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Exchange Rate Hysteresis in UK Imports from the South Asian Countries

by

Nusrate Aziz and Ahmad H. Ahmad

Abstract

We investigate and find evidence for the hysteresis hypothesis in UK imports from South Asian countries, using a monthly sample data that covers 1999 to 2012. This paper finds evidence of the asymmetric effect of exchange rate volatility that 'large' depreciations significantly reduce UK imports from Bangladesh; however, 'large' appreciations do not increase the imports significantly. We also find a partial support for the hysteresis hypothesis in UK import from India, Pakistan and Sri Lanka. We find that hysteresis can be both country- and commodity-dependent, which is largely consistent with previous empirical studies. Theoretical literature suggests that hysteresis occurs due to the presence of sunk costs, however, we find that hysteresis occurs even beyond the sunk costs.

JEL Classification: Hysteresis hypothesis, sunk costs, exchange rate, bilateral trade

Keywords: C22, F31, F32

Centre for Research in Economic Development and International Trade, University of Nottingham

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The Authors

Corresponding Author: Nusrate Aziz, Department of Business and Economics, Algoma University, Ontario, Canada, E-mail: Nusrate.Aziz@algomau.ca

Co-author: Ahmad H Ahmad, School of Business and Economics, Loughborough University, UK

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1. Introduction

In his seminal work, Baldwin (1986) introduced the idea of 'hysteresis' - 'history matters' - in international trade. The work was motivated by the puzzling behaviour of the US trade in the 1980's in that the real value of the US dollar appreciated almost 40 percent in 18 quarters starting from the third quarter of 1980. However, starting from February 1985, the US dollar depreciated between 75 and 100 percent in real terms by the second quarter of 1987. Notwithstanding, the US continued to experience a persistent trade deficit in the period. Baldwin (1986) portends that although the exchange rate appreciation pass-through into the real import price was approximately one-to-one, subsequent exchange rate depreciation did not affect the import prices a significant amount. Pricing-to-market, PTM, behaviour by foreign exporters was cited as one possible explanation. However, as pointed out by Baldwin (1988), the PTM is an implication not an explanation for the hysteresis observed in the US trade. Fedoseeva and Werner (2016) have also found that PTM behaviour was responsible for German beer exports, however, argues that the existence of sunk costs[1] was the main explanation for the PTM behaviour.

A temporary real exchange rate shock should have only a temporary effect on trade prices and trade volumes. The size of the effect depends on the size of the exchange rate shock. However, if the market entry cost is sunk, a temporary exchange rate shock may have a persistent effect on trade which is referred as 'hysteresis' in international trade (see, theoretical literature of Baldwin 1986, Baldwin 1988b, Baldwin and Krugman 1989, Dixit 1989a, Dixit 1989b, Baldwin and Lyons 1994, Roberts and Tybout 1997, and Impullitti, Irarrazabal and Opromolla 2013; and also empirical work of Bean 1987, Baldwin 1988a, Parsley and Wei 1993, Anderton 1999, Giovannetti and Samiei 1995, Martinez-Zarzoso 2001 and Campa 2004). The empirical literature reports mixed results on the existence of hysteresis in trade. For example, Bean (1987), Baldwin (1988), Anderton (1999), Campa (2004) and Kannebley (2008), Belke *et al* (2013), Belke and Kronen (2016), and Fedoseeva and Werner (2016) find support for the hysteresis hypothesis. However, Giovannetti and

1 Sunk costs refer to costs, which cannot be recovered by an enterprise.

Samiei (1995) and Parsley and Wei (1993) find only a partial support for this hypothesis. In fact, Parsley and Wei (1993) cast doubt on the validity of hysteresis in US imports. Similarly, Verheyen (2013) and Aray (2015) report non-significance of hysteresis. Martinez-Zarzoso (2001) on the other hand, indicates that hysteresis effect can be both a commodity and a country-specific issue.

This study makes the following contributions to the literature. First, the existing empirical literature investigates the hysteresis hypothesis without identifying the effect of appreciation and depreciation separately (for example, Baldwin 1988, Anderton 1999, and Bean 1987). In contrast, this study tests the hysteresis hypothesis by separating the effect of exchange rate appreciation from depreciation.

We test the hysteresis hypothesis in UK imports from four South Asian countries. These Asian countries export very similar types of products to the UK and they are located in the same geographic region. These countries are very similar in terms of labour abundance, scarcity of capital, labour intensity in the production process, and factor productivity, too. The UK is one of the main export destinations them. These, therefore, give us an opportunity to minimize heterogeneity in the sample and to reach a robust conclusion. Additional motivation for covering these countries is the fact that the UK has historical ties with these South Asian countries that translated into economic and trade relationships between them. Trade flow between the UK and the sample countries has been established for centuries and has not diminished in importance as it endures even in the face of the recent financial crisis.[2] These are the reasons why we estimate the hysteresis hypothesis in UK imports from these South Asian Countries.

Second, South Asian countries have been implementing export-led growth policies since around the mid-1980s which are reflected by frequent movement in their exchange rates and shifts in the exchange rate regime[3]. However, no studies until now

2 Figures 5 depicts the UK imports from the sample countries, which shows a persistent trend for the sample period covered.

3 See Table 1 for details on *de jure* exchange rate regimes Bangladesh, India, Pakistan and Sri Lanka.

have examined the hysteresis hypothesis in the trade flows of these countries. We, therefore, attempt to fill in this gap in the literature.

Third, Dixit (1989) postulates that firms' entry and exit decisions depend on the magnitude of exchange rate movements. Dixit (1989) parameterized a threshold level for 'sunk entry costs'. Building on this idea, we construct and use exchange rate threshold variables to estimate sunk costs. By applying constructed threshold variables, this paper investigates both the effect of large exchange rate movements on the countries' bilateral trade. We also examine the validity of the theoretical view that sunk costs are the reason for hysteresis. In addition, we allow for flexibility in the threshold levels which captures a common, a firm-specific and time variant 'sunk costs' as suggested by Dixit (1989a and 1989b). Unlike existing literature, this study employs a double-dummy approach to measure separately the effect of large appreciation and large depreciation on UK imports. Two different variables, representing large appreciation and depreciation, allow us to distinguish between the effect of each. A large depreciation at home would essentially reduce imports due to an increase in the price of imported goods. On the contrary, a large appreciation at home would raise imports because of a fall in prices of import goods. If the effect of large depreciation and large appreciation are found empirically different (in size or significance), this would indicate that there is an evidence of exchange rate hysteresis in trade.

Fourth, existing literature examines the hysteresis hypothesis for developed countries. These comprise of Parsley and Wei (1993) and Baldwin (1988) for the US, Anderton (1999) for the UK, Giovannetti and Samiei (1995) for the US, Germany and Japan, Martinez-Zarzoso (2001), and Campa (2004) for Spain. Others are Belke and Kronen (2016), Fedoseeva and Werner (2016), and Belke *et al* (2013) for German and Greek exports to non-Euro countries. Very few literature estimates the hysteresis hypothesis for developing countries, apart from Kannebley (2008) who considered hysteresis hypothesis in Brazilian exports. However, developing countries (particularly South Asian countries) are more concerned about their exchange rate policy and international trade than developed countries. Many developing countries are undertaking export-led growth policies as a major strategy in their development process. Therefore, testing for the hysteresis hypothesis is useful for developing countries in policy-making perspective.

We find support for the hysteresis hypothesis and further show that hysteresis could be country and commodity-specific as being reported in the previous literature (see, Martinez-Zarzoso, 2001). In addition, we point out that 'sunk costs' which is traditionally considered as the reason for hysteresis in international trade is not entirely responsible for hysteresis in trade. We find evidence of hysteresis in UK imports even after minimizing the sunk costs effect.

This is worth noting that the definition of exchange rate used in our study is the units of domestic currency per unit of foreign currency. An increase in the exchange rate, therefore, represents depreciation while a decrease indicates an appreciation.

The rest of the paper is organized as follows. Section 2 gives a theoretical discussion on hysteresis hypothesis. Section 3 discusses the exchange rate threshold, trade flows and the construction method of hysteresis dummies. Section 4 explains the data, methodology and estimation techniques. Section 5 discusses the estimated results while Section 6 concludes.

2. Hysteresis and Sunk Costs

Currency depreciation generally reduces imports of a country as a result of an increase in import prices. If there is a large depreciation in the domestic currency, import becomes more expensive, leading to a large fall in import demand. Consequently, some of the existing exporting firms (supply side) would find their business unprofitable, forcing them to exit the market. For example, suppose, Bangladesh and China export the same product, *X* to the UK. Assume that pound sterling has largely depreciated against foreign currency. Hence, import demand of product *X* has fallen due to higher import price. Let us assume that Chinese firms stay in the market with the pricing-to-market (PTM) strategy. However, Bangladeshi firms exit from the UK market because they are unable to follow the PTM strategy. If they follow the PTM strategy they end up with loss due to their high production costs. In this case, Chinese firms capture a greater market share in the UK.

When the reverse situation occurs, i.e., domestic exchange rate appreciates and the exchange rate returns to its previous level, foreign incumbents (e.g., Chinese firms) remain active with a larger market share, but no new potential foreign entrant could enter the market. In our example, Chinese firms capture a greater market share and remain active with a larger market share. Consequently, Bangladeshi firms cannot re-enter into UK market. Hence, a temporary shock in the exchange rate leads to an irreversible effect on international trade.

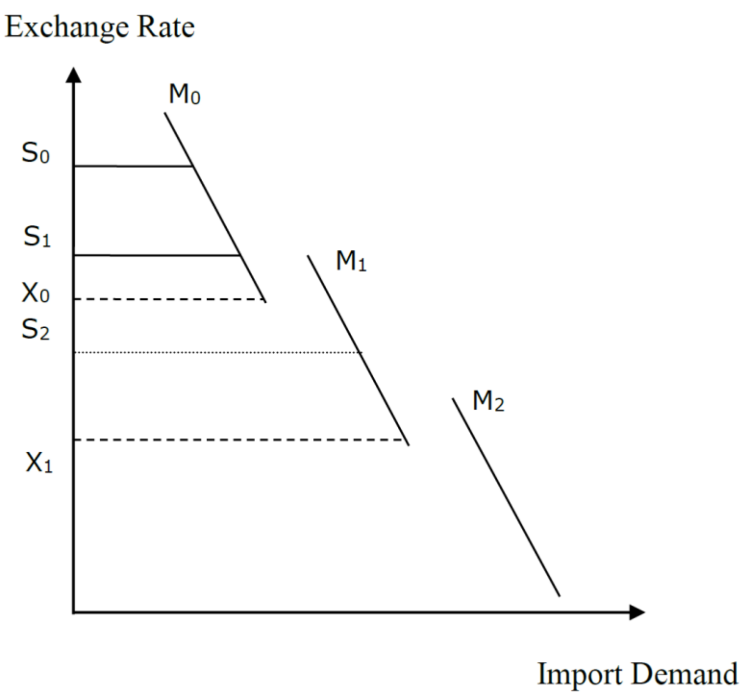
Conceptually, this asymmetric behaviour may also occur in the opposite direction - a large appreciation increases imports but when the reverse situation arises (a large depreciation occur), there will be no significant fall in imports. One of the important reasons for hysteresis in trade is, therefore, the PTM behaviour by the exporting firms.[4] However, this is possible if the PTM strategy is inexpensive to exporters.

Existing theoretical studies suggest that 'sunk costs' is the main reason for the occurrence of hysteresis. Empirically 'sunk costs' can be captured by an exchange rate threshold. There exists a 'no-entry-no-exit' band in our exchange rate threshold which can capture sunk costs effect. No new firms enter the market while the incumbents do not exit the market when the exchange rate movements remain within the 'no-entry-no-exit' band. To capture sunk costs and to test whether 'hysteresis' occurs due to the existence of sunk costs, exchange rate movements must be 'larger' in magnitude. The fact is that with a 'smaller' movements in the exchange rate, any entry or exit of firms to an export market are not cost effective. This so-called 'larger' term can be defined in terms of both size and duration. This 'larger' term in our study refers to 'a larger movement in magnitude' and 'a longer movement in terms of time' as suggested by Parsley and Wei (1993).

4 For the full discussion on hysteresis hypothesis, refer to Baldwin (1988) and Anderton (1999).

Figure 1 illustrates the importance of sunk costs in international trade. The figure depicts the relationship between imports and the exchange rate in the presence of hysteresis. As can be observed from the figure, it shows that any exchange rate movement between S_0 and S_1 (which is considered as 'not a larger movement') cannot influence the decision, whether a foreign firm should enter the export market or any existing firm should exit the market, due to sunk costs. Foreign firms enter the market only if appreciation in importer's currency persists for a longer period and/or if the appreciation is larger in magnitude. This 'longer time' and 'larger magnitude' of exchange rate movements are vital for exporting firms to make their entry and exit decisions. If an exchange rate change is smaller in magnitude or it is shorter in duration, then it leads to a movement along the existing import demand curve (but does not shift the curve). On the contrary, any exchange rate movement from S_0 to S_2 which is a large appreciation in the importer's currency entices new firms to enter the market. In this situation, foreign goods become cheaper to domestic consumers (importers). This causes a shift of import demand curve from M_0 to M_1.

Figure 1: Import and exchange rate relation in presence of hysteresis



Source: Parsley and Wei, 1995

Similarly, any exchange rate movement from X_1 to S_2 (which is not a large depreciation) cannot shift the import demand curve from M_1 to M_0. In this situation, existing firms continue their supply along M_1 because they have already incurred sunk costs. In this stage exit from the market is expensive for them. Existing firms exit the export market only if exchange rate depreciation in importer's currency is very large (something like a movement from X_1 to S_1 in Figure 1). In this situation, staying in the market is very costly for the exporter.

Now, let us assume that an exchange rate band exists for foreign firms' which would determine their entry or exit decision. Suppose that the upper exchange rate threshold of the band is s_t^u and the lower exchange rate threshold is s_t^l and if the current exchange rate is e_t, foreign firms' entry and exit decision can be explained as follows:

	Exchange Rate Movements	Firms' decision
Situation I	$e_t > s_t^u$	Exit
Situation II	$s_t^u > e_t > s_t^l$	No-entry-no-exit
Situation III	$e_t < s_t^l$	Entry

Thus, if current 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 their export market. Hence, following a depreciation or an appreciation in importer's currency, there would be a decrease or an increase in imports, respectively only when the exchange rate exceeds the upper band or the lower band of the threshold. Now assume that hysteresis occurs due to sunk costs. Hence, only sufficiently large exchange rate movements (exceeding sunk costs equivalent) can influence a foreign firm to take an entry or exit decision. This is because the effect of sufficiently large exchange rate movements only can outweigh the sunk costs.

Figure 2: Hysteresis beyond sunk costs

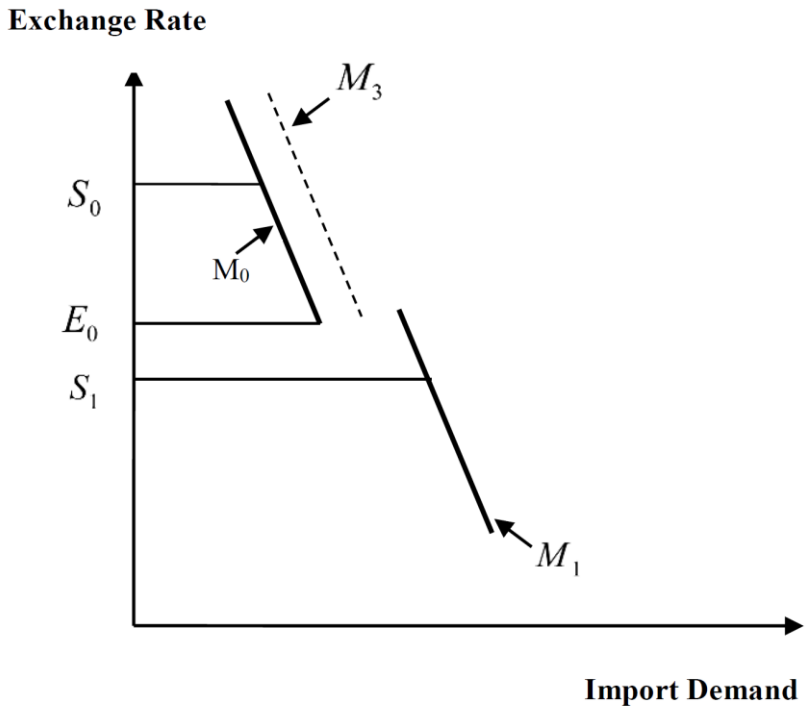


Figure 2 illustrates how hysteresis occurs beyond sunk costs. Any exchange rate movement from S_0 to E_0 (not a sufficiently large appreciation) cannot shift the import schedule from M_0 to M_1 because of the presence of sunk costs. However, a large appreciation such as an exchange rate movement from S_0 to S_1 would lead to a shift from M_0 to M_1.

Assume that there is a large depreciation from S_1 to S_0 in Figure 2. As a result, the import demand curve has shifted back from M_1 to M_0. We can conclude, in this situation, that there is no hysteresis in trade. However, now assume that an opposite and equally large appreciation occurred in importer's exchange rate. This, in reality, does not necessarily shift the import demand curve back from M_0 to M_1. There are two possibilities: first, the import demand curve (M_0) may not shift at all, but there may be some movements which occur along the existing import demand curve. Second, the import demand curve may shift to a new level, such as M_3 (which is less than a shifting to M_1). Both cases will lead to hysteresis.

Now suppose that our middle-band (no-entry-no-exit) is extended to an extent so that it can capture sunk costs[5]. This follows that any hysteresis found in trade is not due to sunk costs.

3. Construction of the exchange rate threshold

Following Parsley and Wei (1993), we compute exchange rate thresholds for explaining hysteresis. The effect of depreciation following a cumulative depreciation could be different from the effects of depreciation following a cumulative appreciation. Accordingly, s_t is defined as a cumulative change in exchange rate, which is measured as follows:

$$s_t = \sum_{i=0}^{\tau} \Delta e_{t-i} = e_t - e_{t-\tau-1} \tag{1}$$

where Δe_t is the first difference of exchange rate, and τ is the number of periods, then the hysteresis dummy[6], d_t can be characterized as follows, as in Parsley and Wei (1993):

$$d_t = \begin{cases} 1 & \text{if } \Delta \mathrm{e_t} > 0 \text{ and } \mathrm{s_t} > 0 \\ -1 & \text{if } \Delta \mathrm{e_t} < 0 \text{ and } \mathrm{s_t} < 0 \\ 0 & \text{otherwise} \end{cases} \tag{2}$$

where d_t takes the value of 1 if both the first difference (Δe_t) and cumulative changes (s_t) in exchange rates are in the positive direction and it is -1 if both are in

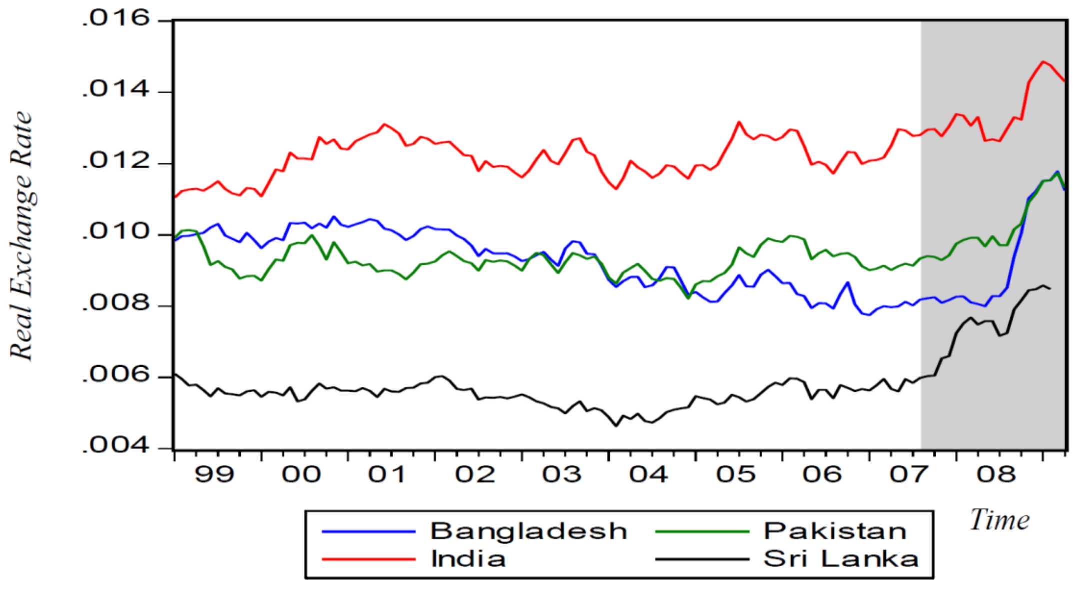
5 We have allowed the variation in the middle band by using the exchange rate movements of 13 months (more than 1 year), 25 months (more than 2 years) and 37 months (more than 3 years) assuming that the bands with longer movements can capture sunk costs.

6 It accounts for cumulative changes in exchange rates and used as a proxy for hysteresis because of an assumption that cumulative appreciation (depreciation) followed by a current appreciation (depreciation) denote, so called, "larger" change in the exchange rate that is sufficient enough to be outside the middle-band and consequently lead to entry (exit) into the markets. It is worth noting that in some cases (in the series) the cumulative change appears to be positive in one month however it is found negative in the next month. In that case, we cannot say that the exchange rate change has lasted sufficiently long to capture so called 'larger' movements. It is just to remind the readers that our 'larger' term includes both bigger magnitude and longer period. Bigger magnitude could be captured by cumulative change but longer period should be captured by a stable movement in the exchange rate. If we impose a restriction that both cumulative and current change must be in the same direction, we find that many observations are not qualified for so called 'larger' movements. Thus, we can capture both larger and longer terms in our exchange rate threshold. For further detail, please see, page 609, Parsley and Wei (2003).

the negative direction while it is 0 (zero) if they are in opposite directions. If the current change and cumulative changes are in opposite direction it indicates that the depreciation or the appreciation is not sufficiently ‘large’ to induce either entry or exit from the market. This is because the plus and the minus reduce the magnitude of the change, and exchange rate movement has not taken place for a sufficiently long period. Thus, this opposite outcome of cumulative and current changes results in the value of hysteresis dummy to be equal to zero (‘no-entry-no-exit’ band).

Figure 3 represents the bilateral exchange rates of the pound sterling against the currencies of the countries in the sample. The figure shows that although the magnitude of the exchange rates varies, the pattern seems to be similar for all bilateral exchange rates. This suggests that there is homogeneity in exchange rate movements in the sample. The shaded area refers to the financial crisis period. It indicates that during the global financial crisis the movements of the currencies are uniform and pound sterling depreciated against South Asian countries’ currencies during the global financial crises.

Figure 3: Real exchange rate of UK with South Asian countries



It is worth mentioning that we are interested in the shifting in import demand function due to large exchange rate movements which can be captured by an intercept dummy (see, Anderton 1999, and Baldwin 1988), i.e., we are not interested in the change in slope of import demand curve. The above hysteresis dummy (equation (2)), thus, can show us whether the intercept of import demand function is significantly different due to large exchange rate movements. However, the weakness of this single dummy is that this dummy can only show us if the import demand function does shift significantly due to large exchange rate movements; it does not show us the impact of large appreciation and large depreciation, separately. In other words, it does not show us whether import demand curve shifts due to appreciation or depreciation. This requires us to construct both large appreciation and large depreciation dummies, separately. We, therefore, construct the following dummies (i.e., a double-dummy approach).

Using equation (2) as a benchmark, we construct two separate dummy variables, one for large appreciation and another for large depreciation, as follows:

$$d_t^i = \begin{cases} 1 \text{ if } \Delta e_t > 0 \text{ and } s_t > 0; \\ 1 \text{ if } \Delta e_t < 0 \text{ and } s_t < 0; \\ 0 \quad \text{otherwise} \end{cases} \tag{3}$$

where $i = \{A, D\}$; 'D' stands for depreciation and 'A' for appreciation. The depreciation dummy (d_t^D) takes the value of 1 (unity) if there is a large depreciation after a cumulative depreciation and *0* (zero) otherwise. It takes the value of *0* (zero) if cumulative change and current change are in opposite directions as well as if there is an appreciation after a cumulative appreciation[6]. This indicates that hysteresis dummy takes value of zero when there is no persistent and large movement in the exchange rate. Similarly, the appreciation dummy (d_t^A) equals *1* (unity) if there is a large appreciation after a cumulative appreciation and *0* (zero) otherwise. The hysteresis dummies, therefore, carry three distinguishable features: large appreciation, large depreciation and the middle band. Current changes are measured as monthly changes and cumulative changes are captured by the changes in the exchange rate for 13 months (more than 1 year), 25 months (more than 2 years), and 37 months (more than 3 years). We allow for variation in cumulative changes to accommodate heterogeneity in firms and commodities as suggested by Dixit (1989b). By allowing these variations we can also capture different speed of exchange rate pass-through into the import prices. That is, in this study both slow and fast exchange rate pass-through are counted for. The cumulative changes for longer period such as 25 months and 37 months can count for sunk costs, too.

Hysteresis hypothesis predicts that the coefficient of the hysteresis would be negative and significant in an import equation. This is because a large appreciation in importer's exchange rate leads to an entry of new firms into the market which shifts the import schedule outward. Similarly, a large depreciation in importer's exchange rate leads to an exit of some existing exporting firms (who faces loss) from the market and, therefore, the import schedule shifts inward. Thus, if hysteresis is significant, one would expect the sign of the coefficient of hysteresis dummy to be negative and significant.

More specifically, a large appreciation increases imports which represents a negative relationship between the exchange rate and imports. On the other hand, a large depreciation will shift the import schedule inward which would again produce a negative coefficient. Hence, we expect negative sign for both large appreciation and large depreciation dummies. The combined effect would also be negative. So, in a single dummy approach (equation (2)) if the sign of the dummy variable appears to be negative and significant, we would find an evidence of hysteresis in trade. However, this result would not show us whether the effect of large appreciation is bigger than the effect of large depreciation, or vice versa. It does not show us whether the negative sign emerged from large appreciation or large depreciation, too.

On the contrary, in a double dummy approach (equation (3)), if the coefficient of appreciation dummy is negative and significant, however, the coefficient of depreciation dummy is not (or vice versa), we would conclude that there is hysteresis in trade. Moreover, we clearly can show whether appreciation or depreciation causes the shift in import schedule. It clearly will show us whether new firms have started exporting during a large appreciation in importer's exchange rate. It will also show us whether incumbents do not exit during a large depreciation in importer's exchange rate, and vice versa.

Large Appreciations and Depreciations

We can show the number and the size of large appreciations and depreciations during our sample period by constructing and plotting the break-points (see, Parsley and Wei, 1993). However, the construction and plot of "the break-points" are limited in showing whether we have a sufficient number of large appreciations and depreciations to estimate our model. Our intercept dummies are sufficient to show whether there is a shift in import demand curve. As mentioned earlier, change in slope of import demand curve is not our concern.

The break-points are computed based on the following procedure as in Parsley and Wei (1993)[7]:

$$Break\text{-}point = d_t^i \times \Delta e_t \times s_t \tag{4}$$

where $i = \{A, D\}$, A stands for appreciation and D for depreciation. The break points are plotted in Figures 4(a) - 4(d) (in Appendices), which indicate large bilateral exchange rate movements of pound sterling against South Asian currencies[8]. Figure 4(a) suggests that in the managed floating regime of Bangladesh's exchange rate, there seem to be more 'large' depreciations of the pound sterling than appreciations against *Taka*. However, between 2003 and the late- 2007, which coincides with the country's *de jure*[9] free floating regime, there are more large appreciations of pound sterling than large depreciations. The pound sterling depreciates from the onset of the financial crisis onwards. It is also noticeable from the figure that the size of depreciations of sterling is larger during the financial crises period than in other periods.

Figures 4(b) and 4(c) depict the constructed threshold for Pakistan and India, respectively, in which there seem to be cyclical fluctuations in the exchange rates.

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7 See Parsley and Wei (1993) for the full details.

8 It is worth noting that there exist several econometric threshold models which include Enders and Siklos (2001), Hansen and Seo (2002) and Tsay (1998). However, these models do not seem to be appropriate for this work. This is because, the first two are bi-variate models but this paper is interested in investigating multi-variate relationships. The Tsay (1998) model is based on vector autoregressive models, which does not account for co-integrating relationship that this paper is interested in.

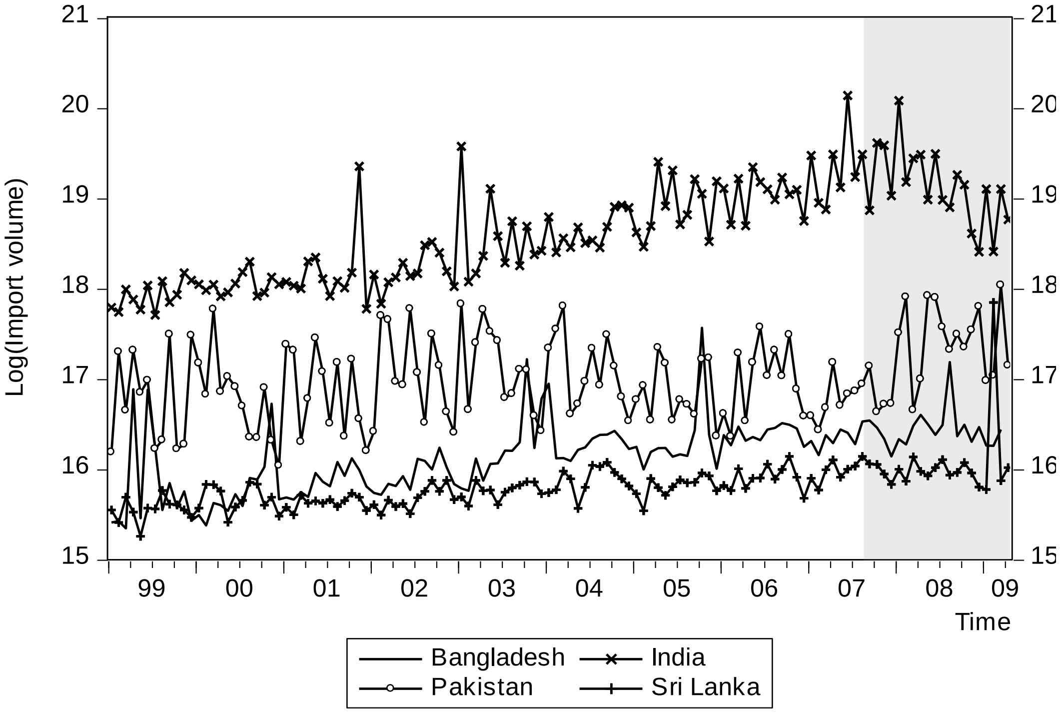
9 Since the seminal work of Calvo and Reinhart (2002), exchange rate regimes declared by countries seem to differ with the actual regime and therefore, the former is known as *de jure* and the latter is *de facto* regimes.

During the sample period, the pound sterling first depreciates, then appreciates and then later depreciates again against the Indian and Pakistani *Rupee*. The size of depreciations during the global financial crisis period is different, exceptionally larger than the other periods. In the case of Sri Lanka, there are more episodes of sterling appreciations than depreciations as indicated by Figure 4(d). Hence, Figure 4(a) – 4(d) indicate that there is a sufficient number of large exchange rate movements above and below the threshold levels for Bangladesh, India, Pakistan and Sri Lanka. We, therefore, have enough number of observations to test the hysteresis hypothesis.

4. Data, Empirical Methodology and Estimations

This paper uses monthly aggregate and disaggregate UK bilateral import volumes and prices from the trade statistics database of the UK HM Revenue & Customs, UK Government**,** for the periods between 1999:01 and 2012:04. Our product classifications are based on Standard International Trade Classification (SITC). *Table 1* (in Appendices) presents the SITC series that we have used in this study. There are ten industries covered in the study, which are enumerated in the table. The study also constructs the UK bilateral real exchange rates between the pound sterling and South Asian currencies by using the data from the International Financial Statistics (IFS) of the International Monetary Fund (IMF). The SITC-wise domestic PPIs of United Kingdom are collected from the OECD database. We also use producer price indices (PPIs) of Bangladesh, India, Pakistan and Sri Lanka, as well as UK industrial production index (a proxy for real income) sourced from IFS of the IMF. Figure 5 shows the logarithm of the volume of total import of UK from its South Asian trading partners covered in this study.

***Figure 5:* UK Imports from South Asia**



Although there were large depreciations of pound sterling at the time of the global financial crisis as shown in Figure 3, it seems that there was less magnitude of fall in the UK imports from these countries. Table 2 (in Appendices) reports the exchange rate regimes for the countries covered in the sample. We report both *de-jure*, as announced by the monetary authorities and *de-facto* regimes, as identified as the actual by IMF[10]. It is evident from the table that the two regimes do not agree with each other for all the countries. For example, Bangladesh has announced that it has adopted free-floating regime since May 2003, but the IMF *de-facto* indicated that the country has been on a conventional fixed peg arrangement. However, *de-facto* regimes of India and Pakistan are not too different from *de-jure* regimes.

Empirical Model

Based on Rose and Yellen (1989), Rose (1990), and Rose (1991) as well as other standard two-country trade literature, demand for imports is assumed to be negatively

10 See footnote 9.

related to relative prices (RP) and positively to domestic real income (Y). The import demand function can be given as follows:

$$\ln Q_{i,t}^{m} = \mu_i + \delta_i \ln RP_{i,t}^{m} + \lambda_i \ln Y_t + \psi_i d_t + u_t \tag{5}$$

where d_t is the hysteresis dummy; u_t is the error, which takes the following form:

$$u_t = \ln Q_{i,t}^{m} - \mu_i - \delta_i \ln RP_{i,t}^{m} - \lambda_i \ln Y_t - \psi_i d_t \tag{6}$$

The model in equation (5) assumes that long-run relationship, i. e. cointegration exists between the variables. Using equation (5) and (6) and as in Hefferman (1997), the growth of $lnQ_{i,t}^{m}$ can be written as:

$$\begin{aligned}\Delta \ln Q_{i,t}^{m} &= \alpha_i + \beta_i \ln Q_{i,t-k}^{m} + \gamma_i \Delta \ln RP_{i,t}^{m} + \phi_i \ln RP_{i,t-k}^{m} + \eta_i \Delta \ln Y_{i,t} \\ &+ \kappa_i \ln Y_{i,t-k} + \theta_i d_t + \varepsilon_{i,t}\end{aligned} \tag{7}$$

where, $Q_{i,t}^{m}$ is the UK import volume, $RP_{i,t}^{m}$ is the relative prices of import for the UK, which is given by the industry-specific import prices divided by the industry-specific domestic price, Y_t is the real income of the UK (proxied by industrial production index for aggregate import and industry-wise industrial production index for disaggregate import models), d_t is hysteresis dummy. If significant, d_t will affect the constant of equation (7) and will shift the demand curve that is shown in Figure 1 and 2. The subscript k is the lag length which is determined by the Schwarz Information Criterion (SIC). The model in equation (7) is extended to include the large depreciations (d_t^D) and the large appreciation (d_t^A) dummies discussed in the preceding sections. The model, therefore, takes the following form:

$$\begin{aligned}&\Delta \ln Q_{i,t}^{m} = \alpha_i + \beta_i \ln Q_{i,t-k}^{m} + \gamma_i \Delta \ln RP_{i,t}^{m} + \phi_i \ln RP_{i,t-k}^{m} + \eta_i \Delta \ln Y_{i,t} + \kappa_i \ln Y_{i,t-k} \\ &+ \rho_i d_t^D + \pi_i d_t^A + \varepsilon_{i,t}\end{aligned} \tag{8}$$

As mentioned earlier depreciation and appreciation typically have different effects on import, these two separate dummies would indicate whether the effect of large appreciations and large depreciations are systematically different or they are same. If the size and significance of ρ and π are found to be different, this indicates that there is an evidence of hysteresis in trade. Since, d_t^D and d_t^A are intercept dummies, they will affect the constant term (α_i) in equation (8).

We test the hysteresis hypothesis employing an intercept dummy because we are interested in the shifting in the intercept of import demand curve, not the change in the slope of the demand curve. If either ρ or π in equation (8) is negative and significant, and the other coefficient is insignificant, this confirms the presence of an asymmetry in the UK imports in response to large exchange rate movements. The coefficients of the first difference of variables provide the short-run estimates and the long-run coefficients are estimated from the lagged variables. We obtain them from estimated equation. 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, equation (7)[11] can be written in terms of the long-run as:

$$-\beta_i \ln Q_{i,t}^{m} = \alpha_i + \phi_i \ln RP_{i,t}^{m} + \kappa_i \ln Y_{i,t} + \theta_i d_t \tag{9}$$

Hence, the long-run coefficients for the import demand function are as follows:

$$\mu_i = -\alpha_i / \beta_i, \qquad \delta_i = -\phi_i / \beta_i, \quad \lambda_i = -\kappa_i / \beta_i, \text{ and } \psi_i = -\theta_i / \beta_i$$

The study estimates the models specified in equations (7) and (8) and then derives equation (5) using the "delta methods" for both the aggregate and the disaggregate UK imports, discussed in Section 5 (as follows).

5. Discussions of the Estimated Results

Descriptive statistics of the UK imports from the South Asian countries in the sample are reported in Table 3 (in Appendices). The industries covered vary from country to country depending on the availability of data. The highest number of industries data that we find is for India; eight industries. Seven industries are covered in Sri Lanka while six industries in Pakistan. The country with the least number of industries is Bangladesh where data for four industries are available in the database. All series were subjected to a battery of unit root tests[12] to identify their level of integration. The results indicate that the individual series are non-stationary *I(1)* in levels, but stationary *I(0)* in first difference. Consequently, Johansen cointegration tests were

11 We apply similar approach to calculate the long-run coefficients from model (8), as well.

12 To this end, ADF, PP and KPSS were used and the results are consistent in that all the variables are I(1) on levels and I(0) on first difference.

conducted and the results rejected the null of no cointegration between the series in favour of the alternative hypothesis of one cointegration.[13] Subsequently, the study estimates the models specified in equations (7) and (8)[14].

The Short-run Dynamics and the Long-run Relationships

In the double dummy case, hysteresis dummies can show whether large appreciations or large depreciations or both significantly shift the intercepts of the import demand function. If one of the dummies but not both is significant we conclude that there is an evidence of hysteresis in trade. However, if both dummies are significant (and the size of the coefficients are same) we conclude that there is no hysteresis in trade. However, in the single dummy approach, if the dummy is negative and significant, it indicates that there is hysteresis in trade (see, Parsley and Wei, 1993 for detail). The results in Tables 4, 5, 6 and 7 (in Appendices) are obtained from the single dummy approach for Bangladesh, India, Pakistan and Sri Lanka, respectively. These are the outcomes from the estimated model specified in equation (7).

The error correction model, ECM, and the long-run results for each of the countries are also reported in the tables. The results indicate that the hysteresis dummies are negative and significant for *SITC 0* and *SITC 7* for Bangladesh; *SITC 5* and *SITC 6* for Pakistan; and *SITC 2* and *SITC 5* for Sri Lanka and none for India. The results also show that the long-run UK GDP coefficient has a negative impact on imports from Bangladesh. This indicates that if the UK income level rises, UK citizens import less from Bangladesh. This perhaps suggests that an increase in the UK income leads the UK buyers to buy expensive products from the export competitors of Bangladesh.

Effects of appreciation or depreciation on the imports in terms of magnitude are very difficult to discern from the 'single-dummy approach'. It is also difficult to determine the type of asymmetry from the 'single-dummy approach'. Therefore, the double-

13 However, both the unit root test and the cointegration results are not reported in this paper in order not to unnecessarily make the paper too long. But they are available on request.

14 For robustness checks, the ARDL test of cointegration was also conducted and the results rejected the null of no cointegration.

dummy approach will shed more light on this and consequently superior to the single-dummy approach. In other words, the advantage of double-dummy over the single-dummy approach is that the former, having incorporated explicit effects of appreciation and depreciation, will indicate whether these changes in exchange rates have different effects on the imports.

The results obtained from the double-dummy approach are reported in *Tables 8* to *Table 11*. The results indicate that all the parameters, except the hysteresis coefficient, are of the expected signs and significant at the conventional level of significance for almost all SITC categories for all the countries. *Table 8* contains the error correction term, ECM, results obtained from the model specified in equation (8) for Bangladesh. The depreciation dummy (d_t^D) is found to be negative and significant for all sectors, except for *SITC 6*. The results also show that large depreciations of pound sterling significantly affect the aggregate import and industrial imports of *SITC 0, SITC 7* and *SITC 8* from Bangladesh; however, large appreciations did not significantly affect the UK imports at aggregate or disaggregate level. This indicates that large depreciations significantly reduce the UK imports from Bangladesh however when the situation is reversed, i.e., large appreciations occur, there was no increase in the UK imports from the country. Understandably, the result from the double-dummy approach is different from the results obtained from the single-dummy approach.

There emerge three implications from estimated results using double-dummy approach. First, depreciation has a negative and significant effect, but appreciation shows an insignificant effect on the UK imports. Hence, there is an asymmetric effect of large exchange rate appreciations and depreciations. Bangladeshi firms those exit UK market during large depreciations of the pound sterling cannot re-enter the market during a favourable situation (large appreciation of the pound sterling). This implies that there is hysteresis in the UK imports from Bangladesh. Second, the asymmetry suggested by the presence of hysteresis is not like the asymmetric effect found for the US imports in the 1980s reported in Baldwin (1988) and Dixit (1989). Baldwin (1988) and Dixit (1989) found that those firms who enter the US market during a large appreciation, by applying the pricing-to-market strategy, they do not exit US market when there is a large depreciation in the US dollar. Third, the asymmetry found in

UK imports from Bangladesh has not occurred due to sunk costs. This is because we alternatively applied dummies which are constructed using 13-month, 25-month and 37-month's cumulative changes in the exchange rate. The latter two are assumed to be able to capture sunk costs. Hence, this hysteresis occurs beyond the effect of sunk costs. [15]

15 During large depreciation in importer's currency small firms exit the market, however large firms stay in the market. During large appreciation in importers currency an incumbent captures a greater market share, it does not give a small firm a chance to enter the market again. This can be termed as a "third country effect" because the firms from China (compared with Bangladesh) may have a relatively advantage of low-cost production. Hence, firms from China are able to apply PTM strategy.

Table 8: ECM results for UK imports from Bangladesh

(Double variable 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	6.696	-0.138	-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)

Results of the Delta Method for the Long-run UK import from Bangladesh

(Double variable approach; standard error in parenthesis)

SITC	C	$\ln RP^m_t$	$\ln Y_t$	d^D_t	d^A_t
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.*

Table 9: ECM results for UK import from India

(Double variable 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)**

Results of the Delta Method for the Long-run UK import from India

(Double variable approach; standard error in parenthesis)

SITC	C	$\ln RP^m_t$	$\ln Y_t$	d^D_t	d^A_t
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 10:* ECM results for UK import from Pakistan**

(Double variable 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)

Results of the Delta Method for the Long-run UK import from Pakistan

(Double variable approach; standard error in parenthesis)

SITC	C	$\ln RP^{m}_{t}$	$\ln Y_t$	d^{D}_{t}	d^{A}_{t}
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 11: **ECM results in UK import from Sri Lanka.**

(Double variable 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)	**(0.109)**	(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)

Results of the Delta Method for the Long-run UK import from Sri Lanka

(Double variable approach; standard error in parenthesis)

SITC	C	$\ln RP^{m}_{t}$	$\ln Y_t$	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)

Asymmetric effect in the UK imports from Bangladesh is different to that of the U.S. in the 1980s as reported by Baldwin (1988) and others, which could be due to the following reasons: First, Baldwin (1988) estimates hysteresis in the US imports from both developed and developing countries', while this study estimates the hysteresis in the UK imports from only developing countries and also from those countries that it has historical ties and it has maintained a strong trading relationship with. It is worth mentioning that capacity utilization, pricing behaviour, production costs, firms' size are different in developing countries from those prevailing in developed countries. Second, Baldwin (1988) tests the hysteresis hypothesis by using the import demand function at the aggregate level, but this paper estimates bilateral industry-specific import demand functions.

Table 9 contains the results for India. The appreciation dummy is negative and significant for aggregate import, and industrial imports of *SITC 0* and *SITC 8* of the UK from India. However, the depreciation dummy is not significant for those products. This appears to be similar to the asymmetric effect reported for the US imports in the 1980s in Balwin (1988) and opposite to that we find for Bangladesh. This may be because, unlike Bangladeshi exports, Indian exports are not affected by the pricing-to-market strategy of competing countries. Alternatively, Indian firms also stay in the UK market through PTM strategy during large depreciation of pound sterling.

Similar to Bangladesh, the depreciation dummy, is found negative and significant for UK industrial imports of *SITC 5* from Pakistan, and *SITC 2* and *SITC 5* from Sri Lanka as shown in *Tables 10* and *Table 11*, respectively. However, appreciation dummies are insignificant for the same categories (with an exception in SITC 6 from Sri Lanka). Appreciation dummy for industrial import of *SITC 6* from Sri Lanka is negative and significant, but depreciation dummy is insignificant for this category.

We also find that large depreciations significantly affect UK industrial import of *SITC 5* from Pakistan; however, large appreciations do not reverse it as reported in *Table 6*. Aggregate import and other industrial imports (except *SITC 5*) of UK from Pakistan have been unaffected by large appreciations and large depreciations. Therefore, hysteresis is not a significant issue for the UK import from Pakistan for all industries, except for SITC 5.

It is clear from the above discussion that there is an evidence of hysteresis in disaggregate import (*SITC 2, SITC 5 and SITC 6*) of UK from Sri Lanka. However, the type of hysteresis for *SITC 2* and *SITC 5* is different to that of *SITC 6*. Large depreciations significantly reduced UK industrial imports of *SITC 2* and *SITC 5* from Sri Lanka while large appreciations cannot increase those imports. On the contrary, large appreciation significantly increased UK industrial imports of *SITC 6* from Sri Lanka, large depreciation cannot reduce it.

The foregoing suggests that there is hysteresis almost in all UK imports (except *SITC 6*) from Bangladesh. However, it is significant only in some industrial imports of the UK from India, Pakistan and Sri Lanka. This indicates that hysteresis is a country-specific phenomenon[21]. We also observe that there is evidence of hysteresis in few industries in each country. For example, there is an evidence of hysteresis in UK industrial import of *SITC 5* from Pakistan and Sri Lanka. We also find an evidence of hysteresis in the industrial import of *SITC 0* and *SITC 8* from Bangladesh and India. We, therefore, can conclude that hysteresis is an industry-specific as well as a country-specific phenomenon[16]. These are consistent with the findings of Martinez-Zarzoso (2001) who finds that hysteresis hypothesis is both a country- and commodity-specific phenomenon for Spanish exports to other EU countries.

We can conclude from above discussion that first, hysteresis is both country and commodity-specific issue; second, sunk costs are not entirely responsible for hysteresis in trade; third, there are two different types of hysteresis in UK imports: large depreciations have reduced UK imports from Bangladesh, Pakistan and Sri Lanka. However, large appreciations have not significantly increased UK imports from these countries. On the contrary, large appreciations have increased the UK imports from India. However, large depreciations have not significantly reduced the UK imports from India.

16This is because some industries (but not all) from some country (not all countries) appear to be characterised by the pricing-to-market (PTM) behaviour. Second, some goods are inelastic and some are elastic in nature. Large exchange rate movements cannot influence the earlier types of commodities.

Robustness Checks: Recursive Estimation

In addition to standard diagnostic tests, which suggest that the models are adequate, we also computed recursive estimations. This is done for all the countries covered for both aggregate and industry-specific data. *Figure 6* and *Figure 7* depict the results for Bangladesh with two standard error bands around the estimated coefficients using for double-dummy and single-dummy approaches, respectively[17]. The results of the recursive estimates in *Figure 7* suggest that the coefficient of hysteresis for UK aggregate import, and industrial import of *SITC 7* and *SITC 8* are negative and significant over the sample period. However, it is not clear from the figure, whether 'large' appreciations or 'large' depreciations or both have significant effects on the UK imports. On the contrary, results from the double-dummy approach (reported in Figure 6), as expected shed more light on that. It is clear from the figure that there is an asymmetric response of UK imports to the large exchange rate movements. Large depreciations significantly reduce the UK imports. However large appreciations do not significantly increase the UK import from Bangladesh. Hence, confirming the results discussed above. We have not reported the recursive estimates of UK imports from India, Pakistan and Sri Lanka (to save space) which are in accordance with the results reported in *Table 9, 10 and 11*.

17 We have presented the recursive estimate results only for the UK imports from Bangladesh (as an example). Recursive estimate results of the UK import from other countries are found in accordance to the estimated results presented in Table 5, 6 and 7 for the single-dummy and Table 9, 10 and 11 for the double-dummy.

Figure 6: **Recursive 'hysteresis' estimate**

(Double-dummy approach; ± 2 standard error bands around the estimated coefficients)

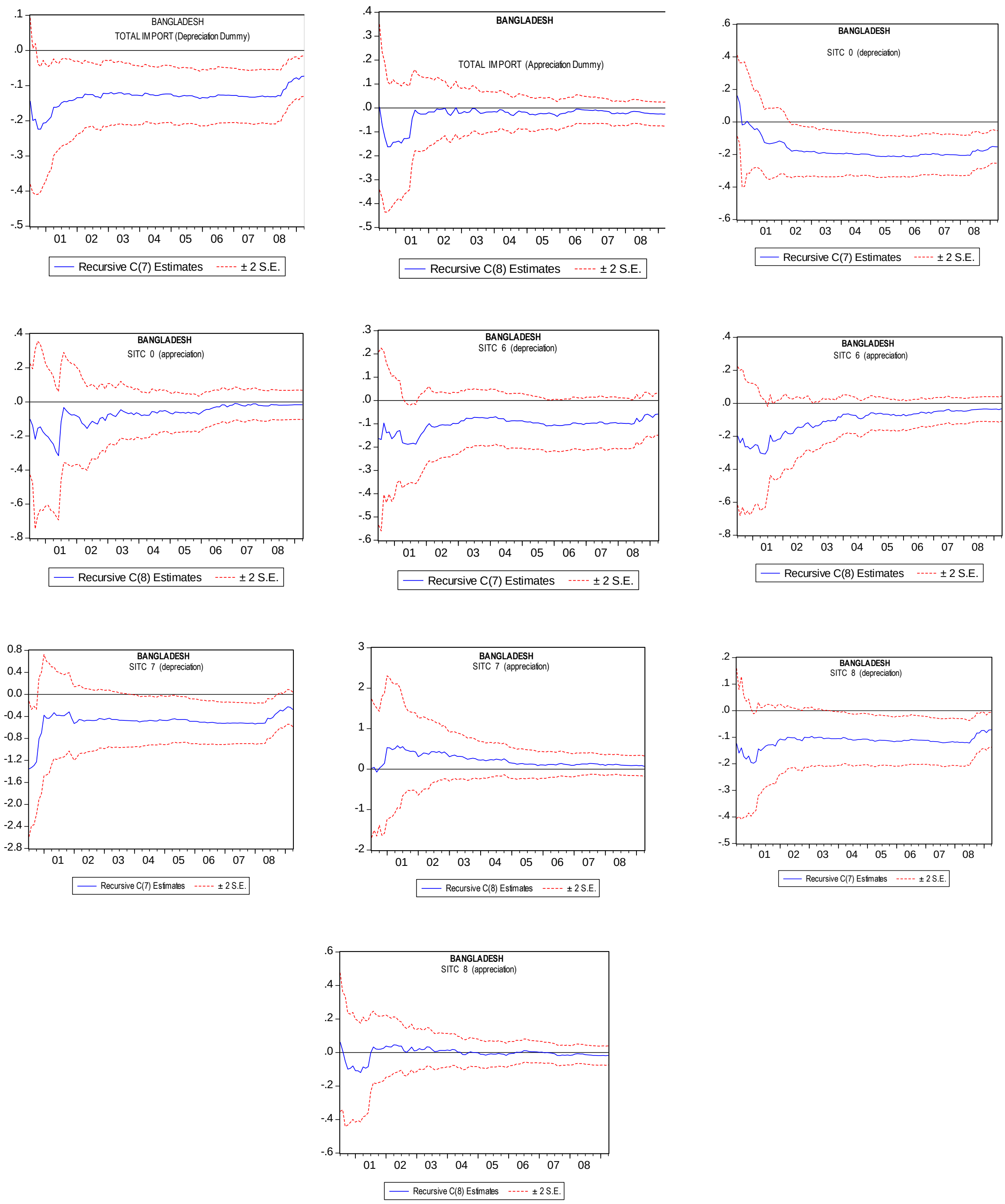
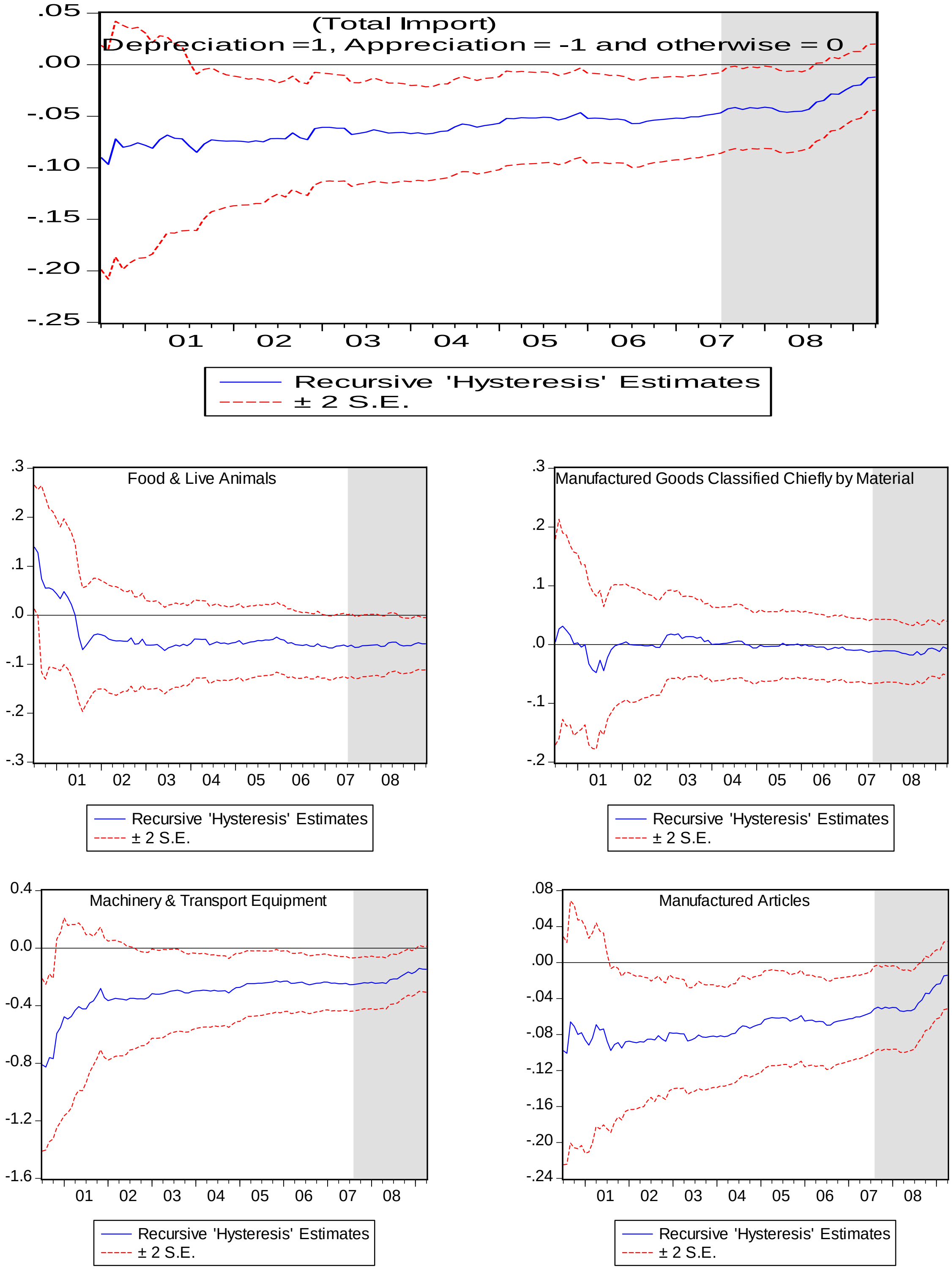


Figure 7: Recursive 'hysteresis' estimate

(single dummy approach; ± 2 standard error bands around the estimated coefficients)



6. Conclusion

Asian countries such as Bangladesh, India, Pakistan and Sri Lanka have been pursuing export-led growth strategies for the last three decades. These countries have frequently devalued their currencies to gain a competitive advantage for their exports. They have also had a long and strong historical trade relationship with the UK.

This paper investigates the exchange rate hysteresis in the UK imports from South Asian countries. Estimated results suggest that there is an evidence of hysteresis in the UK imports from Bangladesh; however, there is partial support for hysteresis in the UK imports from India, Pakistan and Sri Lanka. It also indicates that hysteresis is an industry-specific phenomenon. This is in accordance with the findings of Parsley and Wei (1993), Giovannetti and Samiei (1995), and Martinez-Zarzoso (2001).

The study also suggests that sunk costs are not the only reason for hysteresis; there is an evidence of hysteresis even beyond sunk costs effect. The *ECM* and the *recursive estimates* indicate that large depreciations significantly reduce the UK imports from Bangladesh. However, this is not reversed by large appreciations. Similar results are found for UK imports from Pakistan and Sri Lanka. On the contrary, we find that large appreciations increase the UK imports from India, however, large depreciations do not bring about the reverse. This is consistent with the findings suggested by Baldwin (1986) and other recent studies including Belke et al (2013), Belke and Kronen (2016), and Fedoseeva and Warner (2016).

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Appendices

Figure 4(a): 'Large' real appreciations and depreciations of Pound Sterling against Bangladeshi Taka

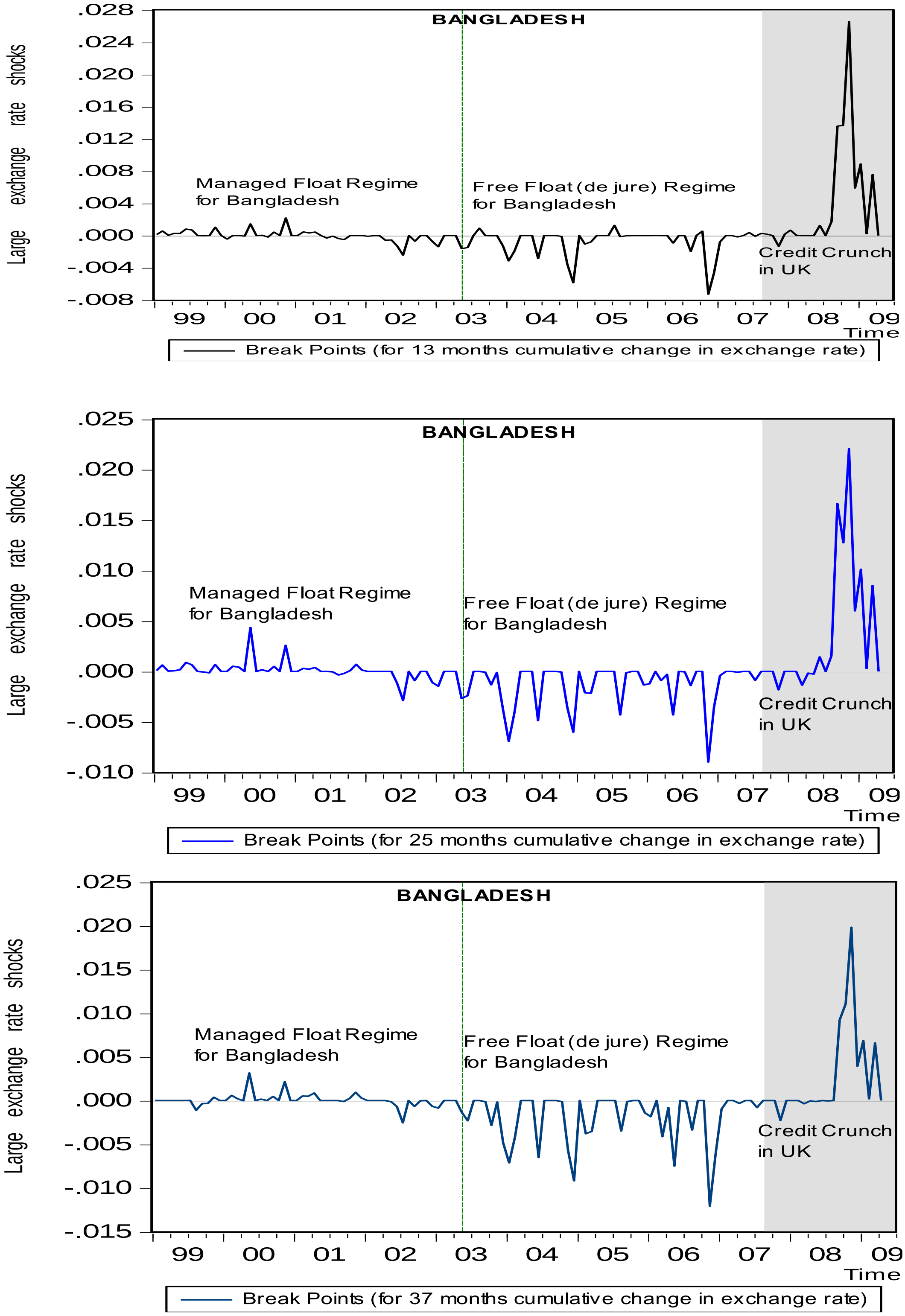

Figure 4(b): 'Large' real appreciations and depreciations of Pound Sterling against Indian Rupees

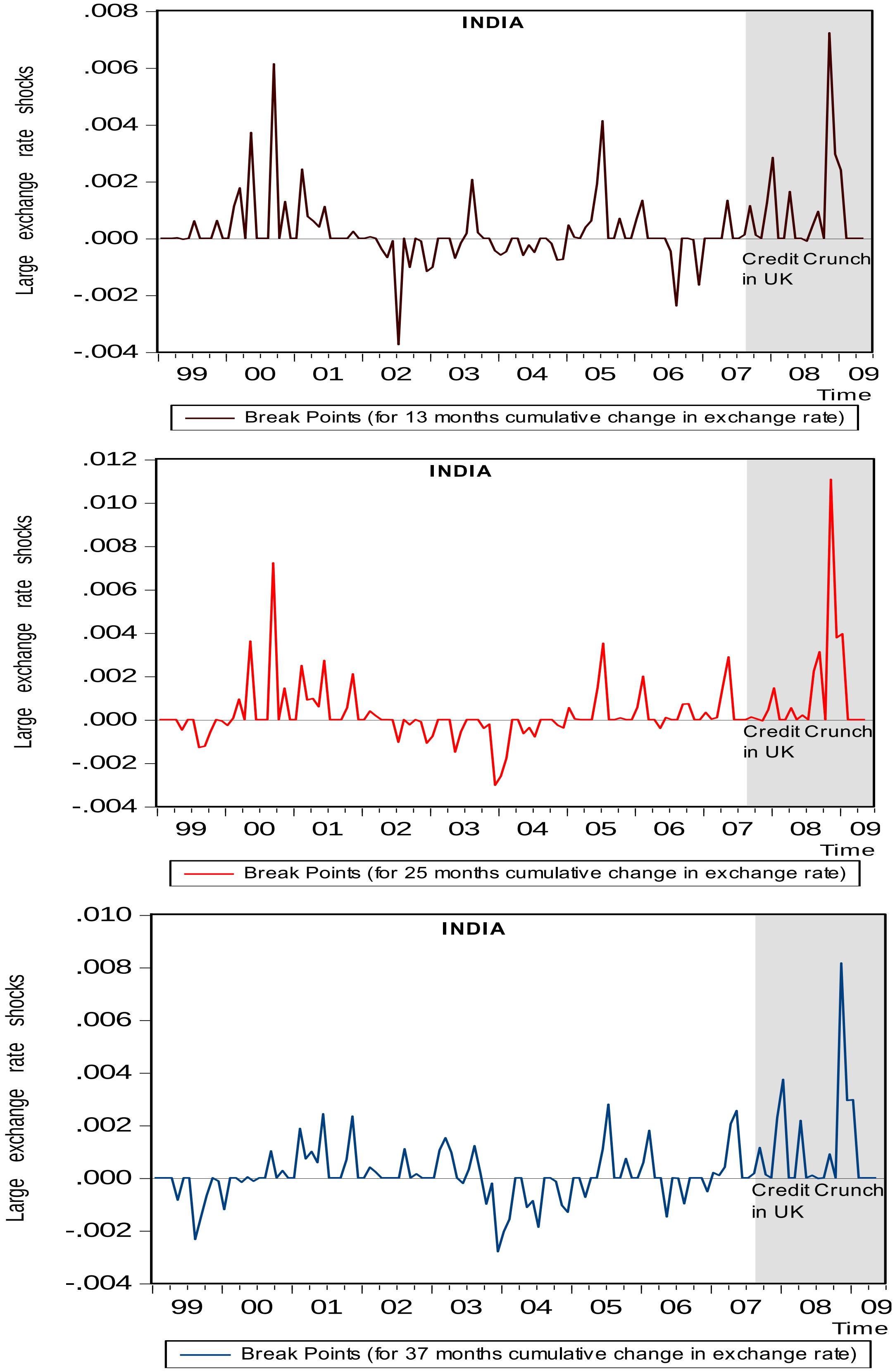

Figure 4(c): 'Large' real appreciations and depreciations of Pound Sterling against Pakistani Rupees

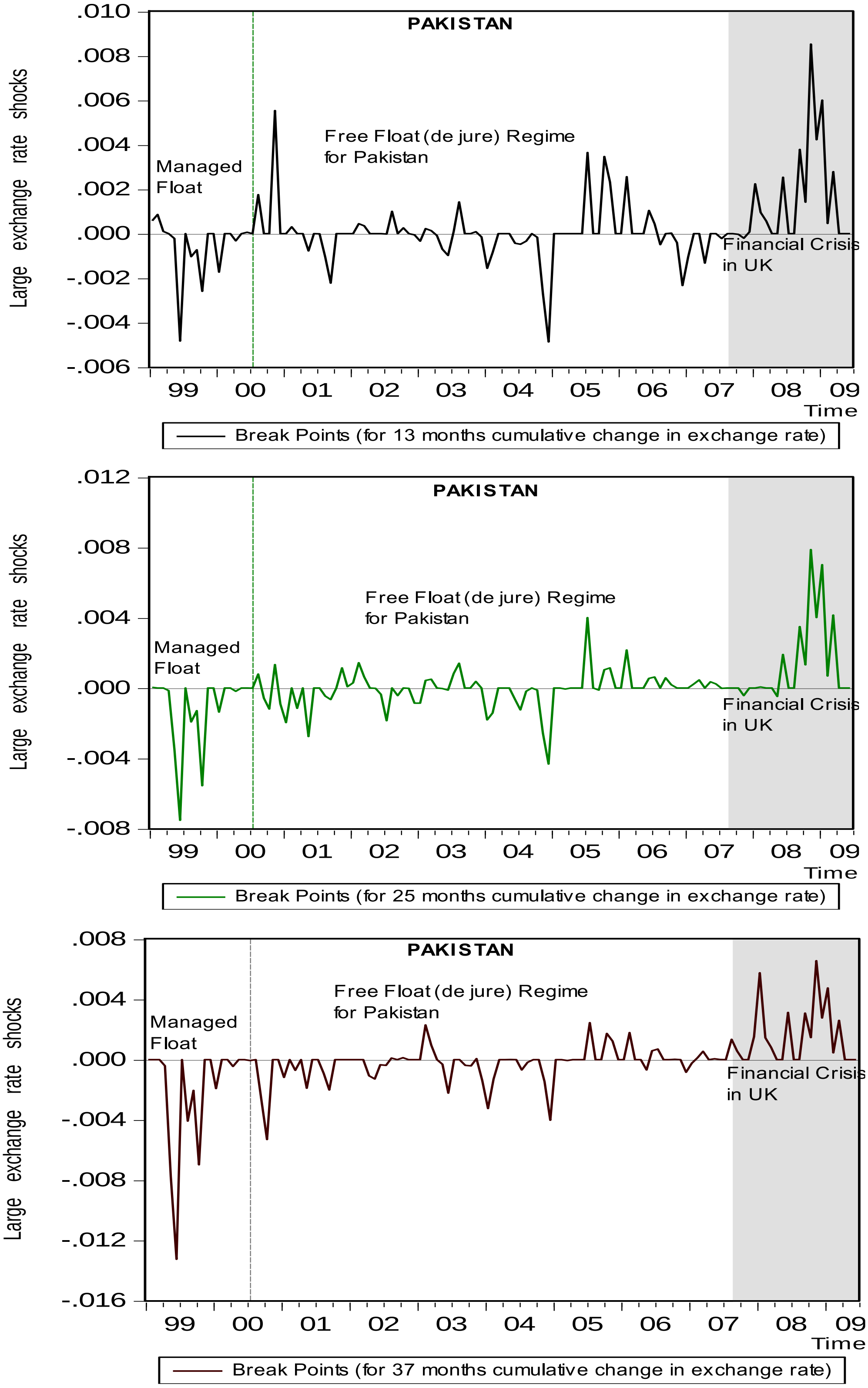

Figure 4(d): ‘Large’ real appreciations and depreciations of Pound Sterling against Sri Lankan Rupees

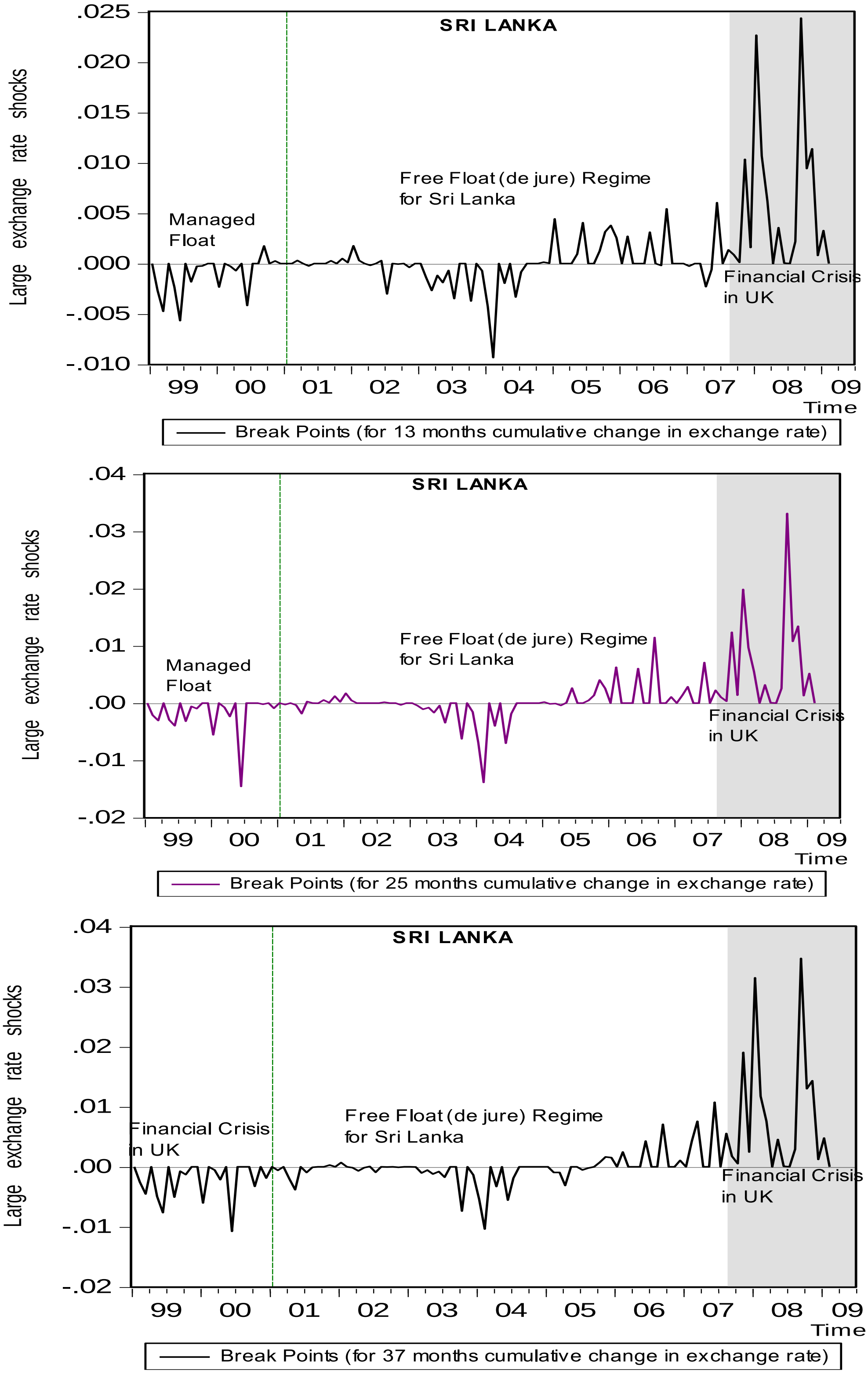

Table 1: Standard International Trade Classification (SITC)

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 2: 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 intends 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.*

Table 3: 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 4: ECM results for UK import from Bangladesh

(Single variable 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 5: ECM results for UK import from India

(Single variable 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: ECM results for UK import from Pakistan
(Single variable 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 7: ECM results for UK import from Sri Lanka
(Single variable 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)