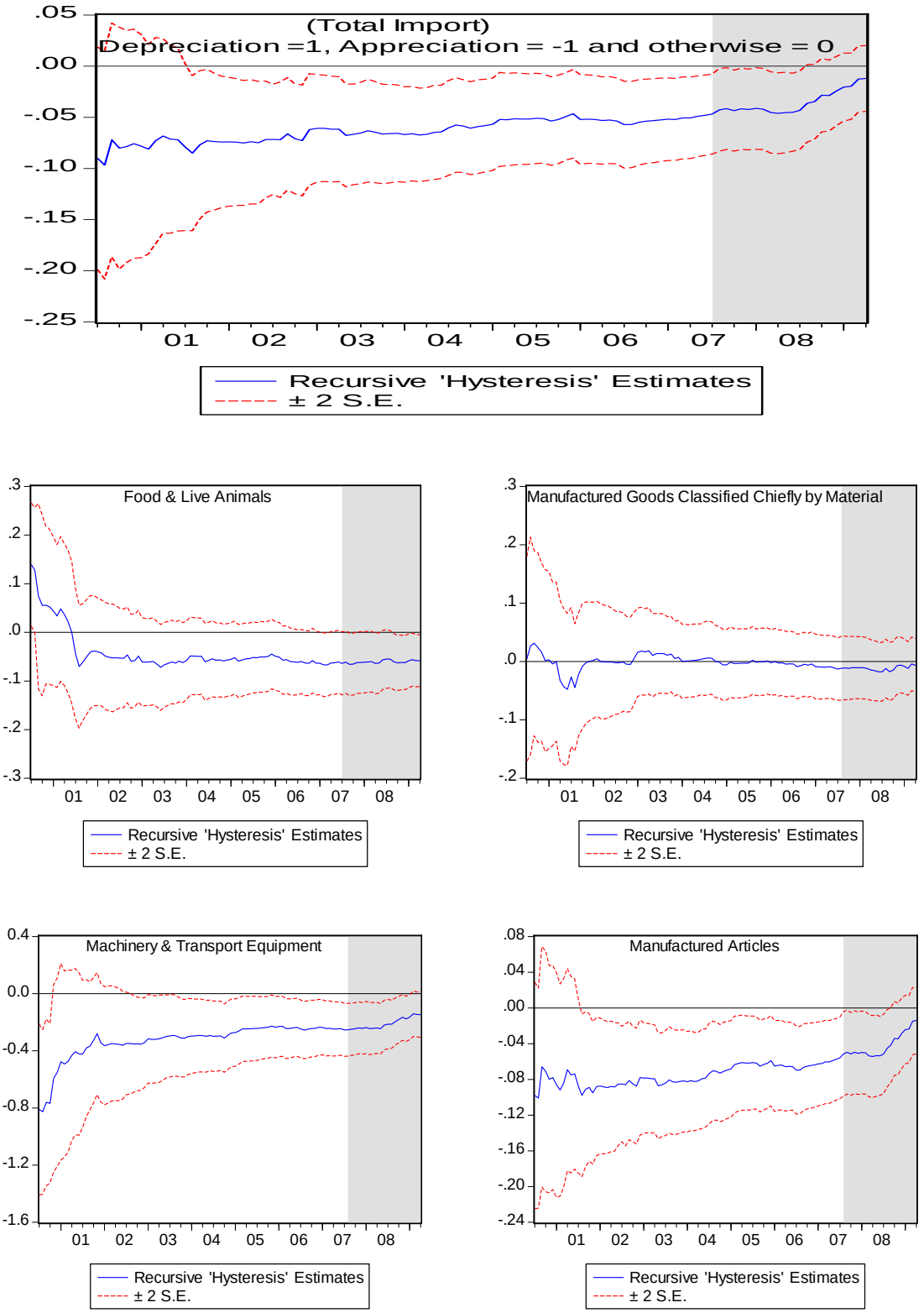


Table 6.5: Standard International Trade Classification (SITC)

Sl.	SITC Code	SITC Title
1	*Total*	Total Imports
2	*SITC 0*	Food & Live Animals
3	*SITC 1*	Beverages & Tobacco
4	*SITC 2*	Crude Materials, Inedible, except fuels
5	*SITC 3*	Mineral Fuels, Lubricants & Related Materials
6	*SITC 4*	Animal & Vegetable Oils, Fats & Waxes
7	*SITC 5*	Chemicals & Related Products, nes
8	*SITC 6*	Manufactured Goods Classified Chiefly by Material
9	*SITC 7*	Machinery & Transport Equipment
10	*SITC 8*	Miscellaneous Manufactured Articles
11	*SITC 9*	Commodities/Transactions not Classified Elsewhere in

Table 6.6: Descriptive Statistics of UK import (volume) from South Asia

(a) UK import from Bangladesh

Variable	Obs.	Mean	Std. Dev.	Min	Max
Total	126	1.12e+07	5105850	4600356	4.25e+07
SITC 0	126	1265868	319650.6	500938	1959541
SITC 6	126	1919286	487779.6	627168	3281522
SITC 7	126	386393.4	206554.1	421	954540
SITC 8	126	6584821	2818284	1922189	1.97e+07

(b) UK import from India

Variable	Obs.	Mean	Std. Dev.	Min	Max
Total	126	1.41e+08	8.80e+07	4.88e+07	5.57e+08
SITC 0	126	2.36e+07	1.17e+07	7012479	7.57e+07
SITC 1	126	641714.9	570063.9	5782	3342529
SITC 2	126	1.94e+07	1.66e+07	3608696	1.10e+08
SITC 4	126	707656.4	330887.5	191125	2320693
SITC 5	126	6174818	2612209	2434346	1.49e+07
SITC 6	126	4.14e+07	1.65e+07	1.69e+07	9.30e+07
SITC 7	126	7373937	3998296	2065151	1.69e+07
SITC 8	126	1.07e+07	3529176	4807487	1.93e+07

(c) UK import from Pakistan

Variable	Obs.	Mean	Std. Dev.	Min	Max
Total	126	2.65e+07	1.28e+07	9192452	6.80e+07
SITC 0	126	1.50e+07	1.23e+07	1547523	5.41e+07
SITC 2	126	588340.9	244558.3	178934	1435989
SITC 5	126	671376.7	1046062	1856	6603781
SITC 6	126	6675964	1257442	3539916	1.12e+07
SITC 7	126	109300.7	73275.55	11696	490172
SITC 8	126	3245150	991229	1487777	9130765

(d) UK import from Sri Lanka

Variable	Obs.	Mean	Std. Dev.	Min	Max
Total	126	7642726	4550513	4201130	5.62e+07
SITC 0	126	1360653	278615.6	852053	2494370
SITC 1	126	43395.42	29531.26	92	144454
SITC 2	126	615014.7	246443.8	182399	1455778
SITC 5	126	123895.4	51919.31	45115	331287
SITC 6	126	1040018	348699.8	384954	1886205
SITC 7	126	403684.7	199037.8	116308	1218163
SITC 8	126	4046355	4554532	1625771	5.39e+07

Table 6.7: ECM results for UK import from Bangladesh

(Single dummy approach; p-value in parenthesis)

SITC	*C*	$\ln Q^{m}_{i,t-1}$	$\Delta \ln RP^{m}_{i,t}$	$\ln RP^{m}_{i.t-1}$	$\Delta \ln Y_t$	$\ln Y_{t-1}$	d_t
Total	6.583	-0.137	-1.049	-0.095	0.180	-1.009	-0.019
	(0.000)	(0.000)	(0.000)	(0.091)	(0.377)	(0.000)	(0.217)
SITC 0	5.381	-0.409	0.252	-0.066	0.805	0.026	**-0.058**
	(0.055)	(0.000)	(0.076)	(0.525)	(0.036)	(0.957)	**(0.034)**
SITC 6	5.917	-0.340	-0.937	0.0355	0.289	-0.187	-0.007
	(0.004)	(0.000)	(0.000)	(0.791)	(0.362)	(0.646)	(0.749)
SITC 7	12.724	-0.684	-1.207	-0.802	-0.364	-1.506	**-0.157**
	(0.039)	(0.000)	(0.000)	(0.000)	(0.723)	(0.245)	**(0.053)**
SITC 8	8.138	-0.149	-1.053	-0.130	-0.0559	-1.335	-0.023
	(0.000)	(0.000)	(0.000)	(0.031)	(0.810)	(0.000)	(0.195)

Table 6.8: ECM results for UK import from India

(Single dummy approach; p-value in parenthesis)

SITC	*Const.*	$\ln Q^m_{i,t-1}$	$\Delta \ln RP^m_{i,t}$	$\ln RP^m_{i.t-1}$	$\Delta \ln Y_t$	$\ln Y_{t-1}$	d_t
Total	3.933	-0.163	-1.304	-0.273	0.546	-0.437	0.018
	(0.010)	(0.002)	(0.000)	(0.006)	(0.009)	(0.088)	(0.251)
SITC 0	3.222	-0.387	-1.137	-0.428	0.530	0.269	0.034
	(0.131)	(0.000)	(0.000)	(0.001)	(0.107)	(0.509)	(0.147)
SITC 1	7.884	-0.661	-1.590	-1.256	0.054	-1.009	-0.149
	(0.353)	(0.000)	(0.000)	(0.001)	(0.971)	(0.593)	(0.186)
SITC 2	3.769	-0.194	-1.243	-0.387	0.156	-0.618	-0.010
	(0.101)	(0.001)	(0.000)	(0.004)	(0.669)	(0.187)	(0.719)
SITC 4	5.359	-0.499	-0.235	0.149	1.133	0.447	-0.068
	(0.160)	(0.000)	(0.186)	(0.305)	(0.085)	(0.605)	(0.165)
SITC 5	4.749	-0.216	-1.094	-0.263	0.389	-0.503	0.025
	(0.051)	(0.000)	(0.000)	(0.051)	(0.268)	(0.263)	(0.352)
SITC 6	6.270	-0.446	-1.140	-0.642	0.500	-0.268	-0.00004
	(0.000)	(0.000)	(0.000)	(0.000)	(0.017)	(0.285)	(0.998)
SITC 7	2.946	-0.180	-0.279	-0.372	0.246	-0.277	-0.017
	(0.206)	(0.001)	(0.008)	(0.007)	(0.474)	(0.537)	(0.500)
SITC 8	3.807	-0.121	-1.090	-0.228	0.580	-0.526	0.016
	(0.001)	(0.004)	(0.000)	(0.079)	(0.000)	(0.005)	(0.147)

Table 6.9: ECM results for UK import from Pakistan

(Single dummy approach; p-value in parenthesis)

SITC	*Const.*	$\ln Q^{m}_{i,t-1}$	$\Delta \ln RP^{m}_{i,t}$	$\ln RP^{m}_{i.t-1}$	$\Delta \ln Y_t$	$\ln Y_{t-1}$	d_t
Total	3.504	-0.236	-1.000	-0.228	0.739	-0.093	0.008
	(0.015)	(0.000)	(0.000)	(0.000)	(0.000)	(0.679)	(0.538)
SITC 0	10.169	-0.491	-1.192	-0.560	0.387	-1.185	-0.015
	(0.015)	(0.000)	(0.000)	(0.000)	(0.551)	(0.151)	(0.732)
SITC 2	10.981	-0.554	-0.233	-0.123	0.085	-0.919	-0.053
	(0.003)	(0.000)	(0.002)	(0.290)	(0.882)	(0.201)	(0.207)
SITC 5	2.061	-0.768	-1.600	-1.484	3.581	0.195	**-0.220**
	(0.815)	(0.000)	(0.000)	(0.000)	(0.015)	(0.917)	**(0.042)**
SITC 6	2.887	-0.314	-0.971	-0.190	0.891	0.291	**-0.025**
	(0.056)	(0.000)	(0.000)	(0.028)	(0.000)	(0.218)	**(0.092)**
SITC 7	-1.739	-0.445	-0.163	-0.144	1.701	1.411	0.061
	(0.765)	(0.000)	(0.003)	(0.057)	(0.084)	(0.250)	(0.377)
SITC 8	2.868	-0.1565	-1.075	-0.188	0.778	-0.232	0.014
	(0.010)	(0.001)	(0.000)	(0.066)	(0.000)	(0.237)	(0.248)

Table 6.10: ECM results for UK import from Sri Lanka

(Single dummy approach; p-value in parenthesis)

SITC	*Const.*	$\ln Q^m_{i,t-1}$	$\Delta \ln RP^m_{i,t}$	$\ln RP^m_{i.t-1}$	$\Delta \ln Y_t$	$\ln Y_{t-1}$	d_t
Total	5.853	-0.337	-0.826	-0.508	0.449	-0.437	0.022
	(0.004)	(0.000)	(0.000)	(0.000)	(0.068)	(0.192)	(0.241)
SITC 0	8.424	-0.519	-0.684	0.061	0.518	-0.181	-0.029
	(0.000)	(0.000)	(0.000)	(0.363)	(0.065)	(0.623)	(0.122)
SITC 1	2.554	-0.965	-0.401	-0.596	2.518	1.353	-0.084
	(0.759)	(0.000)	(0.000)	(0.000)	(0.072)	(0.452)	(0.452)
SITC 2	3.151	-0.048	-0.754	0.018	0.546	-0.542	**-0.075**
	(0.359)	(0.535)	(0.000)	(0.840)	(0.341)	(0.465)	**(0.089)**
SITC 5	4.711	-0.882	-0.662	-0.647	0.332	0.604	**-0.112**
	(0.194)	(0.000)	(0.000)	(0.000)	(0.567)	(0.427)	**(0.009)**
SITC 6	2.785	-0.499	-0.735	-0.644	1.199	0.322	0.034
	(0.150)	(0.000)	(0.000)	(0.000)	(0.000)	(0.415)	(0.163)
SITC 7	1.601	-0.482	-0.490	-0.241	1.925	0.831	0.047
	(0.638)	(0.000)	(0.000)	(0.013)	(0.001)	(0.259)	(0.295)
SITC 8	4.428	-0.247	-0.906	-0.530	0.482	-0.489	-0.001
	(0.060)	(0.001)	(0.000)	(0.000)	(0.112)	(0.225)	(0.960)

Table 6.11: Classifications of exchange rate regimes of South Asian Countries

Country	*De jure* free floating exchange rate regime (Central Banks announced)	*De facto* (according to IMF) exchange rate regime	Monetary Policy Framework
Bangladesh	May 2003	*Conventional fixed peg arrangements*	*Exchange rate anchor**
India	March 1993	*Managed floating with no predetermined path for the exchange rate*	*Other***
Pakistan	July 2000	*Managed floating with no predetermined path for the exchange rate*	*Other*
Sri Lanka	January 2001	*Conventional fixed peg arrangements*	*Exchange rate anchor*

Source: IMF Annual Report, 2008

** The monetary authority intend to buy or sell foreign exchange at given quoted rates to maintain the exchange rate at its predetermined level or within a range (the exchange rate serves as the nominal anchor or intermediate target of monetary policy). These regimes cover exchange rate regimes with no separate legal tender, currency board arrangements, fixed pegs with or without bands, and crawling pegs with or without bands.*

*** Includes countries that have no explicitly stated nominal anchor, but rather monitor various indicators in conducting monetary policy.*

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