



Munich Personal RePEc Archive

# **Malaysia-EU Trade at the Industry Level: Is there an Asymmetric Response to Exchange Rate Volatility?**

BAHMANI-OSKOOEE, Mohsen and Aftab, Muhammad

University of Wisconsin-Milwaukee, University of Malaya, Malaysia

18 November 2016

Online at <https://mpra.ub.uni-muenchen.de/82687/>

MPRA Paper No. 82687, posted 14 Nov 2017 09:17 UTC

# Malaysia-EU Trade at the Industry Level: Is there an Asymmetric Response to Exchange Rate Volatility?

Mohsen Bahmani-Oskooee  
The Center for Research on International Economics and  
Department of Economics  
The University of Wisconsin-Milwaukee

[bahmani@uwm.edu](mailto:bahmani@uwm.edu)

and

Muhammad Aftab  
Department of Finance and Banking  
University of Malaya

[maftab@siswa.um.edu.my](mailto:maftab@siswa.um.edu.my)

## Abstract

A study in this journal that assessed the impact of exchange rate volatility on Malaysia-EU trade at commodity level used the linear ARDL approach of Pesaran *et al.* (2001) and did not find significant effects in most of the 81 Malaysian exporting and 66 importing industries. In this paper, we argue for asymmetric effects of exchange rate volatility on the same industries' trades which implies using Shin *et al.*'s (2014) nonlinear ARDL approach. While we find short-run asymmetric effects of volatility in almost all industries, we find evidence of adjustment asymmetry in 17 exporting and nine importing industries. We also find significant impact or short-run cumulative asymmetry in 12 exporting and six importing industries. The most important finding is significant long-run asymmetric effects in 36 Malaysian exporting industries and 25 Malaysian importing industries. Clearly, trade flows react to an increased exchange rate volatility differently than to a decreased volatility.

**Key Words:** Exchange rate volatility; Asymmetry effects; Commodity trade; Malaysia; US; Nonlinear ARDL

**JEL Classification:** F31

## I. Introduction

Malaysia is now one of the fast growing economies in Asia and one of the largest members of Association of East Asian Nations (ASEAN). As it grows, so does its trade with outside world and European Union is no exception. To reduce any uncertainty associated with impact of exchange rate volatility on its trade flows, Malaysia and other members of ASEAN share the idea of a common currency similar to euro. Until that idea is materialized and a common currency is introduced, Malaysia's trade with other nations including the euro zone could be affected by the real ringgit-euro volatility. To gain some insight in how volatile is the real exchange rate between the two regions, we plot our volatility measure in Figure 1.

Figure 1 goes here

Clearly, the real ringgit-euro rate is volatile enough to be concerned with the response of the trade flows between the two regions to such volatility. To infer the impact of exchange rate volatility on the trade flows, a common practice is to rely upon past studies. Doroodian (1999), Arize *et al.* (2000), and Doganlar (2002) who included Malaysia in their studies, found adverse effects of exchange rate volatility on Malaysia's real exports to the rest of the world. None considered Malaysia's imports.<sup>1</sup> Aftab *et al* (2016) criticized above studies on the ground that they used aggregate trade data between Malaysia and rest of the world. They then considered the trade flows between Malaysia and a specific region, the European Union (EU). However, in order to discover more significant effects of exchange rate volatility on the Malaysia-EU trade, they disaggregated their trade flows by industry and assessed the impact of the real ringgit-euro volatility on the exports of 81 exporting industries and 66 importing industries. They found that in

---

<sup>1</sup> For experiences of other countries see the review article by Bahmani-Oskooee and Hegerty (2007).

the short-run exports of 30 industries and imports of 45 industries are significantly affected by volatility. However, short-run effects were translated into the long-run effects only in five exporting industries and 15 importing industries.

Methodological advances have now moved into a new direction and suggest that failure to find a significant link between two variables could be due to assuming symmetric effects of one variable on the other. If the effects are asymmetric which require applying nonlinear models, the outcome could be different (Bahmani-Oskooee and Fariditavana 2016). In the context of our topic, the symmetry assumption implies that if an  $x\%$  increase in exchange rate volatility depresses exports by a  $y\%$ , an  $x\%$  decrease in volatility should increase exports by  $y\%$ . Clearly, this need not be the case since traders' expectation and therefore their reaction could be different to an increased exchange rate volatility compared to a decreased volatility. Furthermore, if import and export prices react in an asymmetric manner to exchange rate changes, as demonstrated by Bussiere (2013), we would expect trade flows to respond to exchange rate changes as well as to its volatility in an asymmetric manner.

In this paper we consider the same data set which was used by Aftab *et al.* (2016) and investigate the asymmetric effects of exchange rate volatility on the exports of the same 81 industries and imports of the same 66 industries that trade between Malaysia and EU. However, rather than using the linear ARDL approach of Pesaran *et al.* (2001) which was used by Aftab *et al.* (2016), we rely upon the nonlinear ARDL approach of Shin *et al.* (2014). Indeed, we find evidence of asymmetric effects of exchange rate volatility on exports and imports in many industries. To show these results, we introduce the models and methods in Section II. Our empirical results are then presented in Section III. While Section IV concludes, the Appendix is devoted to the sources of the data and definition of variables.

## II. The Models and Methods

Since our goal is to compare our findings using a nonlinear model with the results of Aftab *et al.* (2016) who relied upon a linear model, we begin with the same specifications as Aftab *et al.* (2016) first. Their long-run export and import demand models were as follows:

$$\text{Ln}X_{i,t}^{MY} = \alpha_o + \alpha_1 \text{Ln}IP_t^{EU} + \alpha_2 \text{Ln}REX_t + \alpha_3 \text{Ln}V_t + \varepsilon_t \quad (1)$$

$$\text{Ln}M_{i,t}^{MY} = \beta_o + \beta_1 \text{Ln}IP_t^{ML} + \beta_2 \text{Ln}REX_t + \beta_3 \text{Ln}V_t + \mu_t \quad (2)$$

Specification (1) identifies the determinants of real export of commodity *i* by Malaysia ( $X_{i,t}^{MY}$ ) to EU. These are the main determinants that are included in many studies and theoretically are derived by Peree and Steinherr (1989). These determinants are the level of economic activity in EU, proxied by its index of industrial production,  $IP_t^{EU}$ . As EU grows, we expect Malaysian exports to EU to increase unless the growth in EU is due to increased production of import substitute goods. If the latter is the case, EU could import less. Therefore, estimate of  $\alpha_1$  could be positive or negative (Bahmani-Oskooee 1986). From the Appendix we gather that the real exchange rate, REX, is defined in a manner that an increase reflects depreciation of ringgit. If a depreciation is to promote Malaysia's exports to EU, an estimate of  $\alpha_2$  is expected to be positive. Finally, a GARCH-based measure of volatility of the real exchange rate,  $V$ , is the third determinant. It can have negative or positive effects on the exports, depending on the degree of risk that traders wish to take. While risk averse traders will trade less, risk lover traders could trade more in order to cover their future loses (De Grauwe 1988). Similarly, equation (2) is Malaysian import demand for commodity *i*,  $M_{i,t}^{MY}$ . It is assumed that it could depend positively or negatively to Malaysia's

economic activity identified by  $IP_t^{ML}$ , negatively to REX, and again negatively or positively to exchange rate volatility, V.

As mentioned equations (1) and (2) are long-run models and in order to assess the short-run effects of right-hand side variables, we need to specify them in an error-correction modeling format. Aftab *et al.* (2016) follow Pesaran *et al.*'s (2001) ARDL approach and arrive at:

$$\begin{aligned} \Delta LnX_{i,t}^{MY} = & a_1 + \sum_{j=1}^{n1} a_{2j} \Delta LnX_{t-j}^{MY} + \sum_{j=0}^{n2} a_{3j} \Delta LnIP_{t-j}^{EU} + \sum_{j=0}^{n3} a_{4j} \Delta LnREX_{t-j} + \sum_{j=0}^{n4} a_{5j} \Delta LnV_{t-j} \\ & + \theta_1 LnX_{t-1}^{MY} + \theta_2 LnIP_{t-1}^{EU} + \theta_3 LnREX_{t-1} + \theta_4 LnV_{t-1} + \varepsilon_t \end{aligned} \quad (3)$$

$$\begin{aligned} \Delta LnM_{i,t}^{MY} = & b_1 + \sum_{j=1}^{n5} b_{2j} \Delta LnM_{t-j}^{MY} + \sum_{j=0}^{n6} b_{3j} \Delta LnIP_{t-j}^{MY} + \sum_{j=0}^{n7} b_{4j} \Delta LnREX_{t-j} + \sum_{j=0}^{n8} b_{5j} \Delta LnV_{t-j} \\ & + \rho_1 LnM_{i,t-1}^{MY} + \rho_2 LnIP_{t-1}^{MY} + \rho_3 LnREX_{t-1} + \rho_4 LnV_{t-1} + \varepsilon_t \end{aligned} \quad (4)$$

Specifications (3) and (4) are error-correction models and once they are estimated, short-run effects are inferred by the estimates of coefficients attached to first-differenced variables. Long-run effects are derived by the estimates of  $\theta_2$ - $\theta_4$  normalized on  $\theta_1$  in (3) and estimates of  $\rho_2 - \rho_4$  normalized on  $\rho_1$  in (4). However, an additional step needs to be taken to avoid spurious regression problem. Joint significance of lagged level variables in both models must be established by applying the F test as a sign of cointegration.<sup>2</sup>

Next, we follow Shin *et al.* (2014) and modify (3) and (4) so that we can determine if exchange rate volatility has symmetric or asymmetric effects on trade flows. The first step is to

---

<sup>2</sup> Pesaran *et al.* (2001) supply new critical values for this F test that account for integrating properties of variables. They demonstrate that their upper bound critical values could be used when variables are combination of I(0) and I(1). Since these are properties of almost all macro variables, there is no need for unit root testing here.

construct changes in our volatility measure as  $\Delta \text{Ln}V_t$  which includes positive values reflecting increased exchange rate volatility and negative values reflecting decreased volatility. From this variable we generate two new time-series variables using partial sum concept. Denoting partial sum of positive changes by  $\text{POS}_t$  and partial sum of negative changes by  $\text{NEG}_t$ , at the recommendation of Shin et al. (2014) we move back to (3) and (4) and replace  $\text{Ln}V_t$  by  $\text{POS}_t$  and  $\text{NEG}_t$  variables.<sup>3</sup> We then arrive at:

$$\begin{aligned} \Delta \text{Ln}X_{i,t}^{MY} = & c_1 + \sum_{j=1}^{n1} c_{2j} \Delta \text{Ln}X_{t-j}^{MY} + \sum_{j=0}^{n2} c_{3j} \Delta \text{Ln}IP_{t-j}^{EU} + \sum_{j=0}^{n3} c_{4j} \Delta \text{Ln}REX_{t-j} \\ & + \sum_{j=0}^{n4} c_{5j} \Delta \text{POS}_{t-j} + \sum_{j=0}^{n5} c_{6j} \Delta \text{NEG}_{t-j} + \lambda_1 \text{Ln}X_{t-1}^{MY} + \lambda_2 \text{Ln}IP_{t-1}^{EU} \\ & + \lambda_3 \text{Ln}REX_{t-1} + \lambda_4 \text{POS}_{t-1} + \lambda_5 \text{NEG}_{t-1} + \varepsilon_t \end{aligned} \quad (5)$$

$$\begin{aligned} \Delta \text{Ln}M_{i,t}^{MY} = & d_1 + \sum_{j=1}^{n6} d_{2j} \Delta \text{Ln}M_{t-j}^{MY} + \sum_{j=0}^{n7} d_{3j} \Delta \text{Ln}IP_{t-j}^{MY} + \sum_{j=0}^{n8} d_{4j} \Delta \text{Ln}REX_{t-j} \\ & + \sum_{j=0}^{n9} d_{5j} \Delta \text{POS}_{t-j} + \sum_{j=0}^{n10} d_{6j} \Delta \text{NEG}_{t-j} + \pi_1 \text{Ln}M_{i,t-1}^{MY} + \pi_2 \text{Ln}IP_{t-1}^{MY} \\ & + \pi_3 \text{Ln}REX_{t-1} + \pi_4 \text{POS}_{t-1} + \pi_5 \text{NEG}_{t-1} + \varepsilon_t \end{aligned} \quad (6)$$

Specifications (5) and (6) are labeled as nonlinear ARDL models due to method of constructing partial sum variables. Indeed, Shin *et al.* (2014) demonstrate that the F test proposed by Pesaran *et al.* (2001) is equally applicable to both models (5) and (6). Comparing (5) to (3) and (6) to (4), although (5) and (6) have one more variable than (3) and (4) respectively, Shin *et al.* (2014, p. 291)

---

<sup>3</sup> At any point in time, the partial sum of a variable is the same as cumulative sum where the negative values are replaced by zeros. Similarly, the partial sum of negative values at a given time is the cumulative sum where positive values are replaced by zeros. For more on their formulas to generate see Bahmani-Oskooee and Fariditavana (2016).

recommend treating the POS and NEG as one variable and using the same critical values of the F test for both linear and nonlinear models.<sup>4</sup>

Once the nonlinear models are estimated, we can test a few asymmetry assumptions. First, short-run adjustment asymmetry will be established if the  $\Delta$ POS in either model take a different lag order than the  $\Delta$ NEG. Second, exchange rate volatility will have short-run asymmetric effects on trade flows if size or sign of the coefficient estimates attached to the  $\Delta$ POS variable are different than those attached to the  $\Delta$ NEG variable. Third, short-run cumulative or impact asymmetry will be established if  $\sum \hat{c}_{5j} \neq \sum \hat{c}_{6j}$  in the nonlinear model (5) and if  $\sum \hat{d}_{5j} \neq \sum \hat{d}_{6j}$  in the nonlinear model (6). Finally, the long-run asymmetric effects will be established if  $\hat{\lambda}_4 / -\hat{\lambda}_1 \neq \hat{\lambda}_5 / -\hat{\lambda}_1$  in (5) and  $\hat{\pi}_4 / -\hat{\pi}_1 \neq \hat{\pi}_5 / -\hat{\pi}_1$  in (6). The Wald test which has a  $\chi^2$  distribution with one degree of freedom will be used to test the last two hypothesis.<sup>5</sup>

### III. Empirical Results

In this section we estimate nonlinear models (5) and (6) using monthly data that spans from June 2000- December 2013. Following Aftab *et al.* (2016) we too impose a maximum of four lags on each first-differenced variable and use the Akaike's Information Criterion (AIC) to select an optimum model in each case. Only under the same conditions we will be able to compare our estimates from the nonlinear models in this paper to those of Aftab *et al.* (2016) from their linear models. Since there are different critical values for different estimates and statistics, we gather

---

<sup>4</sup> This recommendation is based on the dependency between POS and NEG variables.

<sup>5</sup> For other applications of the partial sum concept and nonlinear ARDL approach see Apergis and Miller (2006), Delatte and Lopez-Villavicencio (2012), Verheyen (2013), and Bahmani-Oskooee *et al.* (2016). For applications of the linear model see De Vita and Abbott (2004), Narayan *et al.* (2007), Wong and Tang (2008), De Vita and Kyaw (2008), Halicioglu (2007), Hajilee *et al.* (2014), and Durmaz (2015).



them in notes to each table and use them to identify an estimate by \* (\*\*) if that estimate is significant at the 10% (5%) level.

Let us first consider estimate of nonlinear Malaysian export demand model (5) for each of the 81 industries that are reported in Tables 1-3. Note that for brevity, while we report the short-run estimates only for  $\Delta$ POS and  $\Delta$ NEG variables in Table 1, normalized long-run estimates are reported for all variables in Table 2. Finally, diagnostic statistics are reported in Table 3. From Table 1 we gather that either  $\Delta$ POS or  $\Delta$ NEG carry at least one significant lagged coefficient in 26 industries, implying that increased or decreased volatility has short-run effects on the exports of 26 industries. The comparable figure from Aftab *et al.* (2016) and their estimates of the linear model is 25. Thus, allowing nonlinear adjustment of the exchange rate volatility has not resulted in any more short-run evidence. However, since either the sign or size of significant short-run estimates are different, there is evidence of short-run asymmetric effects. For example, in the first industry coded 01 (live animals), while increase in volatility will discourage Malaysian export of this commodity to EU, decreased volatility seems to have no significant short-run effects. The opposite is true in industry coded as 19 (Preparations of cereals, flour, n.e.s.). Furthermore, number of lags on the  $\Delta$ POS are different number of lags on  $\Delta$ NEG is a total of 17 industry, supporting short-run adjustment asymmetry. Finally, short-run cumulative or impact asymmetry is evidenced in 12 industries coded 03, 08, 22, 27, 48, 57, 64, 79, 82, 85, 91, and 95 since in these industries the Wald test that is reported in Table 3 as Wald-S is significant. Do these asymmetric short-run effects last into the long run?

From the normalized long-run estimates reported in Table 2 we gather that either POS or NEG variable carry a significant coefficient in 24 industries coded as 06, 08, 12, 18, 19, 24, 27, 28, 32, 33, 39, 48, 51, 52, 61, 68, 74, 79, 82, 85, 89, 95, 96, and 98. The comparable figure from

the linear model by Aftab *et al.* (2016) is only five industries coded as 11, 24, 51, 57, and 82. Thus, it appears that separating increases in volatility from declines in volatility and introducing nonlinear adjustment of exchange rate volatility has substantially contributed to number of industries that are affected by exchange rate uncertainty. For example, in industry 06 in the linear model of Aftab *et al.* (2016) exchange rate volatility carried an insignificant coefficient. If we were to rely upon the linear ARDL model, the process would have stopped and it would have been concluded that exchange rate volatility has no significant long-run effects on Malaysian exports of this industry (Live trees and other plants). However, our estimates from the nonlinear ARDL model reveals that while reduced volatility will stimulate exports of this commodity to EU, increased volatility will have no significant effects, supporting our asymmetry hypothesis. Are these long-run asymmetric effects significantly different? The answer is in the affirmative in 36 industries coded as 01, 03, 06, 07, 15, 16, 17, 19, 22, 24, 28, 32, 33, 35, 36, 37, 38, 39, 40, 42, 43, 44, 48, 49, 52, 57, 63, 68, 72, 76, 82, 83, 85, 90, 92, 94, and 98. In these industries the Wald statistic reported as the Wald-L in Table 3 is significant, implying that the normalized estimate attached to the POS variable is different than the normalized estimate attached to the NEG variable.<sup>6</sup>

As for the long-run effects of the other two variables, Table 2 reveals that the index of industrial production in EU carries a significant coefficient in 29 industries and in most cases the estimate is positive, implying that as EU grows, so does Malaysian exports to EU. The real exchange rate is significant in only 16 industries. However, in order for all long-run estimates to be valid, we must establish cointegration. The results of the F test applied for joint significance of

---

<sup>6</sup> Note this list of 36 exporting industries includes even industries in which neither the POS nor the NEG variable was significant, due to the fact that we are testing the size difference. For example in industry coded 01, the POS variable carries a coefficient estimate of 0.2209 and the NEG variable carries an estimate of 0.4024. The Wald-L reveals that these are significantly different.

lagged level variables reveal that in any model that there is at least one significant long-run coefficient estimate, the F statistic is significant. In some cases, e.g., industry coded 41 in which we had at least one long-run significant coefficient but the F statistic is insignificant, we rely upon an alternative test. In this alternative test we use normalized long-run estimates and long-run export model to generate the lagged error term that is known as the error-correction term,  $ECM_{t-1}$  as follows:

$$ECM_{t-1} = LnX_{t-1}^{MY} - \frac{\hat{\lambda}_2}{\hat{\lambda}_1} LnIP_{t-1}^{EU} - \frac{\hat{\lambda}_3}{\hat{\lambda}_1} LnREX_{t-1} - \frac{\hat{\lambda}_4}{\hat{\lambda}_1} POS_{t-1} - \frac{\hat{\lambda}_5}{\hat{\lambda}_1} NEG_{t-1} \quad (7)$$

We then shift back to specification (5) and replace the linear combination of lagged level variables by  $ECM_{t-1}$ . The new specification is estimated after imposing the same optimum lags. A significantly negative coefficient estimate attached to  $ECM_{t-1}$  will support cointegration. Note that the t-ratio that is used to judge significance of  $ECM_{t-1}$  has a new distribution. Therefore, like the F test, Pesaran *et al.* (2001, p. 303) tabulate an upper and a lower bound critical value. As can be seen from Table 3,  $ECM_{t-1}$  is significant in most models.

A few additional diagnostics are also reported in Table 3. The Lagrange Multiplier (LM) statistic is reported to establish autocorrelation free property of the residuals in each optimum model. Since we are testing for first order serial correlation, it is distributed as  $\chi^2$  with one degree of freedom. Clearly, it is insignificant in most models. Ramsey's RESET test is also insignificant in most models, implying that optimum models are correctly specified. Note that this statistic is also distributed as  $\chi^2$  with one degree of freedom. To establish stability of short-run and long-run estimates, we apply CUSUM and CUSUMSQ tests to the residuals of each optimum model. These two tests are reported as CU for CUSUM and  $CU^2$  for CUSUMSQ. Denoting stable estimates by

“S” and unstable ones by “U”, clearly most estimates are stable. Finally, to judge goodness of fit, we report the size of adjusted  $R^2$ .

Following the same procedure and the same approach, we estimate Malaysian import demand model for each of the 66 importing industries and report the results in Tables 4-6. Short-run coefficient estimates that are reported in Table 4 reveal that either the  $\Delta POS$  or  $\Delta NEG$  variable carries at least one significant coefficient in 15 industries. The comparable figure from the linear model in Aftab *et al.* (2016, Table 4) is 19. Like export demand model, apparently introducing nonlinear adjustment of the exchange rate volatility does not help to improve the short-run estimates. However, the nonlinear model reveals interesting asymmetry information that are masked by the linear model. First, in most cases, the size or sign of short-run estimates are different when volatility increases as compared to when it declines. This supports short-run asymmetric effects of exchange rate volatility on imports. Second, short-run adjustment asymmetry is observed only in nine industries coded as 02, 25, 27, 29, 70, 73, 82, 85, and 86. Third, short-run cumulative asymmetry is established in industries coded 08, 25, 32, 70, 86, and 93 since only in these industries the Wald-S is significant in Table 6.

In order to identify industries in which short-run asymmetric effects last into the long run, we move to Table 5 and estimates of long-run normalized coefficients. As can be seen, only in industries 08, 65, and 86 either POS or NEG carry a significant coefficient. Thus, unlike export demand model, Malaysian imports are not affected by either increased or decreased volatility in the long run. However, significant long-run asymmetric effects is established by the Wald-L test in 25 out of 66 industries (Table 6). Furthermore, while the real exchange rate itself does not play that much significant role in the long run, Malaysian income proxied by the index of industrial

production does. The  $\ln IP^{MY}$  variable carries significant coefficient in 41 out of 66 models, supporting importance of economic activity as the main determinants of imports.

Long-run estimates of Malaysian import demand for each industry in which there is at least one significant long-run coefficient estimate are valid since cointegration is established either by the F test or by  $ECM_{t-1}$ . (Table 6). Other statistics reported in Table 6 support autocorrelation free residuals in most models as well as stability of coefficient estimates at least by CUSUM test. Finally, the size of adjusted  $R^2$  indicates that most models enjoy a good fit.

#### **IV. Summary and Conclusion**

Since introduction of asymmetry analysis, researchers are revisiting and trying to establish asymmetric response of one variable to another. Examples include response of import and export prices to exchange rate changes, response of domestic price level to exchange rate changes, response of domestic production to exchange rate changes, response of house prices to changes in mortgage rates and personal income, etc. If trade flows react to exchange rate changes in an asymmetric manner, we would expect them to also react asymmetrically to volatility of the exchange rate. This could be mostly due to change in expectations of traders. For example, a trader may decide to trade more when an exchange rate becomes more volatile so that he can cover his future losses. He will still trade more when exchange rate volatility declines due to stabilization policies since he will become more optimistic about future courses of action that have led to the decline in the exchange rate volatility, hence asymmetric response of trade flows to volatility.

A previous paper in this journal assessed the short-run and long-run effects of the real ringgit-euro volatility on Malaysian exports of 81 industries to EU and on 66 Malaysian importing industries from EU using the linear ARDL approach of Pesaran *et al.* (2001). They found that the real ringgit-euro volatility has short-run effects on exports of 25 industries and on imports of 15

industries. However, in the long run, only five exporting and 15 importing industries were significantly affected. We use the same data set and nonlinear ARDL approach of Shin *et al.* (2014) which is designed to assess the short-run and long-run asymmetric effects by separating increases in the exchange rate volatility from declines in the volatility and found some interesting results that were hidden in the results from the linear model. First, we find short-run asymmetric effects of exchange rate volatility almost in all exporting and importing industries. Second, there was evidence of adjustment asymmetry in 17 exporting and nine importing industries. Thirds, significant impact or short-run cumulative asymmetry was discovered in 12 exporting and six importing industries. The most important finding was significant long-run asymmetric effects in 36 Malaysian exporting industries and 25 Malaysian importing industries. Clearly, our findings are industry specific and cannot be generalized. There was evidence of industries that react to an increased exchange rate volatility but not to a decreased volatility and vice versa. It appears that incorporating nonlinear adjustment of volatility yields useful information that could be important for every industry that trade. This analysis should be extended to commodity trade between other pair of countries so that we can arrive at some general conclusion.

## Appendix *Data Definition and Sources*

As mentioned the data set is the same as Aftab et al. (2016). Monthly data over the period June-2000 to Dec-2013 come from the following sources:

- a. External Trade Statistics, Department of Statistics Malaysia,
- b. Datastream, Thomson Reuters,
- c. International Financial Statistics (IFS), International Monetary Fund (IMF)

### *Variables*

$X_i$  = Malaysian real export flows to EU for each industry  $i$ . In the absence of the price level at the industry level on a monthly basis for our study period, nominal exports in terms of ringgit from source (a) are deflated by Malaysian CPI, from source (c).

$M_i$  = Malaysian real import flows from EU for each industry  $i$ . Again, in the absence of the price level at the industry level on a monthly basis, nominal imports in terms of ringgit (source a) are deflated by Malaysian CPI (source c).

$IP_t^{EU}$  = EU industrial production index is used as a measure of economic activity in EU. Source b.

$IP_t^{MY}$  = Malaysian industrial production index, source b.

$REX_t$  = Real bilateral exchange rate calculated as  $REX_t = \frac{NEX_t * CPI_t^{EU}}{CPI_t^{ML}}$  where  $NEX_t$  is a nominal bilateral exchange rate defined as the number of Malaysian ringgit per euro.  $CPI_t^{EU}$  and  $CPI_t^{ML}$  are consumer price indices for EU and Malaysia, respectively. All data come from source c.

$V_t$  = Volatility measure of  $REX_t$  based on Generalized Autoregressive Conditional Heteroskedasticity (GARCH 1, 1). See Aftab et al. (2016) for details.

## Reference

Aftab, M., R. Ahmad, I. Ismail, and M. Ahmed (2016), "Does Exchange-Rate Uncertainty Matter in the Malaysia-E.U. Bilateral Trade? An Industry Level Investigation", *Empirica*, 43, 461-485.

Apergis, N., and S. Miller (2006) "Consumption Asymmetry and the Stock Market: Empirical Evidence" *Economics Letters* 93, 337-342

Arize, A. C., T. Osang, and D. J. Slottje (2000), "Exchange-Rate Volatility and Foreign Trade: Evidence from Thirteen LDCs," *Journal of Business and Economics Statistics* 18, 10-17.

Bahmani-Oskooee, M. (1986), "Determinants of International Trade Flows: Case of Developing Countries," *Journal of Development Economics*, 20, 107-123.

Bahmani-Oskooee, M., and S. W. Hegerty (2007), "Exchange Rate Volatility and Trade Flows: A Review Article," *Journal of Economic Studies* 34, 211-255.

Bahmani-Oskooee, M. and H. Fariditavana (2016), "Nonlinear ARDL Approach and the J-Curve Phenomenon", *Open Economies Review*, Vol. 27, pp. 51-70.

Bahmani-Oskooee, M., H. Harvey, and M. Aftab (2016), "Asymmetry Cointegration and the J-Curve: New Evidence from Malaysia-Singapore Commodity Trade", *Journal of Economic Asymmetries*, forthcoming.

Bussiere, M. (2013), "Exchange Rate Pass-through to Trade Prices: The Role of Nonlinearities and Asymmetries", *Oxford Bulletin of Economics and Statistics*, 75, 731-758.

De Grauwe, P. (1988), "Exchange rate variability and the slowdown in growth of international trade", *IMF Staff Papers*, pp. 63-84.

Delatte, Anne-Laure and Antonio Lopez-Villavicencio (2012), "Asymmetry Exchange Rate Pass-Through: Evidence from Major Countries," *Journal of Macroeconomics*, 34, 833-844.

De Vita, G., and A. Abbott (2004), "Real Exchange Rate Volatility and US Exports: An ARDL Bounds Testing Approach," *Economic Issues* 9, 69-78.

De Vita, G. and K. S. Kyaw, (2008), "Determinants of Capital Flows to Developing Countries: A Structural VAR Analysis", *Journal of Economic Studies*, Vol. 35, pp. 304-322.

Doganlar, M. (2002), "Estimating the Impact of Exchange Rate Volatility on Exports: Evidence from Asian Countries", *Applied Economics Letters*, 9, 859-863.

Doroodian, K. (1999), "Does Exchange Rate Volatility Deter International Trade in Developing Countries?", *Journal of Asian Economics*, 10, 465-474.

Durmaz, Nazif (2015), "Industry Level J-Curve in Turkey," *Journal of Economic Studies* 42, 689-706.



Hajilee, Massomeh, and Omar M. Al-Nasser, (2014), "Exchange Rate Volatility and Stock Market Development in Emerging Economies", *Journal of Post Keynesian Economics*, Vol. 37, pp. 163-180.

Halicioglu, F., (2007), "The J-Curve Dynamics of Turkish Bilateral Trade: A Cointegration Approach", *Journal of Economic Studies*, Vol. 34, pp. 103-119.

Narayan, P.K., S. Narayan, B.C. Prasad, and A. Prasad, (2007), "Export-led Growth Hypothesis: Evidence from Papua New Guinea and Fiji", *Journal of Economic Studies*, Vol. 34, pp. 341-351.

Peree, E. and A. Steinherr (1989), "Exchange Rate Uncertainty and Foreign Trade", *European Economic Review*, Vol. 33, pp. 1241-1264.

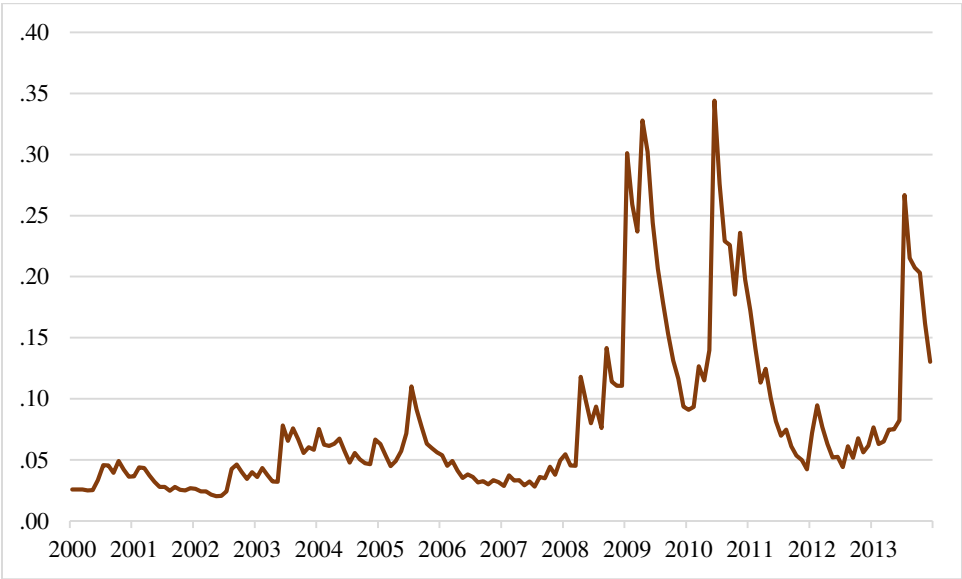
Pesaran, M. H., Y. Shin, and R. J. Smith (2001), "Bounds Testing Approaches to the Analysis of Level Relationships," *Journal of Applied Econometrics* 16:289-326.

Shin, Y., Yu, B. and Greenwood-Nimmo, M. (2014), "Modelling asymmetric cointegration and dynamic multipliers in a nonlinear ARDL framework", *Festschrift in Honor of Peter Schmidt*, Springer, pp. 281-314.

Wong, K. N.. and T. C. Tang, (2008) "The Effects of Exchange Rate Variability on Malaysia's Disaggregated Electrical Exports", *Journal of Economic Studies*, Vol. 35, pp. 154-169.

Verheyen, F. (2013), "Interest Rate Pass-Through in the EMU-New Evidence Using Nonlinear ARDL Framework", *Economics Bulletin*, Vol. 33, No 1, pp. 729-739.

Figure 1: Plot of Volatility Measure of the Real Ringgit-Euro Rate (REX)



<b>Industry</b>	$\Delta$ POS <sub>t</sub>	$\Delta$ POS <sub>t-1</sub>	$\Delta$ POS <sub>t-2</sub>	$\Delta$ POS <sub>t-3</sub>	$\Delta$ NEG <sub>t</sub>	$\Delta$ NEG <sub>t-1</sub>	$\Delta$ NEG <sub>t-2</sub>	$\Delta$ NEG <sub>t-3</sub>
01-Live animals	-.8131**				-.1772			
03-Fish and crustaceans, molluscs, n.e.s.	-.1247				.1415			
06-Live trees and other plants, n.e.s.	-.1767				-.1485			
07-Edible vegetables , n.e.s.	.4619				.4418			
08-Edible fruit and nuts, n.e.s.	.0399	.2763**			-.0629	-.2848	-.3915**	-.4172**
09-Coffee, tea, mate and spices	.4126				-.3985			
11-Products of the milling industry, n.e.s.	-.047				.4774			
12-Oil seeds and oleaginous fruits, n.e.s.	-.5682				-.4818			
15-Animal or vegetable fats and oils , n.e.s.	-.0488				-.2313			
16-Preparations of meat , n.e.s.	-.0886				.0735			
17-Sugars and sugar confectionery	-.2614				.654			
18-Cocoa and cocoa preparations	-.2224				-.2353			
19-Preparations of cereals, flour, n.e.s.	.0604				-.3391**			
20-Preparations of vegetables, n.e.s.	.1054				-.282			
21-Miscellaneous edible preparations	-.0727				-.1464			
22-Beverages, spirits and vinegar	.1446				-.593**			
23-Residues and waste , n.e.s.	-.0888				-1.44			
24-Tobacco and manufactured, n.e.s.	.4285				1.1136			
25-Salt; sulphur; earths and stone, n.e.s.	-.1834				-.3313			
27-Mineral fuels, mineral oils, n.e.s.	-1.2131**	-1.457**	-.9747*	-1.4363**	2.5564**			
28-Inorganic chemicals; n.e.s.	-.28				-.4644			
29-Organic chemicals	.087				.2435			
30-Pharmaceutical products	-.0681				.0793			
32-Tanning or dyeing extracts; tannins , n.e.s.	-.0731				.0913			
33-Essential oils and resinoids, n.e.s.	.3383*				-.9457**	-.4192	.6484**	
34-Soap, organic surface-active agents, n.e.s.	.0743				-.0299			
35-Albuminoidal substances, n.e.s.	.039				.1956			
36-Explosives; pyrotechnic products, n.e.s.	.0249				.6307			
37-Photographic or cinematographic goods	-.0543				.4303			
38-Miscellaneous chemical products	-.1078				.221			
39-Plastics and articles thereof	-.1046				.1825			
40-Rubber and articles thereof	-.0837				-.0664			
41-Raw hides and skins , n.e.s.	-.3087				.4313			
42-Articles of leather; saddlery, n.e.s.	.0248	-.6746**			-.2378	.7732**		
43-Furskins and artificial fur, n.e.s.	.1193				-.4891			
44-Wood and articles of wood, n.e.s.	-.0849				.0741			
48-Paper and paperboard, n.e.s.	-.1467				.2939*	.2631*		
49-Printed books, newspapers, pictures , n.e.s.	.1162				.0812			
51-Wool, fine or coarse animal hair, n.e.s.	-.2029				.2407	1.544**		
52-Cotton	-.2012				0.143787			
54-Man-made filaments	-.1275				.0999			
55-Man-made staple fibres	.0844				.3609**			
56-Wadding, felt and nonwovens, n.e.s.	-.0658				.2302	.6973**		
57-Carpets and other textile floor coverings	-.2927				.484	1.7051**	1.1697**	1.1499**
58-Special woven fabrics, n.e.s.	-.1156	-.1228	.3001	-.5248**	.2698			

59-Impregnated, coated, textile , n.e.s.	.0415	-.7281**			-.4171			
60-Knitted or crocheted fabrics	.1502				.1588			
61-Articles of apparel and clothing, n.e.s.	.0101				.1362			
62-Articles of apparel, not knitted , n.e.s.	-.0099				.0278			
63-Other made up textile articles, n.e.s.	.013				-.0754			
64-Footwear, gaiters and the like, n.e.s.	-.1732	.2364	-.3547**		.7346**			
65-Headgear and parts thereof	.1395				.155			
68-Articles of stone, plaster, cement, n.e.s.	-.0469				-.0194			
69-Ceramic products	.0203				-.0887			
70-Glass and glassware	.0022				-.0874	.004	.2293	-.3972**
71-Natural or cultured pearls, n.e.s.	.2518				-.1721			
72-Iron and steel	-.0586				.0954			
73-Articles of iron or steel	-.0529				-.2099			
74-Copper and articles thereof	-.0647				.2931			
75-Nickel and articles thereof	.0954				.3537			
76-Aluminium and articles thereof	.0581	-.1719**	-.0538	-.2686**	-.055			
78-Lead and articles thereof	.2395				-.8285			
79-Zinc and articles thereof	-.9093**				2.0476**	-1.1082**		
80-Tin and articles thereof	.2025	-.924**			.4761			
81-Other base metals; cermets, n.e.s.	.4377				-.0037			
82-Tools, implements, cutlery, n.e.s.	.1229				-.3441	-.2084	-.8767**	
83-Miscellaneous articles of base metal	.1258	.0494	-.4501**		-.4892**	-.0763	.4226**	
84-Nuclear reactors, boilers , n.e.s.	.0033				.0005			
85-Electrical machinery n.e.s.	-.0155	-.2774**			.2114			
86-Railway or tramway locomotives, n.e.s.	.5118				-.0021			
87-Vehicles other than railway , n.e.s.	.1059				-.0424			
88-Aircraft, spacecraft, and parts thereof	-.1604				.2561			
89-Ships, boats and floating structures	.8723*				.3234			
90-Optical, photographic, n.e.s.	.0413				.2449			
91-Clocks and watches and parts thereof	.6402**	-.1572	-.2022	.6692**	-2.6414**			
92-Musical instruments; parts, n.e.s.	.6466	-.7906**			-1.1886*			
94-Furniture; bedding, mattresses, n.e.s.	-.0073				.027			
95-Toys, games and sports requisites, n.e.s.	.1838**				-.3539**			
96-Miscellaneous manufactured articles	.1195				.0874			
97-Works of art, collectors' pieces, n.e.s.	.249				.2508			
98-Mail bags, coffins, urns, n.e.s.	-.0384				-.0928			

Notes: \* and \*\* indicates significance at 10% and 5% level respectively. The critical values of standard t-distribution, i.e., 1.64 and 1.96 are used to arrive at \* and \*\*. Abbreviation n.e.s. refers to not elsewhere specified.

<b>Industry</b>	<i>C</i>	<i>ln IP<sup>EU</sup></i>	<i>ln REX<sub>t</sub></i>	<i>POS<sub>t</sub></i>	<i>NEG<sub>t</sub></i>
01-Live animals	4.2892**	.1617	-.6601	.2209	.4024
03-Fish and crustaceans, molluscs, n.e.s.	1.804**	-.0978	.7734	-.1795	-.0097
06-Live trees and other plants, n.e.s.	.7955**	2.0547**	-1.5455**	-.1248	-.1909**
07-Edible vegetables , n.e.s.	-8.9259**	9.3915**	-5.4862**	.5661	.1284
08-Edible fruit and nuts, n.e.s.	8.778**	-.3960	-.0382	-.1586**	-.1486**
09-Coffee, tea, mate and spices	-.7852**	3.5098*	-.9818	-.1064	-.0747
11-Products of the milling industry, n.e.s.	10.0343**	-6.9489*	2.0919	-.4153	-.2666
12-Oil seeds and oleaginous fruits, n.e.s.	4.3448**	-1.9121	-.805	-.92**	-.823**
15-Animal or vegetable fats and oils , n.e.s.	6.3427**	.5043	.2185	.0378	.0784
16-Preparations of meat , n.e.s.	3.4268**	-6.215	6.2746	-.7864	-.4197
17-Sugars and sugar confectionery	-2.8178**	3.5817	-3.6406*	-.0166	-.1888
18-Cocoa and cocoa preparations	5.6801**	-.5597	-.0435	-.2029*	-.2333**
19-Preparations of cereals, flour, n.e.s.	1.9351**	1.5154**	-1.0548**	.1172*	.058
20-Preparations of vegetables, n.e.s.	1.1751**	1.6401	-.3585	-.0467	-.0974
21-Miscellaneous edible preparations	3.4643**	-3.3244*	1.5094	-.197	-.1695
22-Beverages, spirits and vinegar	-2.0978**	3.7832**	-.8397	.0892	.0226
23-Residues and waste , n.e.s.	11.9344**	-4.0172	1.2357	-.5626	-.5565
24-Tobacco and manufactured, n.e.s.	-6.7788**	7.57623**	-5.407**	1.0395**	.8916**
25-Salt; sulphur; earths and stone, n.e.s.	2.5927**	-2.2124	.4626	-.6307	-.4785
27-Mineral fuels, mineral oils, n.e.s.	6.6716**	-2.9909	-1.0625	1.9108*	1.8898*
28-Inorganic chemicals; n.e.s.	-6.0176**	5.6699**	-2.7586**	-.1787	-.3892**
29-Organic chemicals	2.7619**	2.304**	.0699	.0732	.0613
30-Pharmaceutical products	4.1618**	-2.1818	-3.6327**	.3008	.2056
32-Tanning or dyeing extracts; tannins , n.e.s.	.5132**	1.6623	-2.8888**	.454**	.2516
33-Essential oils and resinoids, n.e.s.	2.8968**	-.4823	-1.1345	-.3755	-.5108**
34-Soap, organic surface-active agents, n.e.s.	.0692**	2.6709	-2.1106*	.2048	.1037
35-Albuminoidal substances, n.e.s.	5.6775**	-.1197	-.4571	.0811	.0062
36-Explosives; pyrotechnic products, n.e.s.	-.1943**	3.4007	2.9004	.2728	.4327
37-Photographic or cinematographic goods	2.5086**	1.296	-2.0392**	.0325	-.0161
38-Miscellaneous chemical products	8.4715**	-1.2379**	-.8709**	-.0403	-.0902
39-Plastics and articles thereof	6.2796**	-.1511	-.3545	-.055	-.0843*
40-Rubber and articles thereof	5.3398**	-1.8025**	-.8643**	-.0434	-.099
41-Raw hides and skins , n.e.s.	-5.9153**	11.3787**	5.2289*	-.0281	.1518
42-Articles of leather; saddlery, n.e.s.	.0832**	2.5181*	-2.4197**	.1961	.1105
43-Furskins and artificial fur, n.e.s.	6.6587**	-2.7498	3.6525**	-.4493	-.2994
44-Wood and articles of wood, n.e.s.	7.8144**	.2421	.0129	-.0163	.0149
48-Paper and paperboard, n.e.s.	.4788**	2.5607**	-1.682**	.1714*	.0693
49-Printed books, newspapers, pictures , n.e.s.	1.1564**	1.7173	-1.9777**	.1299	.0158
51-Wool, fine or coarse animal hair, n.e.s.	6.1455**	-1.324	-1.5628	-.7467**	-.8023**
52-Cotton	.8591**	2.5146	-.1955	-.292**	-.1801
54-Man-made filaments	2.176**	-.3859	-.6851	-.1518	-.1328
55-Man-made staple fibres	3.0465**	-1.4369	-.9386	-.1162	-.0822
56-Wadding, felt and nonwovens, n.e.s.	.5272**	1.7052	-2.2381	-.0291	-.1081
57-Carpets and other textile floor coverings	6.2736**	-3.7493	-5.4718**	.0778	-.1584
58-Special woven fabrics, n.e.s.	5.7846**	-1.8795	-.1896	.2573	.2381
59-Impregnated, coated, textile , n.e.s.	2.0049**	-1.6621	1.8122	1.5336	1.4565
60-Knitted or crocheted fabrics	5.8239**	-.5119	-1.4247*	.178	.1955

61-Articles of apparel and clothing, n.e.s.	3.4991**	1.5538**	.2391	.0739	.0982*
62-Articles of apparel, not knitted , n.e.s.	1.2027**	2.5889**	-.0954	-.0924	-.0782
63-Other made up textile articles, n.e.s.	2.6758**	-1.1385	-2.2932**	-.0253	-.1619
64-Footwear, gaiters and the like, n.e.s.	1.3858**	1.3561	-2.6345**	.4075	.3451
65-Headgear and parts thereof	1.3328**	1.0358	-2.532**	.1279	.0826
68-Articles of stone, plaster, cement, n.e.s.	1.2899**	1.0602	-.9913	-.2148	-.3046*
69-Ceramic products	3.2835**	-2.4657	-.2681	-.2472	-.2231
70-Glass and glassware	.1262**	3.6578**	1.7508*	.0747	.1344
71-Natural or cultured pearls, n.e.s.	-.7481**	3.8524*	-.5494	.0445	.0514
72-Iron and steel	-6.7576**	9.3103**	-1.0984	.2985	.1078
73-Articles of iron or steel	3.3322**	-.6479	-.856	.0619	.028
74-Copper and articles thereof	.6252**	2.9972**	0.735079	.3576**	.3692**
75-Nickel and articles thereof	-4.1068**	7.01	.3793	.2491	.2733
76-Aluminium and articles thereof	-.9715**	4.6974**	-1.4187*	.2191	.1126
78-Lead and articles thereof	12.6061**	-10.6936**	1.7497	-.7423	-.5609
79-Zinc and articles thereof	.2227**	2.4884	.1679	.8139**	.8507**
80-Tin and articles thereof	-2.0071**	4.4473**	-.4889	.3533	.3504
81-Other base metals; cermet, n.e.s.	.8849**	1.9790	5.6562*	.2195	.2248
82-Tools, implements, cutlery, n.e.s.	-2.3449**	4.3643**	-1.5624**	.4171**	.3432**
83-Miscellaneous articles of base metal	1.2116**	1.2973	-1.5738**	.2301	.126
84-Nuclear reactors, boilers , n.e.s.	8.1615**	-1.5366**	.4514	-.0047	.0097
85-Electrical machinery n.e.s.	4.3655**	.1109	1.2682**	.1526	.2042*
86-Railway or tramway locomotives, n.e.s.	-6.6339**	10.7962	-3.3314	1.0955	1.0139
87-Vehicles other than railway , n.e.s.	3.3178**	1.0122	-.0801	.0015	-.0190
88-Aircraft, spacecraft, and parts thereof	6.0938**	-1.036	-1.1368	-.0270	-.0450
89-Ships, boats and floating structures	1.1213**	1.8301	-.9357	.8732**	.8827**
90-Optical, photographic, n.e.s.	3.0059**	.7221	-1.1933**	.0897	.041
91-Clocks and watches and parts thereof	6.7539**	-3.8265	-.8031	-.7099	-.5837
92-Musical instruments; parts, n.e.s.	12.1207**	-10.0152**	5.8979**	-0.04928	.5077
94-Furniture; bedding, mattresses, n.e.s.	1.3062**	1.7747**	-1.721**	.0647	.0069
95-Toys, games and sports requisites, n.e.s.	4.7806**	.8278*	-.7591**	-0.08361	-.1019*
96-Miscellaneous manufactured articles	3.9162**	.4361	-.5897*	.1226**	.1139**
97-Works of art, collectors' pieces, n.e.s.	-1.8174**	4.2931	-3.5213	-.3839	-.4633
98-Mail bags, coffins, urns, n.e.s.	2.6696**	-1.1512	.5475	-.3037**	-.2326

Notes: \* and \*\* indicates significance at 10% and 5% level respectively. The critical values of standard t-distribution, i.e., 1.64 and 1.96 are used to arrive at \* and \*\*. Abbreviation n.e.s. refers to not elsewhere specified.

**Table 3: Diagnostics Associated with Estimates of Nonlinear Export Models in Table 2.**

Industry (Trade Share)	Diagnostics								
	F <sup>a</sup>	ECM <sub>t-1</sub> <sup>b</sup>	Adj. R <sup>2</sup>	LM <sup>c</sup>	RESET <sup>c</sup>	CU	CU <sup>2</sup>	Wald-S	Wald-L
01-Live animals (.0002)	8.9803**	-.6654(6.7257)**	.5336	.2809	2.3051	S	S	.7479	8.1909**
03-Fish and crustaceans, molluscs, n.e.s. (.1382)	6.2898**	-.2896(5.718)**	.913	.7694	1.8394	S	U	4.5289**	6.9575**
06-Live trees and other plants, n.e.s. (.0542)	19.792**	-.7802(10.928)**	.2728	.6398	1.2128	S	U	.0736	8.1727**
07-Edible vegetables , n.e.s. (.035)	6.6887**	-.5115(5.7052)**	.6207	.0599	.7800	S	U	.0226	12.6**
08-Edible fruit and nuts, n.e.s. (.1517)	8.8722**	-1.229(6.6407)**	.1335	.6096	.0346	S	S	7.6019**	.6712
09-Coffee, tea, mate and spices (.0952)	16.2719**	-.6954(9.1728)**	.3315	.8892	1.9095	S	U	1.5594	.3885
11-Products of the milling industry, n.e.s. (.0071)	4.4018**	-.4856(4.5765)**	.3248	2.8902*	3.4807*	S	S	.2129	1.9894
12-Oil seeds and oleaginous fruits, n.e.s. (.0034)	5.943**	-.4532(5.6209)**	.5815	.7494	.0025	S	U	.0513	1.1112
15-Animal or vegetable fats and oils , n.e.s. (1.4091)	29.7001**	-.968(12.181)**	.1697	.3213	.0011	S	S	.1361	6.9938**
16-Preparations of meat , n.e.s. (.1248)	4.0103*	-.1512(4.5243)**	.8732	2.1348	.0605	S	U	.0529	3.8268**
17-Sugars and sugar confectionery (.0108)	5.8591**	-.7221(5.3781)**	.1547	2.0207	7.8025**	S	U	.9028	3.6799**
18-Cocoa and cocoa preparations (1.3305)	9.3294**	-.6956(6.8096)**	.1649	.0208	1.8786	S	S	.0126	.9491
19-Preparations of cereals, flour, n.e.s. (.2564)	6.9331**	-.7093(6.0243)**	.3355	.0658	1.2019	S	S	2.3521	8.5395**
20-Preparations of vegetables, n.e.s. (.1087)	5.8392**	-.4621(5.5029)**	.4102	1.2638	.0111	S	S	.1525	1.6898
21-Miscellaneous edible preparations (.9095)	2.5873	-.2436(3.6546)	.6081	1.6187	.7272	S	S	.0733	.4662
22-Beverages, spirits and vinegar (.0853)	24.9814**	-.894(11.3766)**	.3043	1.1034	.1639	S	U	838.6336**	8.2919**
23-Residues and waste , n.e.s. (.3663)	7.632**	-.7983(6.23)**	.0353	.6873	.1953	S	S	.8917	.0204
24-Tobacco and manufactured, n.e.s. (.1379)	5.667**	-.5757(5.4493)**	.3346	.3981	1.9988	S	U	.365	3.6979**
25-Salt; sulphur; earths and stone, n.e.s. (.0072)	2.1361	-.244(3.2938)	.5431	1.1088	5.097**	S	U	.1426	.3441
27-Mineral fuels, mineral oils, n.e.s. (.5646)	6.2244**	-.5209(5.6562)**	.1999	1.3534	10.7723**	S	U	13.4695**	.001
28-Inorganic chemicals; n.e.s. (.1906)	10.6197**	-.8439(8.4632)**	.5369	.1394	.4847	S	U	.0144	22.054**
29-Organic chemicals (1.4689)	18.8256**	-1.09(10.0765)**	.2256	.0103	.5841	S	S	.2729	1.1349
30-Pharmaceutical products (.0541)	6.0898**	-.4687(5.4528)**	.283	.038	.1607	S	S	.2111	1.54
32-Tanning or dyeing extracts; tannins , n.e.s. (1.0325)	4.3855**	-.2889(4.7456)**	.7869	.2158	1.0438	U	S	.2418	10.2065**
33-Essential oils and resinoids, n.e.s. (.0914)	10.9078**	-.4944(7.4619)**	.5297	.6742	4.2838**	S	S	1.7188	7.0858**
34-Soap, organic surface-active agents, n.e.s. (.6242)	1.3991	-.1608(2.7502)	.7506	.7325	.495	S	U	.3678	1.3564
35-Albuminoidal substances, n.e.s. (.1367)	32.7721**	-1.004(12.821)**	.371	.6243	2.7114*	S	U	.2146	14.3079**
36-Explosives; pyrotechnic products, n.e.s. (.0021)	4.7476**	-.4511(4.8122)**	.2117	.3318	2.3401	S	U	.4688	2.7021*
37-Photographic or cinematographic goods (.1031)	23.5769**	-.869(10.9197)**	.3005	.6105	.0249	S	S	1.423	3.5726**
38-Miscellaneous chemical products (1.6541)	25.6623**	-.905(11.4298)**	.1004	.8276	.7506	S	S	1.8567	10.3059**
39-Plastics and articles thereof (2.9074)	21.9323**	-.823(10.6309)**	.1438	.0717	1.3932	S	S	2.3597	(5.0177)**
40-Rubber and articles thereof(2.8405)	5.2249**	-.5006(4.8076)**	.3004	.0342	.0088	S	S	.1295	8.8111**
41-Raw hides and skins , n.e.s.(0.0368)	3.1713	-.3916(4.0543)**	.2778	.0123	1.4079	S	S	.8582	1.6517
42-Articles of leather; saddlery, n.e.s.(0.1059)	6.315**	-.5457(5.6826)**	.4098	1.0836	3.7959*	S	U	.1214	6.1317**
43-Furskins and artificial fur, n.e.s.(0.062)	6.8477**	-.516(6.004)**	.2393	.8678	3.3325*	S	U	1.2949	3.7509**
44-Wood and articles of wood, n.e.s.(1.2165)	38.3265**	-1.119(13.656)**	.318	.1807	1.4313	S	S	.717	7.7583**
48-Paper and paperboard, n.e.s. (.693)	9.7318**	-.6313(7.1373)**	.6155	3.2183	.1237	S	U	4.2025**	17.2781**
49-Printed books, newspapers, pictures , n.e.s. (.6468)	10.3495**	-.4946(7.2836)**	.5655	.5222	1.5044	S	S	.0718	13.9838**
51-Wool, fine or coarse animal hair, n.e.s. (.0121)	21.6026**	-.787(10.3307)**	.2397	1.5016	2.4929	S	S	1.7342	1.0762
52-Cotton (.0447)	5.7892**	-.4901(5.2031)**	.8118	.2309	6.8645**	S	U	1.4146	7.2719**
54-Man-made filaments (.7009)	2.0833	-.2763(3.2479)	.6513	1.7546	.6509	S	S	1.6519	.3172
55-Man-made staple fibres (.2925)	4.0963*	-.3207(4.5746)**	.6799	1.0722	.002	S	S	1.4201	.4576
56-Wadding, felt and nonwovens, n.e.s. (.104)	3.5083	-.2666(4.1939)**	.5684	.1887	.0339	S	S	.29	.8331
57-Carpets and other textile floor coverings (.0015)	15.4822**	-.6574(8.8507)**	.2638	1.0336	.2236	S	S	11.9755**	8.8956**
58-Special woven fabrics, n.e.s. (.034)	5.7305**	-.6419(5.3277)**	.1007	.6707	1.7782	S	S	.8005	.2457
59-Impregnated, coated, textile , n.e.s. (.1392)	2.0327	-.2198(3.0676)	.7275	3.4934*	.0196	U	U	.0315	.1964

60-Knitted or crocheted fabrics (.0116)	29.2577**	-.962(12.0694)**	.228	.0678	1.3858	S	U	.0242	.4501
61-Articles of apparel and clothing, n.e.s. (1.5644)	10.854**	-.7961(7.2746)**	.1301	.115	.0002	S	S	.3719	2.0791
62-Articles of apparel, not knitted, n.e.s. (.6378)	14.8015**	-.6362(8.5535)**	.2828	.3111	.2251	S	S	.0001	.1953
63-Other made up textile articles, n.e.s. (.151)	3.9769*	-.3816(4.4735)**	.4331	.3721	.1032	S	U	.0787	6.9315**
64-Footwear, gaiters and the like, n.e.s. (.3934)	9.1947**	-.43(6.8597)**	.572	.0359	.7569	S	U	4.4769**	2.2194
65-Headgear and parts thereof (.0604)	8.7603**	-.4333(6.5688)**	.6044	.9459	.8764	S	S	.0331	1.8822
68-Articles of stone, plaster, cement, n.e.s. (.1123)	4.0249*	-.4001(4.544)**	.5428	1.5064	1.9601	S	S	.0009	3.558**
69-Ceramic products (.6233)	3.3692	-.273(4.1979)**	.6068	.6074	3.7236*	S	U	.3069	.4715
70-Glass and glassware (.8406)	3.4347	-.3183(4.1825)**	.5409	.6987	.1777	S	U	.9333	.5614
71-Natural or cultured pearls, n.e.s. (.4193)	4.0375*	-.5358(4.4271)**	.1461	.6537	1.2323	S	U	.6971	.1041
72-Iron and steel (.4469)	4.3019*	-.4908(4.6309)**	.4618	1.9222	1.3219	S	U	.0712	3.9847**
73-Articles of iron or steel (1.7138)	3.7412	-.4035(4.1468)**	.265	.8658	1.96	S	S	.2041	2.1287
74-Copper and articles thereof (.5812)	9.3518**	-.6417(7.0052)**	.2916	.3712	.8697	S	S	.9957	.1905
75-Nickel and articles thereof (.0088)	6.9164**	-.453(6.8716)**	.334	.2418	6.9164**	S	U	1.5575	.0001
76-Aluminium and articles thereof (.7704)	2.8865	-.2858(3.8514)*	.7847	.1207	4.2749**	S	S	1.5575	5.6615**
78-Lead and articles thereof (.0047)	4.0719*	-.442(4.5702)**	.4454	1.249	4.5864**	S	U	1.9996	2.4464
79-Zinc and articles thereof (.0172)	12.2635**	-.7542(7.8785)**	.2616	.0925	.4077	S	S	8.2698**	.2494
80-Tin and articles thereof (.3386)	20.9675**	-.776(10.1838)**	.0764	1.3588	2.1139	S	S	1.5557	.1194
81-Other base metals; cermet, n.e.s. (.0707)	4.4413**	-.3311(4.6234)**	.6913	.2303	2.0692	S	S	.5134	.0001
82-Tools, implements, cutlery, n.e.s. (.3076)	17.859**	-.6926(9.5165)**	.3394	.9556	.772	S	S	4.5325**	4.9939**
83-Miscellaneous articles of base metal (.5746)	4.6034**	-.3819(4.7754)**	.6718	1.3855	.4159	S	S	.109	8.1862**
84-Nuclear reactors, boilers, n.e.s. (2.687)	18.4227**	-.7554(9.6246)**	.2089	.4964	2.4403	S	S	.001	.7236
85-Electrical machinery n.e.s. (2.6397)	5.213**	-.5571(5.2504)**	.1887	.6375	3.6812*	S	S	3.4097*	3.8611**
86-Railway or tramway locomotives, n.e.s. (.1742)	4.6888**	-.3614(4.9319)**	.3961	.0874	9.3165**	S	S	.307	.0928
87-Vehicles other than railway, n.e.s. (1.5909)	8.6263**	-.6449(6.5129)**	.2042	.4125	.0026	S	U	1.0055	2.3271
88-Aircraft, spacecraft, and parts thereof (.7809)	5.5370**	-.6852(5.4323)**	.0351	.9038	.3815	S	S	1.5153	.0911
89-Ships, boats and floating structures (.2414)	6.6754**	-.5544(5.8391)**	.1361	.4475	3.6065*	S	U	.4818	.0801
90-Optical, photographic, n.e.s. (1.8382)	5.2567**	-.5642(5.2593)**	.19	1.4549	.1616	S	S	.7465	3.7983**
91-Clocks and watches and parts thereof (.1155)	10.833**	-.5013(7.4508)**	.6128	.0696	.0172	S	U	10.1523**	2.381
92-Musical instruments; parts, n.e.s. (.0023)	7.5974**	-.4098(6.4018)**	.7928	.3804	.5221	S	U	.9725	15.3039**
94-Furniture; bedding, mattresses, n.e.s. (2.2814)	5.9288**	-.4069(5.4411)**	.5875	1.2816	.7715	S	S	.2358	9.3078**
95-Toys, games and sports requisites, n.e.s. (0.9987)	14.8675**	-.9227(8.7852)**	.3144	.6985	1.8525	S	U	7.949**	2.5896
96-Miscellaneous manufactured articles (.4678)	9.2025**	-.6956(6.7736)**	.1228	1.9344	.0698	S	S	.0318	.124
97-Works of art, collectors' pieces, n.e.s. (0.0056)	5.0966**	-.3574(4.9805)**	.4076	.348	.0975	S	S	.0186	.0677
98-Mail bags, coffins, urns, n.e.s. (1.0529)	2.4566	-.2633(3.6866)*	.7641	.4332	.6704	U	S	.2057	2.7627*

Notes:

- At the 10% (5%) significance level when there are three exogenous variables ( $k=3$ ), the upper bound critical value of the F test is 3.77 (4.35). These come from Pesaran *et al.* (2001, Table CI-Case III, page 300).
- Number inside the parenthesis next to  $ECM_{t-1}$  is the absolute value of the t-ratio. Its upper bound critical value at the 10% (5%) significance level is -3.66 (-3.99) when  $k=4$  and these come from Pesaran *et al.* (2001, Table CII-Case III, page 303).
- LM is Lagrange Multiplier test of residual serial correlation. It is distributed as  $\chi^2$  with one degree of freedom (first order). Its critical value at 10% (5%) significance level is 2.70 (3.84). These critical values are also used for Wald tests since they also have a  $\chi^2$  distribution with one degree of freedom.
- RESET is Ramsey's test for misspecification. It is distributed as  $\chi^2$  with one degree of freedom.
- Trade share is in percentage calculated over the sample period.
- Abbreviation n.e.s. refers to not elsewhere specified.



**Table 4: Short-Run Coefficient Estimates Attached to  $\Delta POS$  and  $\Delta NEG$  Variables in Nonlinear ARDL Import Model (6)**

Industry	$\Delta POS_t$	$\Delta POS_{t-1}$	$\Delta POS_{t-2}$	$\Delta POS_{t-3}$	$\Delta NEG_t$	$\Delta NEG_{t-1}$	$\Delta NEG_{t-2}$	$\Delta NEG_{t-3}$
01-Live animals	.1346				-.4703			
02-Meat and edible meat offal	-.0118				-.2618	-.4339*		
03-Fish and crustaceans, molluscs and other, n.e.s.	-.0118				.2129			
04-Dairy produce; birds' eggs; natural honey, n.e.s.	-.1207				-.2226			
07-Edible vegetables and certain roots and tubers	-.0665				-.1525			
08-Edible fruit and nuts; peel of citrus, n.e.s.	.8156**	.7479**	1.0942**	.7471**	-.3517	-.4218	-1.2241**	-1.3661**
09-Coffee, tea, mate and spices	.0973				.1723			
11-Products of the milling industry, n.e.s.	-.0849				.0771			
15-Animal or vegetable fats and oils, n.e.s.	-.1251				.3416			
16-Preparations of meat, of fish, n.e.s.	.0465				-.0190			
18-Cocoa and cocoa preparations	.2286				-.0401			
19-Preparations of cereals, flour, n.e.s.	-.0679				-.3665			
20-Preparations of vegetables, fruit, n.e.s.	.069				-.3259			
21-Miscellaneous edible preparations	.4171				.6099			
22-Beverages, spirits and vinegar	-.1631				.5185			
23-Residues and waste from the food industries, n.e.s.	.0195				.063			
24-Tobacco and manufactured tobacco substitutes	.017				.5385			
25-Salt; sulphur; earths and stone, n.e.s.	-.4437**	-.4656**	-.3772**		.4378			
27-Mineral fuels, mineral oils and products, n.e.s.	-.1157				-.126	-.5303	.6972*	
28-Inorganic chemicals; , n.e.s.	-.059				-.0191			
29-Organic chemicals	.0701				-.1725	.6766**		
30-Pharmaceutical products	-.5086*				.3776			
31-Fertilisers	.0646				.4611			
32-Tanning or dyeing extracts, n.e.s.	.1773	.4221**	.1294	.8447**	.0769	.4892	.12	-1.0446**
33-Essential oils and resinoids; perfumery, n.e.s.	-.0822				.1419			
34-Soap, organic surface-active agents, n.e.s.	.282				-.0523			
35-Albuminoidal substances, n.e.s.	.0609				.0149			
36-Explosives; pyrotechnic products, n.e.s.	.523				-.938			
37-Photographic or cinematographic goods	-.0163				.0327			
38-Miscellaneous chemical products	.1122				-.1275			
39-Plastics and articles thereof	-.022				.5248			
40-Rubber and articles thereof	.1865				-.3145			
42-Articles of leather; saddlery and harness, n.e.s.	.2292				-.4117			
44-Wood and articles of wood; wood charcoal	.0838				.4334			
48-Paper and paperboard; articles, n.e.s.	.0188				-.0849			
49-Printed books, newspapers, pictures, n.e.s.	.1557				.2978			
51-Wool, fine or coarse animal hair, n.e.s.	-.0573				-.0338			
55-Man-made staple fibres	-.1132				.0246			
56-Wadding, felt and nonwovens, n.e.s.	-.239				-.6631			
59-Impregnated, coated, covered, n.e.s.	-.2608				.0409			
62-Articles of apparel and clothing, n.e.s.	.2009				-.5443			
63-Other made up textile articles, n.e.s.	-.1149				-.2791			
65-Headgear and parts thereof	-.2623				-.6785			
68-Articles of stone, plaster, cement, n.e.s.	.0388				-.2152			
69-Ceramic products	-.308				-.0616			
70-Glass and glassware	.0033				.5313*	.3893**	.6162**	
72-Iron and steel	.002				.2687			

73-Articles of iron or steel	-.2815**	.2438*	-.0542	.3412**	.3198			
74-Copper and articles thereof	.0951				.1764			
75-Nickel and articles thereof	-.1144				-.141			
76-Aluminium and articles thereof	-.2124				-.6098*			
82-Tools, implements, cutlery, n.e.s.	.0352				-.2771	.4415**		
83-Miscellaneous articles of base metal	.0591				-.3446			
84-Nuclear reactors, boilers, n.e.s.	.0278				.0032			
85-Electrical machinery and equipment , n.e.s.	-.3345**				.401	-.0892	.6087**	-.4312*
86-Railway or tramway locomotives, n.e.s.	-.1245	-1.0814**	-.6437*		.7931	1.1268*		
87-Vehicles other than railway , n.e.s.	-.3177*	.3353	.2717	.5879**	.6999**	.4051	.3542	-.9149**
88-Aircraft, spacecraft, and parts thereof	.0482				.1943			
89-Ships, boats and floating structures	.0678				-.5638			
90-Optical, photographic, cinematographic, n.e.s.	.0331				.066			
91-Clocks and watches and parts thereof	-.0245				.8324**			
93-Arms and ammunition; parts, n.e.s.	.0155				-.0307			
94-Furniture; bedding, mattresses, n.e.s.	.1645				-.2264			
95-Toys, games and sports requisites, n.e.s.	.1491				-.4929			
96-Miscellaneous manufactured articles	.0448				-.1658			
98-Mail bags, coffins, urns, n.e.s.	-.1117				.0365			

Notes: \* and \*\* indicates significance at 10% and 5% level respectively. The critical values of standard t-distribution, i.e., 1.64 and 1.96 are used to arrive at \* and \*\*. Abbreviation n.e.s. refers to not elsewhere specified.

**Table 5: Long-Run Coefficient Estimates of Nonlinear ARDL Import Model**

Industry	<i>C</i>	<i>ln IP<sup>MY</sup></i>	<i>ln REX<sub>t</sub></i>	<i>POS<sub>t</sub></i>	<i>NEG<sub>t</sub></i>
01-Live animals	6.6053**	-4.3189**	-3.7622	.3022	-.0222
02-Meat and edible meat offal	1.7551**	.7687	1.9191	-.1048	.0137
03-Fish and crustaceans, molluscs and other, n.e.s.	7.2274**	-.8614	-.4007	.083	.0621
04-Dairy produce; birds' eggs; natural honey, n.e.s.	.7381**	1.9412**	.9265	.0919	.2086
07-Edible vegetables and certain roots and tubers	5.7485**	-3.1497**	-4.0933	.0079	-.2958
08-Edible fruit and nuts; peel of citrus, n.e.s.	9.6401**	-3.6326**	-4.0363	-.8685**	-1.2315**
09-Coffee, tea, mate and spices	-1.3905**	1.6537**	.2757	-.0527	-.0428
11-Products of the milling industry, n.e.s.	6.2623**	-7.8831**	-10.0486	.5266	-.29
15-Animal or vegetable fats and oils, n.e.s.	8.3473**	-7.8456*	-7.9264	.5579	-.1879
16-Preparations of meat, of fish, n.e.s.	4.4641	-.7002	-.3215	.2403	.2552
18-Cocoa and cocoa preparations	3.9309**	-3.7531	-3.1619	1.0933	.7109
19-Preparations of cereals, flour, n.e.s.	8.2131**	-13.9974**	-16.8572	.6514	-.667
20-Preparations of vegetables, fruit, n.e.s.	5.7972**	-4.6186**	-2.2306	.3311	-.0473
21-Miscellaneous edible preparations	8.0055**	-16.8369*	-25.941	2.6931	.9756
22-Beverages, spirits and vinegar	4.8996**	-1.0707	-.3825	.0356	.0088
23-Residues and waste from the food industries, n.e.s.	5.3241**	-10.8232**	-15.9409	.9631	-.2257
24-Tobacco and manufactured tobacco substitutes	8.2674**	-.6435	-.7175	.112	-.0058
25-Salt; sulphur; earths and stone, n.e.s.	.8893**	1.0739	1.2008	.2718	.3571
27-Mineral fuels, mineral oils and products, n.e.s.	6.4776**	-8.2231**	-6.8932	.2707	-.4247
28-Inorganic chemicals; , n.e.s.	3.5277**	-4.8608	-8.3862	.0782	-.4472
29-Organic chemicals	5.6773**	-5.7518**	-4.8231	.4431	.0225
30-Pharmaceutical products	4.9381**	-6.2324*	-8.6714	1.559	.9678
31-Fertilisers	4.1194**	.2726	1.1288	-.1136	-.0436
32-Tanning or dyeing extracts, n.e.s.	5.3585**	-16.3641*	-24.8717	-.7005	-2.3682
33-Essential oils and resinoids; perfumery, n.e.s.	5.6272**	-9.1581**	-11.0441	.5693	-.2872
34-Soap, organic surface-active agents, n.e.s.	5.769**	-10.0719*	-11.2718	1.0817	.1803
35-Albuminoidal substances, n.e.s.	7.1442**	-14.0134*	-19.8699	1.465	.0105
36-Explosives; pyrotechnic products, n.e.s.	3.1991**	.7133	1.5786	-.0595	.0444
37-Photographic or cinematographic goods	6.3986**	-5.0236	-6.5083	.4707	.0355
38-Miscellaneous chemical products	4.6703**	-3.7154*	-3.3683	.2555	-.0347
39-Plastics and articles thereof	5.8231**	-6.4712**	-7.0752	.6794	.1363
40-Rubber and articles thereof	4.6883**	-9.2948**	-11.852	.5528	-.3819
42-Articles of leather; saddlery and harness, n.e.s.	6.6729**	-3.7491**	-3.4092	.087	-.3104
44-Wood and articles of wood; wood charcoal	6.1195**	-8.3375*	-8.2397	.9428	.2723
48-Paper and paperboard; articles, n.e.s.	5.0476**	-4.9004**	-5.7122	.1879	-.2334
49-Printed books, newspapers, pictures, n.e.s.	8.4485**	-8.2766**	-7.6203	.5186	-.1612
51-Wool, fine or coarse animal hair, n.e.s.	12.3504**	-2.0448**	-1.6593	.1277	.0868
55-Man-made staple fibres	-1.2278**	2.6946*	2.5533	.3283	.6686
56-Wadding, felt and nonwovens, n.e.s.	8.9718**	-3.3423**	-.4149	-.3238	-.529
59-Impregnated, coated, covered, n.e.s.	2.0072**	-.2861	-.4298	.4649	.4368
62-Articles of apparel and clothing, n.e.s.	8.5103**	-1.6768**	-2.4154	-.0119	-.2486
63-Other made up textile articles, n.e.s.	5.9017**	-2.2672*	-2.6219	-.1052	-.3239
65-Headgear and parts thereof	8.9345**	-.7427	-.8171	-.3163*	-.4311**
68-Articles of stone, plaster, cement, n.e.s.	5.3846**	-7.7555*	-8.8475	.4041	-.302
69-Ceramic products	4.9144**	-13.5515	-11.6319	-1.2391	-2.3379
70-Glass and glassware	.9393**	9.0034	-13.646	-3.5925	-3.6326
72-Iron and steel	5.6675**	-5.0454**	-4.177	.4058	.0254

73-Articles of iron or steel	4.5425**	-2.7413*	-2.1889	-.0325	-.2532
74-Copper and articles thereof	4.6269**	-3.8028*	-3.8433	.2451	-.0601
75-Nickel and articles thereof	-.7906**	1.4107**	-1.1091	.12	.1046
76-Aluminium and articles thereof	3.0176**	4.7385	3.6811	2.2931	5.8772
82-Tools, implements, cutlery, n.e.s.	5.0167**	-6.0009**	-6.5654	.1765	-.3841
83-Miscellaneous articles of base metal	5.6519**	-3.4184*	-3.5676	-.124	-.4454
84-Nuclear reactors, boilers, n.e.s.	6.3842**	-.0564	-.7609	.0702	.0536
85-Electrical machinery and equipment , n.e.s.	4.3685**	-2.7919*	-2.8727	.7792	.5731
86-Railway or tramway locomotives, n.e.s.	4.0949**	-.1614	.2434	.9911**	.9553*
87-Vehicles other than railway , n.e.s.	3.2976**	-1.3259	-3.1814	.1163	-.0431
88-Aircraft, spacecraft, and parts thereof	3.9353**	.1706	2.6616	.1148	.2271
89-Ships, boats and floating structures	9.3701**	-2.4467	-.5595	-.1466	-.3284
90-Optical, photographic, cinematographic, n.e.s.	4.9125**	-4.0027**	-4.3527	.2614	-.0931
91-Clocks and watches and parts thereof	3.5199**	-2.8496	-3.791	.3889	.0292
93-Arms and ammunition; parts, n.e.s.	9.1122**	-1.3607	-1.6737	-.1032	-.1829
94-Furniture; bedding, mattresses, n.e.s.	4.5119**	-8.0014	-9.7229	.4421	-.2594
95-Toys, games and sports requisites, n.e.s.	7.3712**	-8.1868*	-8.9334	.2805	-.501
96-Miscellaneous manufactured articles	-.6566	-5.1599	-10.5257	-.444	-1.0732
98-Mail bags, coffins, urns, n.e.s.	5.1322**	-6.8413**	-7.3712	.06	-.5437

Notes: \* and \*\* indicates significance at 10% and 5% level respectively. The critical values of standard t-distribution, i.e., 1.64 and 1.96 are used to arrive at \* and \*\*. Abbreviation n.e.s. refers to not elsewhere specified.

**Table 6: Diagnostics Associated with Estimates of Nonlinear Import Models in Table 5.**

Industry (Trade Share)	Diagnostics								
	F <sup>a</sup>	ECM <sub>t-1</sub> <sup>b</sup>	Adj. R <sup>2</sup>	LM <sup>c</sup>	RESET <sup>d</sup>	CU	CU <sup>2</sup>	Wald-S	Wald-L
01-Live animals (0.158)	4.0232*	-2671(4.3131)**	.4362	2.2634	4.1022**	S	U	.7229	1.4748
02-Meat and edible meat offal (0.5807)	8.503**	-4369(6.4791)**	.3235	.6433	.1126	S	U	1.9292	.9498
03-Fish and crustaceans, molluscs and other, n.e.s. (0.1502)	20.0384**	-7003(9.8286)**	.1744	.5809	.9798	S	S	.2041	.4734
04-Dairy produce; birds' eggs; natural honey, n.e.s. (1.5037)	4.5731**	-4828(4.7473)**	.545	1.441	17.3989**	S	U	.0025	1.148
07-Edible vegetables and certain roots and tubers (0.3654)	5.723**	-.2947(5.4293)**	.525	2.056	2.8813*	S	S	.0086	3.2832*
08-Edible fruit and nuts; peel of citrus, n.e.s. (0.1163)	10.7345**	-4765(7.3915)**	.6349	2.8424*	5.8487**	S	U	16.2603**	3.7361**
09-Coffee, tea, mate and spices (0.1079)	20.2036**	-6775(9.9031)**	.4549	2.3858	2.0664	S	S	.0005	.0152
11-Products of the milling industry, n.e.s. (0.9077)	4.4678**	-.1612(4.7409)**	.7263	.0633	3.5679*	S	U	.2165	.8123
15-Animal or vegetable fats and oils, n.e.s. (0.5213)	3.9183*	-.2116(4.7077)**	.5635	2.7422*	6.1517**	S	U	.5015	7.1416**
16-Preparations of meat, of fish, n.e.s. (0.0786)	6.0873**	-4797(5.4242)**	.329	1.5296	.0117	S	U	.002	.0144
18-Cocoa and cocoa preparations (0.9233)	3.2518	-1769(3.7209)*	.6723	1.9023	4.2392**	S	U	.2356	.3177
19-Preparations of cereals, flour, n.e.s. (1.108)	4.5467**	-1269(4.6236)**	.7736	.3172	3.6572*	S	U	.8154	.6648
20-Preparations of vegetables, fruit, n.e.s. (0.7088)	5.0122**	-.2163(4.7589)**	.7351	.6858	3.8059*	S	U	.7228	.0019
21-Miscellaneous edible preparations (1.6348)	3.9690*	-1079(4.5389)**	.7454	1.4574	.2909	S	U	.0165	.4155
22-Beverages, spirits and vinegar (0.5062)	3.4869	-411(4.268)**	.2187	.4443	.3949	S	S	.0469	.1159
23-Residues and waste from the food industries, n.e.s. (0.8814)	4.5773**	-1069(4.7889)**	.8094	.2024	4.2098**	S	U	.0552	.3684
24-Tobacco and manufactured tobacco substitutes (0.4472)	13.1401**	-9209(8.3806)**	.2118	.6159	.6605	S	U	.5928	.2191
25-Salt; sulphur; earths and stone, n.e.s. (0.3919)	6.2508**	-3794(5.6626)**	.359	2.2371	2.1189	S	U	4.7374**	.0048
27-Mineral fuels, mineral oils and products, n.e.s. (0.8589)	3.5256	-1538(4.2043)**	.6768	.1308	4.1395**	S	U	.1489	2.0061
28-Inorganic chemicals; , n.e.s. (1.0445)	3.4237	-1342(4.1476)**	.6173	.9446	4.0626**	S	U	.0924	5.4105**
29-Organic chemicals (1.3733)	4.7225**	-1755(4.7966)**	.7236	.5993	5.588**	S	U	.5415	2.6787*
30-Pharmaceutical products (1.7631)	4.5153**	-1498(4.9053)**	.7811	1.2862	5.1228**	S	U	1.5709	.0284
31-Fertilisers (0.821)	6.0949**	-6516(5.4788)**	.0629	1.3019	.7639	S	S	1.4188	1.8013
32-Tanning or dyeing extracts, n.e.s. (1.3339)	2.9701	-.0749(3.9083)*	.8193	.4087	4.9939**	S	U	3.6987**	7.2692**
33-Essential oils and resinoids; perfumery, n.e.s. (1.287)	4.1152*	-1248(4.5877)**	.803	.0476	4.5079**	S	U	.4213	4.3809**
34-Soap, organic surface-active agents, n.e.s. (0.8233)	3.3243	-1183(3.9786)*	.7166	3.1785*	2.4117	S	U	.4586	3.9872**
35-Albuminoidal substances, n.e.s. (1.033)	3.5529	-1132(4.1977)**	.6951	.0188	2.6604	S	U	.0018	5.2535**
36-Explosives; pyrotechnic products, n.e.s. (0.0786)	8.6998**	-10496(6.2531)**	.1082	.585	.1529	S	S	1.6602	.6721
37-Photographic or cinematographic goods (0.2681)	5.0526**	-.2334(5.0321)**	.5615	3.0967*	5.9906**	S	U	.0404	1.9394
38-Miscellaneous chemical products (1.8121)	3.7469	-.2014(4.1235)**	.4863	.8263	3.2011*	S	U	.5945	4.3684**
39-Plastics and articles thereof (1.8416)	3.6783	-1678(4.6827)**	.7021	1.2566	1.6377	S	U	1.2432	4.51551**
40-Rubber and articles thereof (1.6674)	3.9132*	-1046(4.2394)**	.813	1.6367	3.2689*	S	U	1.5794	6.0179**
42-Articles of leather; saddlery and harness, n.e.s. (0.5416)	3.4592	-.3023(4.116)**	.5344	1.4014	2.5335	S	U	1.3702	4.7335**
44-Wood and articles of wood; wood charcoal (0.5848)	4.1642*	-.1444(4.6334)**	.6849	.1382	1.9848	S	U	.3407	3.5254*
48-Paper and paperboard; articles, n.e.s. (1.5151)	3.41	-.1814(4.3705)**	.6576	1.0333	3.8583**	S	U	.0767	3.7323**
49-Printed books, newspapers, pictures, n.e.s. (0.7648)	3.7225	-.2007(4.5044)**	.6394	1.2865	2.6806	S	S	.0032	5.2824**
51-Wool, fine or coarse animal hair, n.e.s. (0.0107)	8.5437**	-8404(6.4975)**	.3935	1.5577	.4799	S	S	.0278	.0909
55-Man-made staple fibres (0.1047)	2.6361	-.2579(3.4912)	.6373	1.2897	.2702	S	U	.2108	2.5049
56-Wadding, felt and nonwovens, n.e.s. (0.2129)	9.815**	-4144(7.0546)**	.4609	.4064	2.8349*	S	U	.1883	1.3149
59-Impregnated, coated, covered, n.e.s. (0.2655)	9.2896**	-.2605(6.7572)**	.6955	3.011*	10.4546**	S	U	.3315	.0262
62-Articles of apparel and clothing, n.e.s. (0.3062)	16.7068**	-6672(9.11)**	.25	.1522	3.003*	S	U	1.5361	7.3069**
63-Other made up textile articles, n.e.s. (0.07)	3.0167	-.3879(3.7906)*	.1654	2.3952	3.6112*	S	S	.038	2.289
65-Headgear and parts thereof (0.0187)	36.4413**	-1.1368(13.628)**	.0718	1.8702	.0551	S	S	.1507	1.2981
68-Articles of stone, plaster, cement, n.e.s. (0.3056)	3.1966	-.1391(3.8977)*	.6809	.5148	2.9858**	S	U	.1513	2.8891*
69-Ceramic products (0.3261)	1.325	-.0754(2.5188)	.6744	.8418	2.6073	S	U	.475	2.048
70-Glass and glassware (1.2028)	.8904	-.0206(1.9734)	.7919	3.072*	6.6875**	S	U	6.8754**	.1512

72-Iron and steel (1.7258)	4.0626*	-.1941(4.5523)**	.6324	.6342	3.4357*	S	U	.3006	1.847
73-Articles of iron or steel (1.6025)	3.6886	-.2374(4.328)**	.4622	.2892	4.2457**	S	S	.0137	2.9011*
74-Copper and articles thereof (0.7871)	3.587	-.1996(4.2221)**	.5782	.3427	2.7293*	S	U	.0149	2.3367
75-Nickel and articles thereof (0.2208)	9.6917**	-.7557(6.8622)**	.1649	.2077	1.3159	S	U	.0166	.077
76-Aluminium and articles thereof (0.7307)	.9444	-.0165(2.1149)	.8475	.0924	1.8136	S	U	.2062	1.5201
82-Tools, implements, cutlery, n.e.s. (1.19)	4.2906*	-.1563(4.6517)**	.732	.7379	3.69*	S	U	.0546	6.5241**
83-Miscellaneous articles of base metal (0.4416)	4.268*	-.2697(4.5832)**	.5488	1.3656	.2084	S	U	.3869	1.5104
84-Nuclear reactors, boilers, n.e.s. (1.4998)	23.7792**	-.8746(10.8479)**	.0622	1.3337	1.0760	U	S	.0003	.2594
85-Electrical machinery and equipment, n.e.s. (1.6692)	4.744**	-.2252(4.7446)**	.508	1.8811	4.8161**	S	U	1.7712	2.7718*
86-Railway or tramway locomotives, n.e.s. (0.3418)	4.3766**	-.5634(4.7014)**	.2276	.2286	1.2609	S	S	7.8102**	.1723
87-Vehicles other than railway, n.e.s. (0.9735)	2.4686	-.2778(3.5286)	.3321	.0306	2.2381	S	S	.1244	1.177
88-Aircraft, spacecraft, and parts thereof (0.8522)	10.6799**	-.5303(7.2981)**	.2062	4.6598**	1.5523	S	U	.0129	.1685
89-Ships, boats and floating structures (0.1757)	6.0259**	-.5478(5.5789)**	.1525	.0585	1.6535	U	S	.2884	.222
90-Optical, photographic, cinematographic, n.e.s. (2.1019)	4.511**	-.2033(4.7661)**	.6291	.1015	4.4577**	S	U	.0177	4.6609**
91-Clocks and watches and parts thereof (0.2985)	3.2673	-.1991(4.051)**	.658	1.3742	2.7971*	S	U	2.257276	1.4547
93-Arms and ammunition; parts, n.e.s. (0.0691)	9.8546**	-.7695(6.9907)**	.1113	.6521	1.8693	S	S	3.3466*	.1295
94-Furniture; bedding, mattresses, n.e.s. (1.0782)	3.4346	-.112(3.9595)*	.7808	1.7298	.0023	S	U	.7835	3.6037**
95-Toys, games and sports requisites, n.e.s. (0.3285)	3.1747	-.1828(3.9808)*	.592	.2467	2.4998	S	U	.6532	3.3836*
96-Miscellaneous manufactured articles (0.212)	.1989	-.0252(.9009)	0.846144	3.5939*	6.0127**	S	S	.0147	.6038
98-Mail bags, coffins, urns, n.e.s. (1.661)	4.2314*	-.142(5.0932)**	.806	.6798	5.6891**	S	U	.4089	7.0913**

Notes:

- At the 10% (5%) significance level when there are three exogenous variables ( $k=3$ ), the upper bound critical value of the F test is 3.77 (4.35). These come from Pesaran *et al.* (2001, Table CI-Case III, page 300).
- Number inside the parenthesis next to  $ECM_{t-1}$  is the absolute value of the t-ratio. Its upper bound critical value at the 10% (5%) significance level is -3.66 (-3.99) when  $k=4$  and these come from Pesaran *et al.* (2001, Table CII-Case III, page 303).
- LM is Lagrange Multiplier test of residual serial correlation. It is distributed as  $\chi^2$  with one degree of freedom (first order). Its critical value at 10% (5%) significance level is 2.70 (3.84). These critical values are also used for Wald tests since they also have a  $\chi^2$  distribution with one degree of freedom.
- RESET is Ramsey's test for misspecification. It is distributed as  $\chi^2$  with one degree of freedom.
- Trade share is in percentage calculated over the sample period.
- Abbreviation n.e.s. refers to not elsewhere specified.