Asymmetric effects of exchange rate changes on the Malaysia-China commodity trade

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ABSTRACT

Previous research that considered the response of the trade balance between Malaysia and China to exchange rate changes used a linear model and did not find any significant long-run link. Suspecting that the results suffer from aggregation bias as well as ignoring nonlinear adjustment of the exchange rate, we consider the trade balance of 59 industries that trade between the two countries and use a nonlinear ARDL model to show that almost 1/3rd of the industries are affected by ringgit depreciation against yuan, in an asymmetric manner. The largest industry which accounts for more than 25% of the trade is found to benefit from ringgit depreciation but not hurt from appreciation. In total, 15 industries that account for 40% of the trade enjoy this property.

JEL Classification: F31

Key words: Nonlinear ARDL, Asymmetry, 65 Industries, Malaysia, China

I. Introduction

The economic success of Malaysia is due to its transition from agriculture based economy to an industry based economy with a substantial part of its external trade. It has achieved success in getting specialty in high tech goods like electrical and electronics and built comparative advantage in exporting such manufactured goods, more to other Asian countries than to the U.S. and European Union. Today, the largest export market for Malaysia happens to be China. Indeed, in terms of aggregate trade China is the largest trading partner of Malaysia. Therefore, it is important to determine if there is any role for the ringgit-yuan exchange rates in the trade between the two countries. In order to see how the real ringgit-yuan exchange rate has moved overtime, we plot that rate in Figure 1.

Figure 1 goes about here

How has the Malaysian-Chinese trade balance responded to the movements in the real ringgit-yuan rate? Has real depreciation of ringgit against yuan played any significant role in improving competitive position and therefore the trade balance of Malaysia with China?

In trying to answer the above question, a common practice by economists is to infer the size of trade elasticities summarized by the well-known Marshall-Lerner condition. The condition asserts that as long as sum of price elasticities of import demands is greater than one, a depreciation will improve the trade balance in the long run. In the distant past, the condition was mostly estimated for industrial countries due to availability of data. Recent studies, however, have included countries from developing world. Examples are Khan (1974) who estimated the condition for 15 countries, Bahmani-Oskooee (1986) who did it for seven developing countries, Bahmani-Oskooee and Niroomand (1998) who estimated the condition for 28 developed and developing countries, and Bahmani-Oskooee and Kara (2005) who updated the estimate for the same 28

countries using a different method. Unfortunately, none of the studies have included Malaysia in order to get some direction. Even if they did, it will be between Malaysia and the world and not between Malaysia and China.[1]

Today, a common practice to assess the effectiveness of exchange rate changes on the bilateral trade balance of a country is to rely upon a reduced form trade balance model which included the real exchange rate in addition to scale variables as determinants of the trade balance. Indeed, Bahmani-Oskooee and Harvey (2010) relied upon this approach and estimated bilateral trade balance models between Malaysia and 14 largest partners including China. In the results with China, they found that ringgit depreciation has no significant long-run effects on Malaysia-China trade balance. There are two deficiencies associated with this study. First, the lack of significant link between Malaysia-China trade balance and the real ringgit-yuan exchange rate could be due to aggregation bias. If the bilateral trade data are disaggregated by commodity, for sure there will be some commodities that could benefit from ringgit-yuan depreciation. Second, Bahmani-Oskooee and Harvey (2010) used Pesaran et al.'s (2001) linear ARDL bounds testing method which assumes exchange rate changes to have symmetric effects on the trade balance. Thus, introducing nonlinear adjustment of the real exchange rate may have different impact. In this paper we correct these two deficiencies and consider the trade balance of each of the 59 industries that trade between Malaysia and China by applying the nonlinear ARDL approach of Shin et al. (2014) which is an extension of the linear ARDL approach of Pesaran et al. (2001). To this end, we outline the models and review the two approaches in Section II. In section III we present our results mostly

[1] For a review article on the Marshall-Lerner condition see Bahmani-Oskooee and Hegerty (2013). Note that Lal and Lowinger (2001), Duasa (2007) and Yusoff (2007, 2010) have estimated aggregate trade balance of Malaysia with the rest of the world and have found no significant link between the exchange rate and Malaysia's trade balance. This maybe an indication of violation of the Marshall-Lerner condition.

supporting nonlinear model and evidence of asymmetric effects of exchange rate changes. Finally, while Section IV concludes, data definition and sources are cited in an Appendix.

II. The Linear and Nonlinear Trade Balance Models and Methods[2]

Rose and Yellen (1989) developed a theoretical model which identified the level economic activity in two trading partners and the real bilateral exchange rate to be the main determinants of the bilateral trade balance. Indeed, Bahmani-Oskooee and Harvey (2010) included these three variables in their specification. Therefore, we adopt the same model here as outlined by equation (1):

$$LnTB_{j,t} = \alpha_o + \alpha_1 LnIP_t^{ML} + \alpha_2 LnIP_t^{CH} + \alpha_3 LnREX_t + \varepsilon_t \qquad (1)$$

where TB_j is the trade balance of industry j. It is defined as the ratio of Malaysian imports from China over its exports to China. Since the data are monthly, the only measures available for both countries are Index of Industrial Production which are denoted by IP^{ML} for Malaysia and IP^{CH} for China as measures of economic activities. Since an increase in Malaysian economic activity is expected to boost its imports, we expect an estimate of α_1 to be positive. By the same token since an increase in economic activity in China is expected to boost Malaysian exports, we expect an estimate of α_2 to be negative.[3] Lastly, the REX in (1) denotes the real bilateral exchange rate and is defined in a manner that a decline reflects a real depreciation of ringgit against yuan. If ringgit depreciation is to discourage Malaysian imports of commodity j and stimulate its exports of commodity j, we expect an estimate of α_3 to be positive.

[2] The method in this section closely follows Bahmani-Oskooee and Fariditavana (2016) who raised the asymmetry concern against Rose and Yellen (1989). Both studies relied upon aggregate bilateral trade balance model.

[3] Note that if the increase in economic activity is due to an increase in production of import-substitute goods, an estimate of α_1 could be negative and that of α_2 could be positive.

Ever since introduction of the J-curve concept in 1973, it is now a common practice to distinguish short-run effects of currency depreciation from its long-run effects. To do so, we must specify (1) in an error-correction format. We too follow Pesaran et al.'s (2001) ARDL approach and move to specification (2):

$$\Delta LnTB_{j,t} = \beta_o + \sum_{i=1}^{n1} \beta_{1,i} \Delta LnTB_{j,t-i} + \sum_{i=0}^{n2} \beta_{2,i} \Delta LnIP_{t-i}^{ML} + \sum_{i=0}^{n3} \beta_{3,i} \Delta LnIP_{t-i}^{CH} + \sum_{i=0}^{n4} \beta_{4,i} \Delta LnREX_{t-i}$$
$$+ \gamma_0 LnTB_{j,t-1} + \gamma_1 LnIP_{t-1}^{ML} + \gamma_2 LnIP_{t-1}^{CH} + \gamma_3 LnREX_{t-1} + \xi_t \qquad (2)$$

The above equation is an error-correction model where instead of including lagged error term from (1) in (2), Pesaran *et al*. (2001) recommend including linear combination of lagged level variables. They demonstrate that if lagged level variables are jointly significant by applying the F test, variables in (1) are cointegrated. However, they also show that the F test in this context has new critical values that they tabulate.[4] Once (2) is estimated by OLS and cointegration is established, estimates of γ_1-γ_3 normalized on γ_0 constitute long-run estimates. Short-run estimates are reflected in the coefficients attached to first-differenced variables.

A main assumption in (1) or (2) is that exchange rate elasticity is the same for a depreciation and an appreciation. Bahmani-Oskooee and Fariditavana (2015, 2016) argued that this need not be the case. Traders' expectation and reaction could be different to a depreciation compared to an appreciation. Furthermore, there is now evidence that import and export prices react to exchange rate changes asymmetrically (Bussiere 2013). This implies that the quantities, hence the trade balance should also react to exchange rate changes in an asymmetric manner. Shin et al. (2014) who introduced the concept of asymmetry cointegration, proposed decomposing the variable of

[4] Note that since the critical values account for integrating properties of variables, there is no need for pre-unit-root testing and variables could be a combination of I(0) and I(1) which are properties of almost all macro variables. This is one of the main advantage of this approach.

concern into its positive and negative changes. In our case, this amounts to forming ΔLnREX which includes positive changes (ringgit appreciations) and negative changes (ringgit appreciation). From this series we generate two new variables as follows:

$$POS_t = \sum_{j=1}^{t} \Delta LnREX_j^+ = \sum_{j=1}^{t} \max(\Delta LnREX_j, 0)$$

$$NEG_t = \sum_{j=1}^{t} \Delta LnREX_j^- = \sum_{j=1}^{t} \min(\Delta LnREX_j, 0). \qquad (3)$$

In (3) the POS variable is the partial sum of positive changes in ΔLnREX and represents only ringgit appreciation and the NEG variable is the partial sum of negative changes and represents only ringgit depreciation. The next step is to go back to (2) and replace the LnREX variable by POS and NEG to arrive at:

$$\begin{aligned}\Delta LnTB_{j,t} = \beta_o &+ \sum_{i=1}^{n1} \beta_{1,i} \Delta LnTB_{j,t-i} + \sum_{i=0}^{n2} \beta_{2,i} \Delta LnIP_{t-i}^{ML} + \sum_{i=0}^{n3} \beta_{3,i} \Delta LnIP_{t-i}^{CH} \\ &+ \sum_{i=0}^{n4} \beta_{4,i} \Delta POS_{t-i} + \sum_{i=0}^{n5} \beta_{5,i} \Delta NEG_{t-i} + \gamma_0 LnTB_{j,t-1} + \gamma_1 LnIP_{t-1}^{ML} \\ &+ \gamma_2 LnIP_{t-1}^{CH} + \gamma_3 POS_{t-1} + \gamma_4 NEG_{t-1} + \xi_t \qquad (4)\end{aligned}$$

Specification (4) is another error-correction model that is known as the nonlinear ARDL model whereas, (2) is called a linear model. The nonlinearity is due to method of constructing the two partial sum variables. Because of dependency between the two variables, Shin *et al.* (2014, p. 291) recommend treating them as a single variable in testing for cointegration such that the critical value of the F test remains the same in (4) compared to (2). First, since imports originate in China and exports in Malaysia and the two countries are subject to different rules and regulations, it is possible to have short-run adjustment asymmetry where ΔPOS and ΔNEG variables take different lag order. Second, short-run asymmetric effects will be present if $\hat{\beta}_{4,i}$ is different than $\hat{\beta}_{5,i}$ at each

lag order i. However, if $\sum \hat{\beta}_{4,i} \neq \sum \hat{\beta}_{5,i}$, that will be an indication of short-run cumulative or impact asymmetry. The Wald test will be used to test this inequality. Finally, long-run asymmetric effects will be established by testing if $-\hat{\gamma}_3/\hat{\gamma}_0 \neq -\hat{\gamma}_4/\hat{\gamma}_0$. Again, we will apply the Wald test here.[5]

III. The Results

In this section we estimate both the linear model (2) and the nonlinear model (4) for each of the 59 industries that trade between Malaysia and China. Monthly data over the period March 2001-December 2015 (178 observations) are used to carry out the empirical exercise. We include a dummy variable to account for Global Financial Crisis of 2008. A maximum of eight lags is imposed on each first-differenced variable and Akaike's Information Criterion (AIC) is used to select an optimum model for each industry. Since there are different critical values for different estimate or diagnostic statistic, they are all collected in the notes to tables and used to identify a significant estimate at the 10% level by * and at the 5% level by **.

Let us consider the estimates of the linear model (2) first. Due to volume of the results they are reported in Tables 1-3. While Table 1 reports short-run coefficient estimates attached only to the exchange rate (to save space), Table 2 reports long-run estimates for all exogenous variables. Diagnostic statistics are reported in Table 3.

Tables 1-3 go about here

From the short-run results in Table 1 it is clear that in 21 industries there is evidence of significant short-run effects since the exchange rate carries at least one significant coefficient.

[5] For some other application of these methods see Delatte and Lopez-Villavicencio (2012), Verheyen (2013), Gogas and Pragidis (2015), Durmaz (2015), Baghestani and Kherfi (2015), Pal and Mitra (2016), Al-Shayeb and Hatemi-J.(2016), Lima et al. (2016), Nusair (2017), Arize et al. (2017), and Gregoriou (2017).

These industries are coded as 01, 08, 22, 27, 29, 43, 52, 54, 56, 62, 72, 74, 76, 77, 78, 83, 85, 87, 89, 93, and 97. These industries together engage in almost 50% of the trade (see trade shares in Table 3). The largest industry coded 77 (Electrical machinery) with 27.6% trade share is among the list. In how many of these industries, short-run effects last into the long run? From Table 2 we gather that in 20 industries the normalized estimate attached to the real exchange rate is significant. Furthermore, while in industries coded 03, 22, 23, 34, 52, 53, 56, 57, 72, 73, 74, and 88 the estimate is positive, in 04, 08, 09, 27, 32, 61, 62, and 84 it is negative.[6] The largest industry is no longer in the list and 12 industries that benefit from ringgit depreciation engage in almost 15% of the trade. Therefore, the Rose and Yellen (1989, p. 67) definition of the J-curve, i.e., short-run deterioration combined with long-run improvement is supported only in 12 industries.[7]

For the long-run estimates to be valid, cointegration must be established. The result of the F test along with some other diagnostics are reported in Table 3. From Table 3 we gather that in most models in which at least one of the exogenous variables is significant, so is the F statistic. In some cases like industry coded 04 (Cereals and cereals preparations) in which long-run estimates are significant but the F statistic is insignificant, we rely upon alternative test. Under this alternative test, we use normalized long-run coefficient estimates and long-run model (1) and generate the error term which we denote by ECM. We then shift back to error-correction model (2) and replace the lagged level variables by ECM_{t-1} and estimate this new specification after imposing the same optimum lags. A significantly negative estimate attached to ECM_{t-1} will support cointegration. Note that the t-test that is used to judge significance of this estimate has a new distribution for which Pesaran et al. (2001, p. 303) tabulate new critical values that are used in this

[6] The negative estimate is an indication of import demands being inelastic.
[7] For a review article on the J-curve see Bahmani-Oskooee (1985) and Bahmani-Oskooee and Hegerty (2010).

paper. As can be seen, in most industries included 04, ECM_{t-1} carries significant coefficient supporting cointegration.

A few additional diagnostic statistics are reported in Table 3. First, we have reported the Lagrange Multiplier (LM) test statistic to determine if the residuals in each optimum model are uncorrelated. We do not see many * or **, indicating that there is no evidence of serial correlation in most models. Second, Ramsey's RESET test for misspecification seems to be also insignificant in most instances, supporting correctly specified optimum models. Third, short-run and long-run coefficient estimates are stable in most models. This is indicated by "S" for stable and "U" for unstable estimates under CU and CUQ columns. These two stability tests are the CUSUM and CUSUMSQ tests, respectively. Finally, adjusted R^2 is reported for each model to reflect the goodness of fit. Clearly, most models enjoy good fit.

Next we consider the estimates of the nonlinear models. Again, due to volume of the results they are reported in four tables. While Table 4 reports short-run estimates associated with ringgit appreciation, the ones associated with ringgit depreciation are reported in Table 5. Long-run estimates appear in Table 6 and associated diagnostics in Table 7.

Tables 4-7 go about here

From Tables 4 and 5 we gather that either ΔPOS or ΔNEG carry at least one significant coefficient in 34 industries that are coded 01, 03, 08, 12, 22, 27, 29, 32, 33, 43, 51, 52, 54, 56, 61, 62, 63, 64, 65, 68, 69, 71, 72, 74, 76, 77, 79, 81, 83, 85, 87, 88, 89, and 93. These 34 industries together account for 69% of the trade between the two countries. This increase in the number of industries from 21 with 50% trade share in the linear model to 34 with 69% share in the nonlinear model must be attributed to nonlinear adjustment of the real ringgit-yuan rate. Furthermore, the short-run estimates reveal that the size of coefficient estimate attached to ΔPOS is different than

the one attached to ΔNEG at a given lag, supporting short-run asymmetric effects of exchange rate changes. However, the sum of these estimates are significantly different only in 16 industries coded as 03, 08, 22, 27, 32, 56, 63, 65, 68, 69, 74, 79, 81, 87, 88, and 89, supporting short-run cumulative or impact asymmetry. This is due to the fact that the Wald statistic reported as Wald-S in Table 7 is significant only in these industries. Finally, there is also evidence of short-run adjustment asymmetry in 30 industries since in these 30 industries number of optimum lags on ΔPOS (Table 4) are different than the number of optimum lags on ΔNEG (Table 5). As mentioned before, adjustment asymmetry could be due to the fact that exports originate in Malaysia and imports in China. The two countries are subject to two different trade, production, delivery, tariff, etc. rules and regulations. Do short-run asymmetric effects last into the long run?

From the long-run normalized coefficient estimates in Table 6 we gather that either the POS variable or the NEG variable carries a significant coefficient in 27 industries coded as 03, 04, 09, 22, 23, 27, 32, 34, 43, 52, 53, 55, 57, 58, 62, 65, 71, 73, 74, 76, 77, 78, 81, 83, 84, 87, and 89. Again, the increase in number of industries from 20 in Table 2 to 27 in Table 6 must be attributed to nonlinear adjustment of the real bilateral exchange rate. Note that this time the largest industry, i.e., 77 (Electrical machinery, apparatus and appliances) with 27.6% market share is among the list and since the NEG variable in this case carries a significantly positive coefficient, this industry will benefit from ringgit depreciation. However, the POS variable carries an insignificant coefficient in this industry, supporting long-run asymmetric effects. This long-run asymmetric effects is supported by the Wald test reported in Table 7 as Wald-L. All in all, industries that will benefit from ringgit depreciations are 03, 34, 43, 52, 53, 57, 58, 73, 74, 77, 78, and 87. This supports the new definition of the J-curve due to Bahmani-Oskooee and Fariditavana (2015, 2016). If we are to conform to the definition of the J-curve from the linear model, we must also add

industries coded 22, and 71 to the list since in these two cases the POS variable carries a significantly positive coefficient.

The above long-run estimates are meaningful since either the F test or ECM_{t-1} test reported in Table 7 are significant. Furthermore, the Wald-L statistic is significant not just in the largest industry but also in 15 other industries coded 03, 04, 05, 07, 09, 11, 23, 28, 29, 65, 69, 75, 76, 77, 83, and 89, supporting significant long-run asymmetric effects of exchange rate changes on the trade balance of these industries. All other diagnostics are similar to those of the linear models, i.e., there is lack of autocorrelation in most models, most optimum models are correctly specified, estimates are stable, and most models enjoy good fit.

V. Summary and Conclusion

Since the introduction of asymmetry cointegration and error-correction modeling by Shin et al. (2014), the link between the trade balance and the real exchange rate is receiving a renewed attention. This new approach requires separating currency depreciations from appreciations and including nonlinear adjustment of the real exchange rate. The main result from previous research is that the insignificant link between the trade balance and the real exchange rate in linear models could be due to avoiding nonlinear adjustment of the exchange rate.

In this paper we try to support the above conclusion by considering trade between Malaysia and China. Indeed, one previous study considered aggregate trade between the two countries and found no significant link between the bilateral trade balance and the real bilateral ringgit-yuan exchange rate between the two countries. Our claim in this paper is that not only that finding suffer from aggregation bias, but also it could be due to avoiding nonlinear adjustment of the exchange rate. To that end, we disaggregate the trade flows between the two countries by commodity and

consider the trade balance of each of the 59 industries. We first apply the linear ARDL approach of Pesaran et al. (2001) and then apply the nonlinear ARDL approach of Shin *et al.* (2014).

Overall, we find more support for the short-run and long-run importance of the real ringgit-yuan exchange rate from the nonlinear model compared to the linear model. From the linear model, we find significant short-run effects in 21 industries. This number increases to 34 from the nonlinear model. The linear model supports significant long-run effect in 20 industries, whereas, the number increases to 27 in nonlinear models. Furthermore, the nonlinear models reveal that in almost all cases the real bilateral exchange rate was significant, there was evidence of asymmetry in the short-run as well as in the long run. The findings are industry specific and reveal useful information and policy implications. Malaysia has transitioned its economy from agriculture to industry, specializing and gaining advantage in high tech goods like electrical and electronics which constitute more than 25% of the trade with China. Our approach reveals that if we were to rely on the old approach of estimating a linear model, the real ringgit-yuan rate would have no significant long-run effects on the trade balance of this industry and like previous research we would have stopped our investigation here. However, when we introduced nonlinear adjustment of the exchange rate, we find that a real ringgit-yuan depreciation will have favorable effects on the trade balance of this industry in the long run but an appreciation of ringgit-yuan will have no significant effect, a sign of long-run asymmetric effect. All in all, 12 industries will benefit from ringgit depreciation in the long run and these 12 industries engage in 41.4% of the trade between Malaysia and China.

Appendix
Data Sources and Definition of Variables

Monthly data are retrieved over the period March 2001 to December 2015 (178 observations for each variable) from the following sources.

a. Malaysian External Trade Statistics (METS), A Malaysian Department of Statistics database
b. Datastream

Variables

TR_j = Trade balance of industry *j* defined as the ratio of Malaysian imports from China over its exports to China. The sample contains 59 trading industries based on the Standard International Trade Classification (SITC) 2 digit level. The data come from source (*a*).

GFC = Dummy variable to capture the Global Financial Crisis effect such that time 2008=1, otherwise 0.

IPI^{ML} = Industrial production index of Malaysia as a proxy for economic activity in Malaysian economy (source *b*).

IPI^{CH} = Industrial production index of China measures the economic activity in Chinese economy (source *b*).

REX = Bilateral exchange rate defined as the number of Chinese yuan per unit of Malaysian ringgit and adjusted for the relative price levels using CPI data (source b).

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Figure 1: Plot of the Real Exchange Rate (#yuan per ringgit).

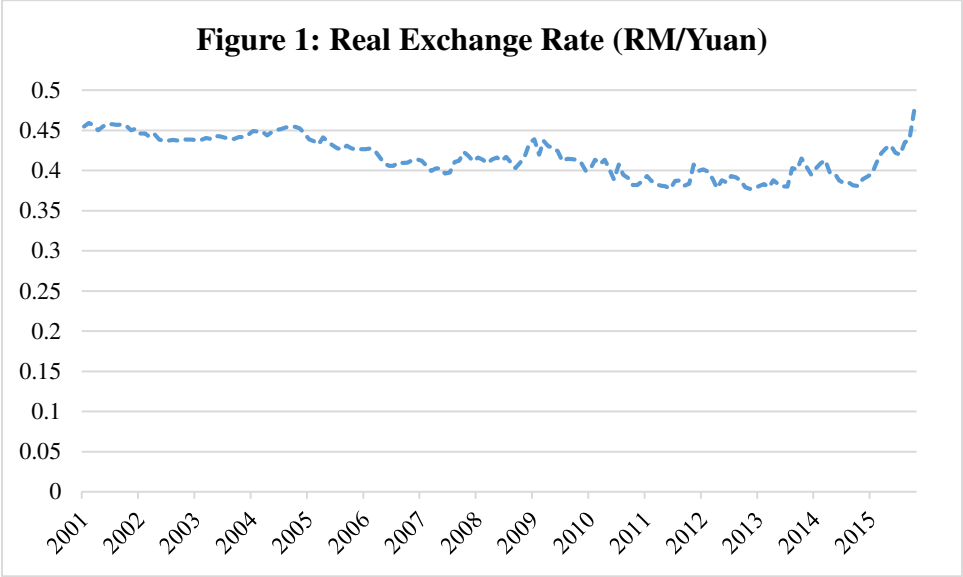

Table 1: Short-Run of the Linear ARDL Model								
Industry	**Short-Run Coefficient Estimates**							
	$\Delta LnREX_t$	$\Delta LnREX_{t-1}$	$\Delta LnREX_{t-2}$	$\Delta LnREX_{t-3}$	$\Delta LnREX_{t-4}$	$\Delta LnREX_{t-5}$	$\Delta LnREX_{t-6}$	$\Delta LnREX_{t-7}$
01-Meat and meat preparations	-9.3669	5.3988	2.4205	-3.6724	18.0528**	2.1313	18.8982**	
03-Fish, crustaceans and molluscs,and preparations thereof	-1.1584							
04-Cereals and cereal preparations	-2.7040							
05-Vegetables and fruits	-1.1136							
06-Sugars, sugar preparations and honey	.8870							
07-Coffee, tea, cocoa, spices, and manufactures thereof	-.2443							
08-Feeding stuff for animals (notincluding unmilled cereals)	-5.6641*							
09-Miscellaneous edible productsandpreparations	-2.2231							
11-Beverages	3.2478							
12-Tobacco and tobacco manufactures thereof	4.0551							
22-Oil seeds and oleaginousfruits	-2.8709	5.6040	-8.8512**					
23-Crude rubber (including synthetic and reclaimed)	2.5581							
24-Cork and wood	-.0495							
26-Textile fibres (other than wool tops) n.e.s.	.9009							
27-Crude fertilizers and crude minerals n.e.s.	-4.6000	4.1867	-4.3906	5.3834	-4.0895	11.4587**		
28-Metalliferous ores and metal scrap	-3.5507							
29-Crude animal and vegetable materials, n.e.s.	1.1847	6.595**						
32-Coal, coke and briquettes	-4.6231							
33-Petroleum, petroleum products and related materials	2.0247							
34-Gas, natural and manufactured	6.7185							
43-Animal or vegetable oils and fats, processed n.e.s.	3.9045	9.5442**	8.8049**	1.1836	3.6945	10.7382**	7.3168**	
51-Organic chemicals	-1.9037							
52-Inorganic chemicals	5.6292**							
53-Dyeing, tanning and colouring materials	1.9375							
54-Medicinal and pharmaceutical products	10.1514**	3.7772	-.2985	-.2067	9.0932*	9.1376	11.1449**	-15.075**
55-Essential oils and resinoids and perfume materials n.e.s.	-1.5931							
56-Fertilizers, manufactured	2.4408	-10.6569*	-13.8201**					
57-Plastics in primary forms	1.4324							
58-Plastics in non-primary forms	1.8843							
59-Chemical materials and products,n.e.s.	.4198							
61-Leather, leather manufactures, n.e.s.	-4.6231							
62-Rubber manufactures, n.e.s.	-6.962**							

63-Cork and wood manufactures(excluding furniture)	-.7564							
64-Paper, paperboard, and articles of paper pulp n.e.s.	-1.8256							
65-Textile yarn, fabrics, made-up aricles, n.e.s.	-.4428							
66-Non-metallic mineral manufactures n.e.s.	2.2266							
67-Iron and steel	.5402							
68-Non-ferrous metals	-1.5543							
69-Manufactures of metal, n.e.s.	.6768							
71-Power generating machinery and equipment	1.5514							
72-Machinery specialized for particular industries	-.2585	.8320	-6.9365**					
73-Metalworking machinery	1.6309							
74-General industrial machinery and equipment, n.e.s.	-.1348	-4.9426**	-.1092	-4.7911**	-6.6904**			
75-Office machines and automatic data processing equipment	-.1098							
76-Telecommunications and sound recording n.e.s.	1.6066	-2.8132**	-2.0668*	.8816	.0866	-3.0215**	2.0557*	
77-Electrical machinery, apparatus and appliances, n.e.s.	-1.2362	-1.3501	-.6864	.1271	-4.0016**			
78-Road vehicles (including air-cushion vehicles)	1.9830	4.0992**	1.5801	4.5594**	6.3589**			
79-Others transport equipment	-.9781							
81-Prefabricated buildings, sanitary, plumbing, heating n.e.s.	3.7431							
82-Furniture and parts thereof	.2545							
83-Travel goods, handbags and similar containers	-2.7317	-.2388	-3.7742	-1.8206	-3.1902	.3447	10.5812**	16.3219**
84-Articles of apparel and clothing accessories	-2.0980							
85-Footwear	11.8748**	12.1853**						
87-Professional instruments and apparatus, n.e.s.	-5.088**	-2.1603	-4.6949**	-4.6632**	-7.1518**			
88-Photographic apparatus, equipment and supplied and optical, n.e.s.	-2.7054							
89-Miscellaneous manufactured articles, n.e.s.	-2.4182**							
93-Special transactions and commodities	.1638	3.5167**	1.3331	2.0131*	3.4136**			
97-Gold, non-monetary	-15.522*							
Notes: **, * show the significance at 5% and 10% respectively. The critical values of standard t-distribution, i.e., 1.64 and 1.96 are used to arrive at * and **, respectively. Abbreviation n.e.s. refers to not elsewhere defined.								

Table 2: Long-Run Estimates of the Linear ARDL Model					
Industry	**Long-Run Coefficient Estimates**				
	Constant	*GFC-08*	$ln\ IPI^{MAY}$	$ln\ IPI^{CHI}$	$ln\ REX_t$
01-Meat and meat preparations	.2452	1.1549	27.0472	-24.5518	-22.5066
03-Fish, crustaceans and molluscs,and preparations thereof	1.2721**	-.3125**	3.099**	-5.2451**	6.3138**
04-Cereals and cereal preparations	-1.3914**	-.5259	-13.0918**	19.1742**	-11.7518**
05-Vegetables and fruits	1.1958*	.8415	-5.4839*	2.3305	.8810
06-Sugars, sugar preparations and honey	14.7595**	.4765	-9.6348**	-3.6269	-5.1246
07-Coffee, tea, cocoa, spices, and manufactures thereof	3.0118**	.2019	-5.4438**	-1.5342	-3.9229
08-Feeding stuff for animals (notincluding unmilled cereals)	14.2732**	.2898**	-5.8817**	-3.1733	-2.8776*
09-Miscellaneous edible productsandpreparations	5.1275**	-.3307**	-1.8275**	-2.2344	-3.2919**
11-Beverages	16.2012**	.5572	-4.3391**	-16.4773**	1.8219
12-Tobacco and tobacco manufactures thereof	14.7775**	-.4793	3.4277**	-11.1241*	-4.7293
22-Oil seeds and oleaginousfruits	3.6625**	.4284	-.9691	-3.3738	6.678*
23-Crude rubber (including synthetic and reclaimed)	4.0437**	-.1658	1.6688	-9.4525*	9.6031**
24-Cork and wood	-11.8685**	.1923	7.6812**	4.5272	-.1642
26-Textile fibres (other than wool tops) n.e.s.	-6.4945**	-.0125	.2782	22.3230	-9.4228
27-Crude fertilizers and crude minerals n.e.s.	12.4208**	-.2886	8.2385**	-24.7627**	-8.67946*
28-Metalliferous ores and metal scrap	.4384**	-.4116	-8.1751**	8.2949*	-3.4835
29-Crude animal and vegetable materials, n.e.s.	-1.3149**	.5406	.0738	5.9392	-10.0724
32-Coal, coke and briquettes	-1.1219**	-.8195	-2.4474	9.4468	-23.2239**
33-Petroleum, petroleum products and related materials	3.9403**	-.0285	2.3805	-5.0583	-3.0329
34-Gas, natural and manufactured	-19.9713**	1.5109**	4.6911	12.0235	16.5544**
43-Animal or vegetable oils and fats, processed n.e.s.	9.52**	.3249	4.4692**	-16.184**	-.4024
51-Organic chemicals	-3.9111**	.1726	1.9391	12.2721	-5.3847
52-Inorganic chemicals	-2.4529**	.0736	-2.0254**	4.6354	3.9762**
53-Dyeing, tanning and colouring materials	3.4211**	.1764**	2.8878**	-5.7642**	1.5804*
54-Medicinal and pharmaceutical products	-23.6857**	.6463**	3.6071**	18.3222**	-4.0283
55-Essential oils and resinoids and perfume materials n.e.s.	4.4791**	-.1783**	1.7736**	-5.0131**	-1.6958
56-Fertilizers, manufactured	-8.8195**	.2496	.9752	10.9689	10.0715
57-Plastics in primary forms	-1.2256**	-.0339	2.6031**	-2.3526	3.7181**
58-Plastics in non-primary forms	2.8493**	.0639	4.4319**	-7.2722**	3.2268**
59-Chemical materials and products,n.e.s.	.2086**	-.0760	1.3222**	-1.8710	1.3466
61-Leather, leather manufactures, n.e.s.	-1.1219**	-.8195	-2.4474	9.4468	-23.2239**

62-Rubber manufactures, n.e.s.	1.4733**	.0258	-1.3801	.3500	-16.7561**
63-Cork and wood manufactures(excluding furniture)	-.3959**	.2379	4.6135**	-4.5523	4.5069
64-Paper, paperboard, and articles of paper pulp n.e.s.	-.4838**	.0448	4.8029**	-4.4347**	1.4934
65-Textile yarn, fabrics, made-up aricles, n.e.s.	2.4819**	.1225	-.6334	-1.7178	-.9926
66-Non-metallic mineral manufactures n.e.s.	-.6201**	.0797	3.9469**	-3.1738	.6178
67-Iron and steel	-6.3034**	.1442	8.5614**	1.8766	.5520
68-Non-ferrous metals	-.5018**	-.0740	.7650	-.6511	1.8111
69-Manufactures of metal, n.e.s.	4.0156**	-.0741	2.3303**	-5.2374**	.6437
71-Power generating machinery and equipment	.8158**	-.0562	2.8042**	-4.0985	4.4963**
72-Machinery specialized for particular industries	-4.9148**	-.0088	2.6931**	2.5426	-.0451
73-Metalworking machinery	6.3807**	.1494	2.1493**	-8.6809**	6.6019**
74-General industrial machinery and equipment, n.e.s.	-.0120	.1267	-1.2803	-.0170	8.8412**
75-Office machines and automatic data processing equipment	3.7134**	.0361	-6.3314	-18.8430	-2.4521
76-Telecommunications and sound recording n.e.s.	5.9099**	-.1166	.998*	-8.1799**	.9714
77-Electrical machinery, apparatus and appliances, n.e.s.	-2.6238**	-.1378	-.6043	7.7332**	-1.0712
78-Road vehicles (including air-cushion vehicles)	3.7221**	-.6497**	4.2779**	-11.918**	-.7291
79-Others transport equipment	-13.4905**	.211**	4.9329	5.0401	2.3417
81-Prefabricated buildings, sanitary, plumbing, heating n.e.s.	.2867**	.8583	4.5780	-3.0566	-8.1640
82-Furniture and parts thereof	7.7036**	.4730	-2.2881	-18.5541**	4.2187
83-Travel goods, handbags and similar containers	26.047**	-.3157	-1.6866	-24.2459**	3.8558
84-Articles of apparel and clothing accessories	1.2889**	.1839	-1.5659**	1.1995	-6.087**
85-Footwear	-.2341**	-.0015	-.0448	.8330	3.3602
87-Professional instruments and apparatus, n.e.s.	-1.3969**	.1650	-1.4589	2.6703	2.3153
88-Photographic apparatus, equipment and supplied and optical goods, n.e.s.,	5.5676**	.4657**	-.7260	-9.959**	6.3773**
89-Miscellaneous manufactured articles, n.e.s.	2.1594**	-.1269	-.7680	-2.6023	.5884
93-Special transactions and commodities	2.1335**	-.5051**	1.0023	-7.4461*	-3.9781
97-Gold, non-monetary	17.3512**	-.1663	-5.9676	-31.801*	9.2739
Notes: **, * show the significance at 5% and 10% respectively. The critical values of standard t-distribution, i.e., 1.64 and 1.96 are used to arrive at * and ** respectively. Abbreviation n.e.s. refers to not elsewhere defined.					

Table 3: Linear ARDL Model Diagnostic Statistics

Industry (Trade Share)	Diagnostics						
	F	ECM_{t-1}	Adj. R^2	LM	RESET	CU	CUQ
01-Meat and meat preparations(0.1496)	1.0070	-.0769(2.5331)	.7433	.0319	2.367*	S	S
03-Fish, crustaceans and molluscs,and preparations thereof(0.4723)	7.0069**	-.5385(6.0813)**	.8135	3.4953*	.7771	U	S
04-Cereals and cereal preparations(0.1874)	3.7012	-.2431(4.3686)**	.8950	1.3989	.0134	U	U
05-Vegetables and fruits(1.2511)	.7447	-.1431(1.7659)	.6355	.4893	4.6742**	S	S
06-Sugars, sugar preparations and honey(0.1351)	4.7564**	-.4804(4.8823)**	.5687	2.2500	6.904**	S	S
07-Coffee, tea, cocoa, spices, and manufactures thereof(0.4888)	1.3218	-.1849(2.6774)	.8572	.0225	.7790	S	S
08-Feeding stuff for animals (notincluding unmilled cereals)(0.1513)	5.5867**	-.6941(5.5571)**	.6020	1.0415	3.0025*	S	S
09-Miscellaneous edible productsandpreparations(0.3974)	8.8408**	-.5275(6.6951)**	.4622	.4007	.6067	U	S
11-Beverages(0.1023)	4.4795**	-.383(5.0336)**	.5048	.1046	5.4139**	S	S
12-Tobacco and tobacco manufactures thereof(0.1015)	23.3707**	-.796(10.5552)**	.1045	.6337	.0590	S	S
22-Oil seeds and oleaginousfruits(0.0479)	9.3593**	-.4369(6.8744)**	.3892	1.5007	1.7955	S	S
23-Crude rubber (including synthetic and reclaimed)(1.2823)	5.0432**	-.3971(5.12)**	.6416	2.876*	1.6066	S	S
24-Cork and wood(0.2605)	4.7217**	-.4401(4.8582)**	.7354	1.4924	4.6269**	S	S
26-Textile fibres (other than wool tops) n.e.s.(0.1052)	2.8706	-.1532(3.7973)**	.7583	.3658	2.863*	S	U
27-Crude fertilizers and crude minerals n.e.s.(0.2061)	3.8601*	-.3366(4.4264)**	.7161	.1018	.0001	S	U
28-Metalliferous ores and metal scrap(2.3065)	4.9257**	-.4424(5.5352)**	.6744	.3472	.4749	S	U
29-Crude animal and vegetable materials, n.e.s.(0.2259)	2.8004	-.1697(3.7687)*	.7430	.8516	.0382	S	S
32-Coal, coke and briquettes(0.1115)	2.5741	-.2398(3.6908)*	.7763	1.7540	.0223	S	S
33-Petroleum, petroleum products and related materials(5.5005)	9.8295**	-.7389(6.9886)**	.0975	.9238	.0535	S	S
34-Gas, natural and manufactured(1.7951)	9.8281**	-.4624(7.0748)**	.4586	.9135	.7964	S	U
43-Animal or vegetable oils and fats, processed n.e.s.(0.6541)	5.4983**	-.4431(5.6146)**	.4586	.4335	1.5969	S	S
51-Organic chemicals(2.5589)	2.6607	-.1408(3.6747)*	.7631	.7084	1.0615	S	U
52-Inorganic chemicals(1.0284)	3.1309	-.4302(3.9956)**	.3975	1.6114	1.8113	S	S
53-Dyeing, tanning and colouring materials(0.2971)	8.1714**	-.6425(6.9157)**	.6538	1.0095	4.8616**	S	S
54-Medicinal and pharmaceutical products(0.3216)	4.349*	-.5652(4.7338)**	.3484	1.0929	1.2051	S	S
55-Essential oils and resinoids and perfume materials n.e.s.(0.3455)	14.347**	-.6198(8.5821)**	.4894	.0487	.1049	U	S
56-Fertilizers, manufactured(0.4258)	5.4171**	-.3433(5.2091)**	.4044	.0769	2.8584*	U	S
57-Plastics in primary forms(2.5989)	3.3051	-.4314(4.5681)**	.7325	.4455	.6407	S	S
58-Plastics in non-primary forms(0.6024)	11.0734**	-.6412(7.6495)**	.8800	.0326	.4667	S	S
59-Chemical materials and products,n.e.s.(1.136)	5.4509**	-.4129(5.3623)**	.3972	.1240	6.5315**	S	S
61-Leather, leather manufactures, n.e.s. (0.0283)	2.5741	-.2398(3.6908)*	.7763	1.7540	.0223	S	S
62-Rubber manufactures, n.e.s.(1.1374)	2.3288	-.1915(3.7573)*	.8564	1.1938	2.0927	S	U

63-Cork and wood manufactures(excluding furniture)(0.2889)	2.0021	-.1707(3.1068)	.8624	2.7685*	2.4753	S	S
64-Paper, paperboard, and articles of paper pulp n.e.s. (0.6186)	11.5191**	-.5043(7.8656)**	.7540	.3091	.7603	S	U
65-Textile yarn, fabrics, made-up aricles, n.e.s. (1.63)	6.9215**	-.4315(5.9415)**	.4084	1.0757	1.3657	S	S
66-Non-metallic mineral manufactures n.e.s.(1.1216)	4.4499**	-.3889(4.9107)**	.7559	1.4450	9.7109**	S	S
67-Iron and steel(3.2187)	3.8141*	-.2963(4.2474)**	.7175	.0092	1.9064	S	S
68-Non-ferrous metals(3.9501)	9.6073**	-.6427(6.9919)**	.5494	.0354	.4975	S	U
69-Manufactures of metal, n.e.s.(2.5583)	4.7583**	-.6475(5.6032)**	.6807	1.6521	2.6056	S	S
71-Power generating machinery and equipment(0.8136)	3.4712	-.4692(4.255)**	.5856	.1550	2.7685*	S	U
72-Machinery specialized for particular industries(1.7949)	3.4903	-.4724(4.235)**	.4626	.9649	.0029	U	S
73-Metalworking machinery(0.4359)	5.7297**	-.5695(5.6205)**	.5544	.3877	2.3997	S	U
74-General industrial machinery and equipment, n.e.s. (4.12)	6.0981**	-.2782(5.4203)**	.6361	2.0874	.0010	S	U
75-Office machines and automatic data processing equipment(7.0426)	3.5818	-.0699(4.5165)**	.8571	2.981*	.0570	S	S
76-Telecommunications and sound recording n.e.s.(5.1674)	7.9672**	-.3994(6.4702)**	.7235	.9576	.7878	S	S
77-Electrical machinery, apparatus and appliances, n.e.s. (27.6279)	3.3509	-.1847(4.1394)**	.7375	.6404	.0074	S	S
78-Road vehicles (including air-cushion vehicles)(1.4914)	3.3341	-.2314(4.4693)**	.7537	.6388	2.9347*	S	U
79-Others transport equipment(0.7802)	5.4437**	-.6509(5.1214**	.1909	1.7102	1.8963	S	S
81-Prefabricated buildings, sanitary, plumbing, heating n.e.s.(0.3648)	4.6805**	-.3258(4.7824)**	.4489	.8026	3.0487*	S	S
82-Furniture and parts thereof(0.629)	2.0355	-.1842(3.9847)**	.6213	1.1300	.1131	S	S
83-Travel goods, handbags and similar containers(0.4329)	4.1796*	-.4829(4.4917)**	.4188	.5335	5.6722**	S	S
84-Articles of apparel and clothing accessories(1.9272)	4.6037**	-.3241(4.8647)**	.7402	.0890	2.6920	S	S
85-Footwear(0.4809)	3.738	-.5144(4.3779)**	.2168	.1207	3.5679*	S	S
87-Professional instruments and apparatus, n.e.s.(2.2879)	7.012**	-.4283(5.9049)**	.4714	1.3313	2.3606	S	U
88-Photographic apparatus, equipment and supplied and optical goods, n.e.s.,(0.525)	2.7344	-.2756(4.1227)**	.6957	.6200	.6359	S	U
89-Miscellaneous manufactured articles, n.e.s.(1.8919)	6.3868**	-.2981(5.7208)**	.5267	1.2921	2.8732*	S	U
93-Special transactions and commodities (0.3208)	2.7278	-.1409(3.9092)**	.8018	.1282	3.8298*	S	U
97-Gold, non-monetary(0.0003)	4.4153**	-.2367(4.7954)**	.6387	.3036	.0736	S	S

Notes:
a. At the 10% (5%) significance level when there are three exogenous variables (k=3), the critical value of the F test is 3.77 (4.35). These come from Pesaran et al. (2001, Table CI-Case III, page 300). * (**) indicates a significant statistic at the 10% (5%) level..
b. LM is the 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%) level is 2.71 (3.84).
c. RESET is Ramsey's test for misspecification. It is distributed as $\chi 2$ with one degree of freedom and its critical value at 10% (5%) level is 2.71 (3.84).
d. CU and CUQ are CUSUM and CUSUMQ respectively to test for stability of all coefficients.
e. Number inside the parenthesis next to ECMt-1 is the absolute value of the t-ratio. Its critical value at the 10% (5%) significance level is -3.46 (-3.78). These come from Pesaran et al. (2001, Table CII-Case III, page 303).
f. Abbreviation n.e.s. stands for not elsewhere defined.
g. Trade share is in percentage calculated for the year 2015.

Table 4: Short-Run Estimates (Appreciation) from Nonlinear ARDL Model								
Industry	**Short-Run Coefficient Estimates**							
	ΔPOS_t	ΔPOS_{t-1}	ΔPOS_{t-2}	ΔPOS_{t-3}	ΔPOS_{t-4}	ΔPOS_{t-5}	ΔPOS_{t-6}	ΔPOS_{t-7}
01-Meat and meat preparations	-20.4859*	21.4404**	-19.2417*	-1.74748	24.9978**	19.6397*		
03-Fish, crustaceans and molluscs,and preparations thereof	-8.4283**							
04-Cereals and cereal preparations	-8.5817							
05-Vegetables and fruits	-1.9101							
06-Sugars, sugar preparations and honey	-.5194							
07-Coffee, tea, cocoa, spices, and manufactures thereof	-4.2786							
08-Feeding stuff for animals (notincluding unmilled cereals)	-14.6151**	-10.9101*						
09-Miscellaneous edible productsandpreparations	-4.3001							
11-Beverages	-2.7286							
12-Tobacco and tobacco manufactures thereof	-13.6863							
22-Oil seeds and oleaginousfruits	15.1866*							
23-Crude rubber (including synthetic and reclaimed)	9.5408							
24-Cork and wood	.2239							
26-Textile fibres (other than wool tops) n.e.s.	-7.3298							
27-Crude fertilizers and crude minerals n.e.s.	-4.2972							
28-Metalliferous ores and metal scrap	-8.7454							
29-Crude animal and vegetable materials, n.e.s.	3.5529	15.3257**	-11.8723**					
32-Coal, coke and briquettes	-28.6947**							
33-Petroleum, petroleum products and related materials	4.7203	-28.8276**	49.4696**					
34-Gas, natural and manufactured	.9709							
43-Animal or vegetable oils and fats, processed n.e.s.	16.2764**	-8.0284	12.1271**					
51-Organic chemicals	-6.8597	14.9907**						
52-Inorganic chemicals	.7894							
53-Dyeing, tanning and colouring materials	2.3549							
54-Medicinal and pharmaceutical products	6.8065	9.1868	-9.04234	12.23128	24.6995**	19.6799**	22.8634**	-28.8891**
55-Essential oils and resinoids and perfume materials n.e.s.	.3067							
56-Fertilizers, manufactured	18.1376							
57-Plastics in primary forms	2.5712							
58-Plastics in non-primary forms	3.9711							
59-Chemical materials and products,n.e.s.	-2.8267							
61-Leather, leather manufactures, n.e.s.	41.3986**	-41.8417**	-6.8638	34.6039**	35.8713**			
62-Rubber manufactures, n.e.s.	-5.7722							

63-Cork and wood manufactures(excluding furniture)	-3.0784	2.5109	-2.33963	4.0174	7.0839***	7.3241**		
64-Paper, paperboard, and articles of paper pulp n.e.s.	-3.1837	8.4018**						
65-Textile yarn, fabrics, made-up aricles, n.e.s.	-5.4905**	1.2674	-4.4819**					
66-Non-metallic mineral manufactures n.e.s.	3.466071							
67-Iron and steel	3.729702							
68-Non-ferrous metals	3.7080							
69-Manufactures of metal, n.e.s.	-1.5293							
71-Power generating machinery and equipment	1.352574	-8.1956*						
72-Machinery specialized for particular industries	-.15968	4.3260	-12.9103**					
73-Metalworking machinery	2.945							
74-General industrial machinery and equipment, n.e.s.	.2635							
75-Office machines and automatic data processing equipment	-2.6091							
76-Telecommunications and sound recording n.e.s.	-.1382							
77-Electrical machinery, apparatus and appliances, n.e.s.	-1.5686	2.0322	3.95*	-.3090	-8.0423**			
78-Road vehicles (including air-cushion vehicles)	-3.2189							
79-Others transport equipment	7.9988	-3.9138	41.8405**	32.0077**	23.9902*			
81-Prefabricated buildings, sanitary, plumbing, heating n.e.s.	11.5876	6.5409	-7.6814	39.1829**	6.8595	16.5708	32.9453**	
82-Furniture and parts thereof	-.1370							
83-Travel goods, handbags and similar containers	-19.6887**	2.2077	-7.9906	-3.8305	-6.1338	3.6942	13.2791	27.3973**
84-Articles of apparel and clothing accessories	-4.2740							
85-Footwear	9.6832	34.3684**						
87-Professional instruments and apparatus, n.e.s.	-9.4381**	6.8410	-8.7682**					
88-Photographic apparatus, equipment and suppliedn.e.s.	4.7647	-4.0277	4.3515	12.5736**				
89-Miscellaneous manufactured articles, n.e.s.	-7.1438**							
93-Special transactions and commodities	.1542							
97-Gold, non-monetary	-17.7505							
Notes: * (**) show the significance at 10% (5%) respectively. The critical values of standard t-distribution, i.e., 1.64 and 1.96 are used to arrive at * and **, respectively. Abbreviation n.e.s. refers to not elsewhere defined.								

Table 5: Short-Run Estimates (Depreciation) from Nonlinear ARDL Model								
Industry	**Short-Run Coefficient Estimates**							
	ΔNEG_t	ΔNEG_{t-1}	ΔNEG_{t-2}	ΔNEG_{t-3}	ΔNEG_{t-4}	ΔNEG_{t-5}	ΔNEG_{t-6}	ΔNEG_{t-7}
01-Meat and meat preparations	-3.9237							
03-Fish, crustaceans and molluscs,and preparations thereof	3.1194							
04-Cereals and cereal preparations	1.0235							
05-Vegetables and fruits	-.0197							
06-Sugars, sugar preparations and honey	1.8104							
07-Coffee, tea, cocoa, spices, and manufactures thereof	1.5381							
08-Feeding stuff for animals (notincluding unmilled cereals)	.3695							
09-Miscellaneous edible productsandpreparations	.7219							
11-Beverages	-.2967							
12-Tobacco and tobacco manufactures thereof	15.4072	-6.0735	-33.797**	11.4130	-29.2102**			
22-Oil seeds and oleaginousfruits	-16.15**	12.6161**	-15.18**	-11.351**				
23-Crude rubber (including synthetic and reclaimed)	-2.7106							
24-Cork and wood	-.1249							
26-Textile fibres (other than wool tops) n.e.s.	6.3743							
27-Crude fertilizers and crude minerals n.e.s.	-3.4757	8.5611	.3052	12.2752**	.3071	22.1182**	16.7301**	
28-Metalliferous ores and metal scrap	-.4811							
29-Crude animal and vegetable materials, n.e.s.	-1.2251							
32-Coal, coke and briquettes	13.1771*	21.6293**	14.7715*	19.7012**	14.4235*	15.44*		
33-Petroleum, petroleum products and related materials	6.5530							
34-Gas, natural and manufactured	10.3655							
43-Animal or vegetable oils and fats, processed n.e.s.	-1.3436	16.3044**						
51-Organic chemicals	-1.3593	-14.603**	-3.3550	.4938	-8.3513**	1.8546	-2.0192	13.1119**
52-Inorganic chemicals	8.8925**							
53-Dyeing, tanning and colouring materials	1.7442							
54-Medicinal and pharmaceutical products	8.4260							
55-Essential oils and resinoids and perfume materials n.e.s.	-3.0560							
56-Fertilizers, manufactured	-8.5748	-14.0885*	-17.2431**					
57-Plastics in primary forms	.6767							
58-Plastics in non-primary forms	.5768							
59-Chemical materials and products,n.e.s.	.7664							
61-Leather, leather manufactures, n.e.s.	.7742	33.2703**	18.6477*					
62-Rubber manufactures, n.e.s.	-7.2611**	-3.9462	2.8437	-.0854	-5.3876	6.3272*	-2.4513	10.9569**

63-Cork and wood manufactures(excluding furniture)	-.9610							
64-Paper, paperboard, and articles of paper pulp n.e.s.	-1.7751	-6.8064**						
65-Textile yarn, fabrics, made-up aricles, n.e.s.	1.9771							
66-Non-metallic mineral manufactures n.e.s.	1.4126							
67-Iron and steel	-1.4298							
68-Non-ferrous metals	-1.6692	11.4445**	13.9211**	7.6294**	5.3428*	11.1829**	7.9279**	
69-Manufactures of metal, n.e.s.	2.1958	3.4437**						
71-Power generating machinery and equipment	-1.5844							
72-Machinery specialized for particular industries	-.3723							
73-Metalworking machinery	.8674							
74-General industrial machinery and equipment, n.e.s.	-2.4336	-10.309**	-.7657	-9.8339**	-10.32**			
75-Office machines and automatic data processing equipment	1.2622							
76-Telecommunications and sound recording n.e.s.	2.2616	-3.439**	-1.2195	1.6679	.2121	-3.8979**	3.7488**	
77-Electrical machinery, apparatus and appliances, n.e.s.	-.9290	-4.5272**	-4.4282**					
78-Road vehicles (including air-cushion vehicles)	3.3191							
79-Others transport equipment	-2.6868							
81-Prefabricated buildings, sanitary, plumbing, heating n.e.s.	-11.6889							
82-Furniture and parts thereof	.4765							
83-Travel goods, handbags and similar containers	8.0304							
84-Articles of apparel and clothing accessories	-.3687							
85-Footwear	10.8816							
87-Professional instruments and apparatus, n.e.s.	-4.8695	-8.1065**	-2.3365	-6.2545**	-8.688**			
88-Photographic apparatus, equipment and supplied and optical goods, n.e.s.,	-7.2067**							
89-Miscellaneous manufactured articles, n.e.s.	.0654							
93-Special transactions and commodities	-.3852	3.6375**	.5016	.4993	2.6028	-2.8389	-.0899	-6.1243**
97-Gold, non-monetary	-13.7554							
Notes: * and ** show the significance at 10% (5%) level respectively. The critical values of standard t-distribution, i.e., 1.64 and 1.96 are used to arrive at *, and **, respectively. Abbreviation n.e.s. refers to not elsewhere defined.								

Table 6: Long-Run Coefficient Estimates of Nonlinear ARDL Model						
Industry	**Long-Run Coefficient Estimates**					
	C	*GFC-08*	$ln\ IPI^{ML}$	$ln\ IPI^{CH}$	POS_t	NEG_t
01-Meat and meat preparations	.3211**	1.3541*	-10.216*	10.1099	6.6465	-1.2829
03-Fish, crustaceans and molluscs,and preparations thereof	-2.5728**	-.1060	1.6024*	.6704	5.3932**	4.13086**
04-Cereals and cereal preparations	8.7222**	-.7317**	-3.3548	-6.7599	-8.0336**	-2.0841
05-Vegetables and fruits	6.6251**	.2819	3.3490	-19.8796	4.8436	10.5279
06-Sugars, sugar preparations and honey	14.3634**	.4731	-9.4651**	-4.2725	-5.0513	-4.9376
07-Coffee, tea, cocoa, spices, and manufactures thereof	8.4696**	-.1461	-1.9449**	-8.8986**	-3.1413	-.7868
08-Feeding stuff for animals (notincluding unmilled cereals)	15.2699**	.3284**	-6.0139**	-3.1608	-2.2934	-2.4565
09-Miscellaneous edible productsandpreparations	10.4499**	-.5407**	1.2512	-9.0336**	-2.1889*	-.2746
11-Beverages	14.063**	.4669**	-5.7623**	-3.0382	.7557	-.9322
12-Tobacco and tobacco manufactures thereof	11.2409**	-.2000	-1.5737	-4.7837	-3.0641	-4.3695
22-Oil seeds and oleaginousfruits	1.8099**	.6743**	-5.7686**	4.6800	8.6558**	6.9631
23-Crude rubber (including synthetic and reclaimed)	-9.4237**	-.0354	-5.5809**	13.1899**	6.8366**	2.4524
24-Cork and wood	-10.9576**	.1656	8.1693**	2.9263	.0249	.3445
26-Textile fibres (other than wool tops) n.e.s.	-3.8844**	-.5463	9.1444	2.8484	-7.9311	-3.041
27-Crude fertilizers and crude minerals n.e.s.	12.3782**	-.0053	5.6716**	-19.0448**	-11.0191**	-13.8931**
28-Metalliferous ores and metal scrap	7.7121**	-.6802**	-3.6452*	-3.4526	-2.2887	.5626
29-Crude animal and vegetable materials, n.e.s.	4.1126**	.0173	9.7270	-21.2825	-4.2042	2.3548
32-Coal, coke and briquettes	-4.1742**	-.4765	1.0923	5.1187	-37.0521**	-39.5604**
33-Petroleum, petroleum products and related materials	25.6324**	-.4814	7.7986**	-25.8175**	-2.9729	.4163
34-Gas, natural and manufactured	-14.7109**	1.4192**	6.5321	7.2819	17.1808**	18.3601**
43-Animal or vegetable oils and fats, processed n.e.s.	11.2006**	.2110	7.6162*	-24.6062**	5.6815*	8.5077**
51-Organic chemicals	-1.2465**	-.1409	2.4086	1.0798	4.3559	8.0645
52-Inorganic chemicals	-1.0226**	.0828	-1.4524	3.1334	3.9758**	4.1909*
53-Dyeing, tanning and colouring materials	5.5968**	.1245	3.8758**	-8.1596**	1.9021**	2.5159**
54-Medicinal and pharmaceutical products	-12.0595**	.1628	5.3756**	5.1210	-2.1842	.3430
55-Essential oils and resinoids and perfume materials n.e.s.	.3828**	-.1158	.5262	-.8229	-2.1689**	-2.9914**
56-Fertilizers, manufactured	-16.9539**	.2826	-4.1043	26.0009*	7.8545	5.3575
57-Plastics in primary forms	-2.0246**	.0225	1.6817**	-.1917	3.3496**	2.7736**
58-Plastics in non-primary forms	2.6516**	.0838	3.9908**	-6.0726**	3.0809**	2.8056**
59-Chemical materials and products,n.e.s.	-.4897**	.0702	-.0724	.6021	.8615	.1488
61-Leather, leather manufactures, n.e.s.	-24.4803**	.4852	6.6369*	19.0418*	-1.5524	-.0976
62-Rubber manufactures, n.e.s.	1.5179**	-.0385	-3.2714	-.6219	-15.2648**	-16.0172**

63-Cork and wood manufactures(excluding furniture)	-1.7175**	.2354	2.9550	.4426	1.6324	.6604
64-Paper, paperboard, and articles of paper pulp n.e.s.	-.1692**	.0335	4.6623**	-4.2385	1.9248	2.1112
65-Textile yarn, fabrics, made-up aricles, n.e.s.	.7256**	.166**	-1.3148**	.9291	-1.3135*	-1.9322**
66-Non-metallic mineral manufactures n.e.s.	.1064**	.0200	4.2207**	-4.2605	.5670	.7574
67-Iron and steel	-6.0739**	.1305	8.8426**	1.0670	.6530	.8326
68-Non-ferrous metals	1.9813**	.0319	3.2366**	-5.3394	.9093	.7873
69-Manufactures of metal, n.e.s.	2.0768**	-.0121	1.4513**	-2.7099*	-.2518	-.9902
71-Power generating machinery and equipment	-1.7995**	-.0451	.8797	1.4187	3.4287**	2.1703
72-Machinery specialized for particular industries	-2.4269**	-.1065	4.6495**	-1.9809	-.1917	.7413
73-Metalworking machinery	8.3062**	.1249	2.603*	-9.6961**	6.7429**	7.0184**
74-General industrial machinery and equipment, n.e.s.	1.888**	-.0716	-.6655	-2.1731	9.3206**	10.6653**
75-Office machines and automatic data processing equipment	5.3504**	-.2400	3.4805*	-20.5956**	-2.1606	1.5624
76-Telecommunications and sound recording n.e.s.	2.1493**	-.0249	-1.1696**	-.6872	-.3841	-1.8842*
77-Electrical machinery, apparatus and appliances, n.e.s.	4.5503**	-.4218**	2.9363**	-9.9887**	.8641	3.8165**
78-Road vehicles (including air-cushion vehicles)	5.5453**	-.8377**	4.9691*	-17.0584**	6.1631**	8.1001**
79-Others transport equipment	-24.4358**	.1953	2.7463	11.4326*	-1.7123	-3.03863
81-Prefabricated buildings, sanitary, plumbing, heating n.e.s.	-6.2798**	.4731	7.9068*	-0.1969	-19.0129**	-17.8795**
82-Furniture and parts thereof	8.2009**	.4792	-1.6084	-21.9951	4.5856	5.1373
83-Travel goods, handbags and similar containers	11.0737**	.0172	-6.4743**	1.2669	-.9744	-5.309**
84-Articles of apparel and clothing accessories	1.3236**	.0702	.4368	-1.4430	-4.8707**	-3.6995**
85-Footwear	3.3131**	-.0177	-1.8460	-.08423	4.8167	4.8188
87-Professional instruments and apparatus, n.e.s.	1.9825**	.0942	-.2864	-1.95654	3.0412	4.1557*
88-Photographic apparatus, equipment and supplied and optical goods, n.e.s.,	5.2623**	.438**	-1.5498	-6.4415	3.8476	3.4777
89-Miscellaneous manufactured articles, n.e.s.	-2.6873**	.0993	-3.2412**	7.1555**	-.66373	-2.5413*
93-Special transactions and commodities	2.4855**	-.6539**	1.7598	-10.9802	.5945	2.2584
97-Gold, non-monetary	11.0101**	.4147	-14.0653	-8.5963	2.638	-4.0224
Notes: * (**) show the significance at the 10% and 5% respectively. The critical values of standard t-distribution, i.e., 1.64 and 1.96 are used to arrive at * and **, respectively. Abbreviation n.e.s. refers to not elsewhere defined.						

Table 7: Nonlinear Model Diagnostic Statistics									
Industry (Trade Share)	**Diagnostics**								
	F	ECM_{t-1}	Adj. R^2	LM	RESET	CU	CUQ	Wald-S	Wald-L
01-Meat and meat preparations(0.1496)	3.996*	-.2732(4.9836)**	.7373	.4014	6.984**	S	S	1.0066	.0271
03-Fish, crustaceans and molluscs,and preparations thereof(0.4723)	5.9648**	-.5673(6.1646)**	.8221	3.6023*	.9414	S	S	3.036*	4.4456**
04-Cereals and cereal preparations(0.1874)	4.4767**	-.3711(5.3548)**	.8994	.3148	5.3707**	S	S	.8848	7.2274**
05-Vegetables and fruits(1.2511)	1.6079	-.1834(3.1069)	.6488	.9622	.3601	S	S	.0434	6.2965**
06-Sugars, sugar preparations and honey(0.1351)	3.9403*	-.4791(4.8651)**	.5657	2.2397	6.9808**	S	S	.1054	.0534
07-Coffee, tea, cocoa, spices, and manufactures thereof(0.4888)	1.8298	-.3674(3.8558)*	.8629	.2109	2.8455*	S	S	1.6621	4.937**
08-Feeding stuff for animals (notincluding unmilled cereals)(0.1513)	6.1289**	-.7679(6.0608)**	.6109	.0438	3.4347*	S	S	5.2362**	.2902
09-Miscellaneous edible productsandpreparations(0.3974)	9.0046**	-.6422(7.9838)**	.4856	1.0755	.6437	S	S	.5701	9.6279**
11-Beverages(0.1023)	12.3562**	-.7693(8.5942)**	.3476	2.9805*	2.1522	S	S	.0761	4.5263**
12-Tobacco and tobacco manufactures thereof(0.1015)	17.6419**	-.7909(10.4543)**	.1384	.3166	2.2681	S	S	.1278	.8504
22-Oil seeds and oleaginousfruits(0.0479)	8.4139**	-.487(7.3854)**	.4417	.4532	.1015	S	S	5.9863**	1.0533
23-Crude rubber (including synthetic and reclaimed)(1.2823)	7.3005**	-.5207(6.8031)**	.6658	.0175	.0439	S	S	2.3598	14.3726**
24-Cork and wood(0.2605)	3.931*	-.4428(4.8484)**	.7338	1.3977	4.7232**	S	S	.0784	.5803
26-Textile fibres (other than wool tops) n.e.s.(0.1052)	2.43	-.1643(3.8802)*	.7575	.2004	2.48	S	U	1.2176	.0556
27-Crude fertilizers and crude minerals n.e.s.(0.2061)	4.3808**	-.447(5.7071)**	.7286	3.6277*	1.4337	S	U	7.0509**	2.1963
28-Metalliferous ores and metal scrap(2.3065)	5.7556**	-.5256(6.163)**	.6841	.2877	1.9865	S	U	.7512	3.939**
29-Crude animal and vegetable materials, n.e.s.(0.2259)	2.7456	-.1667(4.0712)**	.7530	.2988	.0023	S	S	.5883	3.5792**
32-Coal, coke and briquettes(0.1115)	4.3263*	-.4096(5.5831)**	.7852	.4267	.7516	S	S	12.0542**	.8993
33-Petroleum, petroleum products and related materials(5.5005)	7.9829**	-.7165(7.0411)**	.1965	.9678	.0197	S	S	.0002	1.0219
34-Gas, natural and manufactured(1.7951)	8.1553**	-.4657(7.0658)**	.4558	.8650	.7793	S	U	.1173	.0123
43-Animal or vegetable oils and fats, processed n.e.s.(0.6541)	4.0242*	-.3496(5.2106)**	.4654	.3202	.7468	S	S	.0121	.5431
51-Organic chemicals(2.5589)	2.2120	-.1571(3.6571)	.7827	1.1353	12.6021**	S	U	1.4735	1.9159
52-Inorganic chemicals(1.0284)	2.4929	-.4228(3.8978)*	.3998	1.2632	.8081	S	S	1.2602	.0060
53-Dyeing, tanning and colouring materials(0.2971)	6.8027**	-.6403(7.0357)**	.6569	.4069	2.8104*	S	S	.0107	.7888
54-Medicinal and pharmaceutical products(0.3216)	3.4365	-.6063(4.6339)**	.3562	1.0867	3.2329*	S	S	1.8429	1.1343
55-Essential oils and resinoids and perfume materials n.e.s.(0.3455)	12.8479**	-.6282(8.7028)**	.4948	.3814	.7792	S	S	.7938	1.5475
56-Fertilizers, manufactured(0.4258)	5.2883**	-.395(5.8571)**	.4131	.3440	2.2113	S	S	5.2536**	.7905
57-Plastics in primary forms(2.5989)	3.5876	-.4895(4.8129)**	.7338	.1714	.0236	S	S	1.0714	.7896
58-Plastics in non-primary forms(0.6024)	9.3842**	-.6687(7.7733)**	.8798	.0598	1.1481	S	S	.8866	.5605
59-Chemical materials and products,n.e.s.(1.136)	4.3657**	-.4055(5.1155)**	.3983	1.7113	2.4669	S	S	.5705	1.7365
61-Leather, leather manufactures, n.e.s. (0.0283)	7.0623**	-.4722(6.7118)**	.5570	.4800	5.0443**	S	S	.7987	.5862
62-Rubber manufactures, n.e.s.(1.1374)	2.1554	-.1915(3.6381)	.8571	1.3026	2.1525	S	U	.4957	.0504

63-Cork and wood manufactures(excluding furniture)(0.2889)	2.1384	-.2223(3.5809)	.8672	.3184	3.0582*	S	S	4.6408**	.0290
64-Paper, paperboard, and articles of paper pulp n.e.s. (0.6186)	12.8365**	-.5158(8.018)**	.7570	.7008	.7578	S	S	1.9696	.0062
65-Textile yarn, fabrics, made-up aricles, n.e.s. (1.63)	10.025**	-.5085(7.8776)**	.4215	.6463	1.5028	S	S	5.2742**	2.6692*
66-Non-metallic mineral manufactures n.e.s.(1.1216)	3.7282	-.3868(4.8719)**	.7532	1.5196	3.7817*	S	S	.0616	.0336
67-Iron and steel(3.2187)	3.1684	-.3026(4.2739)**	.7158	.0093	1.9989	S	S	.4108	.1201
68-Non-ferrous metals(3.9501)	8.1229**	-.4408(6.7573)**	.5739	.0957	1.2292	S	S	16.305**	.1335
69-Manufactures of metal, n.e.s.(2.5583)	5.3675**	-.6774(6.0423)**	.6895	.4832	2.1072	S	S	2.6801*	4.1072**
71-Power generating machinery and equipment(0.8136)	2.9757	-.4475(4.0617)**	.5562	1.1662	.1169	S	U	.1431	1.3166
72-Machinery specialized for particular industries(1.7949)	2.6254	-.4741(4.0134)**	.4684	.3672	.0155	S	S	.5187	1.8598
73-Metalworking machinery(0.4359)	4.7811**	-.5699(5.6242)**	.5520	.3354	2.4422	S	U	.1270	.2861
74-General industrial machinery and equipment, n.e.s. (4.12)	5.9945**	-.3162(5.8534)**	.6467	.9661	.0592	S	U	9.4416**	.3353
75-Office machines and automatic data processing equipment(7.0426)	5.19**	-.1499(5.5719)**	.8651	3.483*	.1101	S	S	2.0303	7.5081**
76-Telecommunications and sound recording n.e.s.(5.1674)	8.8658**	-.5086(7.3278)**	.7434	.2702	.6517	S	S	.2405	18.8706**
77-Electrical machinery, apparatus and appliances, n.e.s. (27.6279)	3.7809*	-.3139(5.0679)**	.7605	.5020	2.3319	S	S	.1537	5.916**
78-Road vehicles (including air-cushion vehicles)(1.4914)	2.4669	-.2219(4.2675)**	.7460	.5359	8.5437**	S	U	1.7371	.3100
79-Others transport equipment(0.7802)	6.4252**	-.8516(6.3592)**	.2499	.9670	4.6227**	S	S	6.4223**	1.2812
81-Prefabricated buildings, sanitary, plumbing, heating n.e.s.(0.3648)	5.0744**	-.4222(5.6947)**	.4933	.0104	3.4063*	S	S	12.0643**	.7168
82-Furniture and parts thereof(0.629)	2.3454	-.1676(3.9141)*	.6191	1.0726	.0705	S	S	.0006	.0764
83-Travel goods, handbags and similar containers(0.4329)	7.5063**	-.8679(6.8044)**	.4558	.3506	3.0229*	S	S	.0009	23.1169**
84-Articles of apparel and clothing accessories(1.9272)	3.4686	-.4086(4.5839)**	.7488	.0517	2.7793*	S	S	.9554	1.5604
85-Footwear(0.4809)	3.9688*	-.5383(4.5911)**	.2285	.0890	.8978	S	S	1.5865	.7913
87-Professional instruments and apparatus, n.e.s.(2.2879)	5.1244**	-.4403(5.5585)**	.4694	.2145	2.0795	S	U	2.7089*	1.4023
88-Photographic apparatus, equipment and supplied and optical goods, n.e.s.,(0.525)	3.5108	-.3149(4.8641)**	.7126	2.8838	.8271	S	U	7.3895**	.1110
89-Miscellaneous manufactured articles, n.e.s.(1.8919)	6.5763**	-.3606(6.3454)**	.5364	.1275	3.021*	S	U	3.7755**	11.7475**
93-Special transactions and commodities (0.3208)	1.4868	-.1278(3.2532)	.8065	.0077	2.6171*	S	U	.0824	.7007
97-Gold, non-monetary(0.0003)	3.8544*	-.2423(4.8388)**	.6363	.2817	.0524	S	S	.0027	1.0535

Notes:
a. At the 10% (5%) significance level when there are three exogenous variables (k=3), the critical value of the F test is 3.77 (4.35). These come from Pesaran et al. (2001, Table CI-Case III, page 300). * (**) indicates a significant statistic at the 10% (5%) level..
b. LM is the 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%) level is 2.71 (3.84).
c. RESET is Ramsey's test for misspecification. It is distributed as $\chi 2$ with one degree of freedom and its critical value at 10% (5%) level is 2.71 (3.84).
d. CU and CUQ are CUSUM and CUSUMQ respectively to test for stability of all coefficients.
e. Number inside the parenthesis next to ECMt-1 is the absolute value of the t-ratio. Its critical value at the 10% (5%) significance level when k=4 is -3.66 (-3.99). These come from Pesaran et al. (2001, Table CII-Case III, page 303).
f. Abbreviation n.e.s. stands for not elsewhere defined.
g. Trade share is in percentage calculated for the year 2015.
h. Both Wald tests are distributed as $\chi 2$ with one degree of freedom. Its critical value at 10% (5%) level is 2.71 (3.84).