Bangladesh's Trade Partners and the J-Curve: An Asymmetry Analysis

BAHMANI-OSKOOEE, Mohsen and Rahman, Mir Obaidur and Kashem, Muhammad

University of Wisconsin-Milwaukee, Department of Economics, United International University, Dhaka, Bangladesh, Department of Economics, Bangladesh Bank, Dhaka, Bangladesh

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Mohsen Bahmani-Oskooee
The Center for Research on International Economics
Department of Economics
The University of Wisconsinin-Milwaukee, Milwaukee, WI
bahmani@uwm.edu

Mir Obaidur Rahman
Department of Economics
School of Business and Economics
United International University, Dhaka, Bangladesh
obaidur@eco.uiu.ac.bd

Mohammad Abul Kashem
Joint Director
Bangladesh Bank
kashem24bb@gmail.com

ABSTRACT

Separating currency appreciations from depreciations and using nonlinear models in recent literature have improved discovering significant link between the trade balance and the exchange rate. We add to this growing literature by considering the experience of Bangladesh with 11 trading partners. When a linear model was used, support for the J-curve effect was present only with one small partner. However, when a nonlinear model was used, support increased to three countries including the largest partner, the U.S. which accounts for more than 12% of Bangladesh's trade. Furthermore, the nonlinear models supported short-run asymmetry adjustment as well as short-run asymmetry effects of exchange rate changes in most cases. However, long-run asymmetric effects were limited to a few.

**Keywords:** Bangladesh, Taka, J-curve, Asymmetry Analysis, 11 Partners

1. Introduction

Methodological advances in economics always encourage researchers to revisit old theories and the link between the trade balance and the exchange rate is no exception. While standard OLS method used to be applied between the trade balance and its determinants, including the exchange rate, introduction of the error-correction modeling approach and co-integration technique opened another path to distinguish the short-run from the long-run effects. Indeed, it is argued in the literature that a devaluation or depreciation could worsen the trade balance in the short run but improve it in the long run, hence the "J-curve" phenomenon. Two review articles by Bahmani-Oskooee and Ratha (2004) and Bahmani-Oskooee and Hegerty (2010) reveal that every country has its own literature and our country of concern, Bangladesh, must be no exception.[1]

Studies related to the experience of Bangladesh with the J-curve effect are rare, perhaps due to lack of data. The two studies that have assessed the impact of currency depreciation on the trade balance of Bangladesh, have both found support for favorable effects of depreciation in the long run, but mixed results in the short run. While Khatoon and Rahman (2009) used annual data over 1972-2006 periods to arrive at their estimates, Aziz (2012) used annual data over the period 1976-2009. Clearly, thirty some observations do not leave us with enough degrees of freedom to make a reliable inference. Furthermore, both studies suffer from aggregation bias in that they have used aggregate trade flows of Bangladesh with the rest of the world. The implication is that a devaluation or depreciation may improve Bangladesh's trade balance with some but not with all trading partners. Thus, in order to identify trading partners against whom a depreciation of Taka will improve Bangladesh's trade balance, we disaggregate Bangladesh's trade flows by its major

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[1] Note that while Magee (1973) and Junz and Rhomberg (1973) introduced the J-curve concept theoretically, Bahmani-Oskooee (1985) introduced a method of testing it.

partners and try to test the J-curve effect at bilateral level. However, in order to learn about importance of each partner in Bangladesh's trade, we plot their trade share in Figure 1 below:[2]

Figure 1: Trade Shares of Each Partner
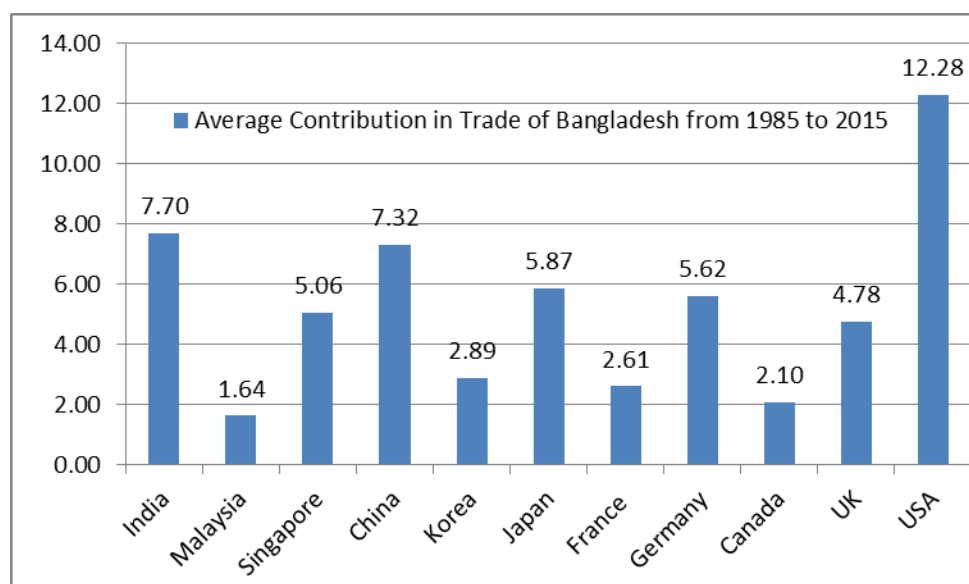
As can be seen, the 11 partners for whom continuous data were available engage in almost 65% of trade with Bangladesh. The U.S. happens to be the largest partner.

Reducing or dismembering   aggregation bias by estimating the trade balance at bilateral level was originally raised against the aggregate literature by Rose and Yellen (1989). However, recently Rose and Yellen (1989) approach was criticized by Bahmani-Oskooee and Fariditavana (2016) for assuming the effects of bilateral exchange rate changes on the bilateral trade balance to be symmetric. After arguing for possibility of asymmetric effects, they provide empirical evidence

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[2] Each trade share is defined as sum of Bangladesh's exports to and imports from each partner as a percent of sum of Bangladesh's exports to and imports from the world.

supporting asymmetric effects of exchange rate changes in the short-run and long-run. Asymmetries arise, as they argue, because of asymmetry pass-through of exchange rate changes to import and export prices and because of change in traders' expectations and behavior. Therefore, our goal in this paper is to assess the asymmetric effects of changes in the value of Taka on the trade balance of Bangladesh with each of her 11 partners depicted in figure 1. For that purpose, in Section II we introduce the models and methods. Empirical results are presented in Section III with a summary in Section IV. Data definition and sources are cited in an Appendix.

2. The Models and Methods

Since Bahmani-Oskooee and Fariditavana's (2016) approach of asymmetry analysis is the latest advance in the trade balance literature, we begin with their specification of the trade balance model first as outlined by (1):

$$LnTB_{i,t} = a + bLnY_{BD,t} + cLnY_{i,t} + dLnREX_{i,t} + \varepsilon_t \qquad (1)$$

where TB_i is Bangladesh's trade balance with trading partner i. Since the model is specified in logarithmic form, the trade balance is defined as the ratio of Bangladesh's imports from partner i over her exports to partner i. The main reason for using the ratio of imports over exports and not the other way around is the definition of the real bilateral exchange rate (REX_i). As the Appendix reveals, it is defined in a manner that a decline signifies Taka depreciation. Thus, if a real depreciation of Taka against partner i's currency is to improve Bangladesh's trade balance with partner i, an estimate of d should be positive. In (1), Y_{BD} denotes Bangladesh's real income and since an increase in it is expected to boost Bangladesh's imports, an estimate of b is expected to

be positive. Finally, Y_i denotes partner i's income and since an increase in it is expected to boost Bangladesh's exports to that partner, and estimate of d is expected to be negative.[3]

The next step in our model building approach is to introduce the short-run dynamic adjustment process into (1) by turning it to an error-correction model as specified by (2):

$$\Delta LnTB_{i,t} = \alpha + \sum_{j=1}^{n} \beta_{t-j} \Delta LnTB_{i,t-j} + \sum_{j=0}^{n} \delta_{t-j} \Delta LnY_{BD,t-j} + \sum_{j=0}^{n} \gamma_{t-j} \Delta LnY_{i,t-j} +$$

$$\sum_{j=0}^{n} \pi_{t-j} \Delta LnREX_{i,t-j} + \lambda_1 LnTB_{i,t-1} + \lambda_2 LnY_{BD,t-1} + \lambda_3 LnY_{i,t-1} +$$

$$\lambda_4 LnREX_{i,t-1} + \mu_t \qquad (2)$$

Specification (2) is an error-correction model where the short-run effects of each variable on the trade balance is inferred by the estimate of coefficients attached to the first-differenced variables and the long-run effects are judged by the estimate of $\lambda_2 - \lambda_4$ normalized on λ_1. However, for these normalized estimates to be meaningful, we must establish co-integration. Since the approach is due to Pesaran et al. (2001), they recommend applying the F test for which they tabulate new critical values. Since the critical values do account for degrees of integration of variables, there is no need for pre-unit root testing and variables could be combination of I(0) and I(1).

The main assumption in (2) is that changes in any of the variables have symmetric effects on the trade balance. Concentrating on the exchange rate, the symmetry assumption implies that Taka depreciation has the same effect on the trade balance as Taka appreciation in size but not in sign. However, Bahmani-Oskooee and Fariditavana (2016) argued to the contrary and for

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[3] Of course, income elasticities could take opposite signs if increase in income is due to an increase in production of import substitute goods (Bahmani-Oskooee 1986).

asymmetric effects since traders' reaction could be different to appreciations as compared to depreciations. They then followed Shin *et al.*'s (2014) approach and changed (2) to a new specification that could be used to assess the asymmetric effects of exchange rate changes as follows:

$$
\Delta LnTB_{i,t} = a' + \sum_{j=1}^{n1} b'_j \Delta LnTB_{i,t-j} + \sum_{j=0}^{n2} c'_j \Delta LnY_{BD,t-j} + \sum_{j=0}^{n3} d'_j \Delta LnY_{i,t-j} + \sum_{j=0}^{n4} e'_j \Delta POS_{t-j}
$$

$$
+ \sum_{j=0}^{n5} f'_j \Delta NEG_{t-j} + \theta_0 LnTB_{i,t-1} + \theta_1 LnY_{BD,t-1} + \theta_2 LnY_{i,t-1} + \theta_3 POS_{t-1}
$$

$$
+ \theta_4 NEG_{t-1} + \xi_t \qquad (3)
$$

As can be seen, in moving from (2) to (3), the *LnREX* variable has been replaced by two new variables, *POS* and *NEG* where *POS* is defined as partial sum of positive *changes* in *LnREX* and reflects only currency appreciation. By the same token, the *NEG* variable is defined as partial sum of negative *changes* in *LnREX* and reflects only Taka depreciations.[4] Since constructing the two partial sum variables introduce nonlinear adjustment of exchange rate changes into our error-correction model, specifications such as (3) are known as nonlinear ARDL models, whereas the ones similar to (2) that assumes symmetric effects are known as the linear ARDL models.

Shin *et al.* (2014) have demonstrated that once (3) is estimated by the OLS, it could be used to assess asymmetric co-integration and several additional asymmetric effects of exchange rate changes on the trade balance. First, the same F test is used to establish joint significance of

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[4] Note that in order to generate the two partial sum variables; we first form $\Delta LnREX_t$ which includes positive and negative changes. Then POS_t at any given period t is defined as cumulative sum all observations in $\Delta LnREX_t$ where negative values are replaced with zeroes. The NEG_t variable is defined the same way where positive values of $\Delta LnREX_t$ are replaced with zeroes. For exact formulation of these two partial sums see Bahmani-Oskooee and Fariditavana (2016).

lagged level variables as a sign of asymmetry co-integration. Here, Shin et al. (2014, p. 291) even recommend treating the POS and NEG variables as a single variable so that the critical values of the F test stay at the same conservative level when we move from (2) to (3), though (3) has one more variable. This is mostly due to dependency between the two partial sum variables. Second, the same alternative test that is used for co-integration in the linear model (2) is also used in the nonlinear model (3). In this alternative test that is known as ECM_{t-1} test, normalized long-run estimates from (3) and a long-run model (1) in which the LnREX is replaced by POS and NEG variables are used to generate the error term, denoted as ECM. After replacing the linear combination of lagged level variables in (3) by ECM_{t-1}, the new specification is estimated at the same optimum lags as before. A significantly negative coefficient attached for ECM_{t-1} will be an alternative way of supporting co-integration. However, just like the F test, 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 upper and lower bound critical values.

Second, if at each lag j, estimate of e'_j is different than estimate of f'_j, that will be an indication of short-run asymmetric effects of exchange rate changes on the trade balance. However, if $\sum \hat{e}'_j \neq \sum \hat{f}'_j$, this will be an indication of short-run cumulative or impact asymmetry. The Wald test will be used to test this inequality. Third, if optimum number of lags on ΔPOS is different than the number of lags on ΔNEG, that will be a sign of short-run "adjustment asymmetry". Finally, if we establish that $-\hat{\theta}_3 / \hat{\theta}_0 \neq -\hat{\theta}_4 / \hat{\theta}_0$, i.e., normalized estimate attached to the POS variable is significantly different than the normalized estimate attached to the NEG variable,

which will be an indication of long-run asymmetric effects. Again, the Wald test will be used to establish this inequality. Both linear and nonlinear models are estimated in the next section.[5]

3. Empirical Results

In this section we estimate both models between Bangladesh and each of her 11 major partners displayed in figure 1. These 11 partners, i.e. China, United States, India, Germany, Singapore, United Kingdom, Canada, France, Japan, Korea and Malaysia engage in almost 65% of total Bangladesh's trade. Quarterly data over the period 1985I-2015IV are used to carry out the empirical exercise. Furthermore, a maximum of four lags are imposed on each first-differenced variable and Akaike's Information Criterion is used to select an optimum model. Since there are different critical values for different estimate (coefficient or diagnostic), they are collected in the notes to Table 1 and are used to indicate significant levels. Any significant estimate at the 10% level is indicated by * and those at 5% level by **. Note also that an estimate of the linear model is headed by L-ARDL and those of the nonlinear model by NL-ARDL.

Table 1 goes about here

From the short-run coefficient estimates of the linear ARDL models that are reported in Panel A, we gather that the real exchange rate carries at least one significant coefficient in the models where Germany, China, and Malaysia are trading partners. However, when we consider the results from nonlinear models, it appears that either ΔPOS or ΔNEG carry at least one significant coefficient in the cases of USA, Canada, France, Germany, India, Japan, Korea, Singapore and Malaysia. Clearly, the increase from three partners in the linear model to nine in

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[5] For more on some other application of these methods see Gogas and Pragidis (2015), Durmaz (2015), Baghestani and Kherfi (2015), Al-Shayeb and Hatemi-J.(2016), Lima et al. (2016), Nusair (2016), Aftab et al. (2017), Arize et al. (2017), and Gregoriou (2017).

the nonlinear model which includes the largest partner, the US, must be attributed to nonlinear adjustment of the real bilateral exchange rate. This by itself supports application of nonlinear models.

In addition to providing relatively more support for the short-run effects of exchange rate changes on Bangladesh's trade balances, the nonlinear models also support short-run adjustment asymmetry in the models that belong to the U.S., U.K., France, Germany, China, India, Japan, Korea, Singapore, and Malaysia since in these cases ΔPOS takes a different lag order than ΔNEG. Furthermore, the size of short-run coefficient estimates attached to ΔPOS and ΔNEG are different at almost all the same lags. This indeed, supports short-run asymmetric effects of exchange rate changes on Bangladesh's bilateral trade balances. However, the sum of coefficients attached to ΔPOS are significantly different than the sum attached to ΔNEG only in the results for the U.S., Canada, Germany, and Singapore since in these cases the Wald statistics reported as the Wald-S in Panel C are significant. Do these short-run asymmetric effects translate into the long run?

The long-run coefficient estimates are reported in Panel B. Estimates from the L-ARDL models reveal that the real bilateral exchange rate carries a significant normalized coefficient only in the results with Canada and Korea. In the case of Canada, while Taka depreciation will improve Bangladesh's trade balance with Canada, in the results with Korea, it will hurt. This could be due to either an inelastic Korean demand for Bangladesh's goods or an inelastic demand by Bangladesh for Korean goods. However, when we shift to NL-ARDL models, we gather that either POS or NEG carry a significant normalized long-run coefficient in the models that belong to the U.S., Canada, UK, and Malaysia. Furthermore, the long-run effects are asymmetric in the cases of the U.S., France, and Malaysia since the Wald test reported as the Wald-L in Panel C are significant only in these cases.

As for the J-curve effect, not much support is found by either model. The linear model supports Rose and Yellen (1989) definition only in the case of Canada since short-run insignificant results are combined with significant and positive long-run estimate for the exchange rate variable. The nonlinear model supports Bahmani-Oskooee and Fariditavana's (2016) definition in the cases of the U.S., Canada, and Malaysia. In the nonlinear models that belong to these three partners, insignificant short-run results are combined with significantly positive coefficient obtained either for POS or NEG variable. Again, separating appreciations from depreciations and introducing nonlinear adjustment of the real bilateral exchange rate is the reason for the increase from one partner to three in which asymmetry J-curve is supported. Clearly, the results are partner-specific. For example, consider the models with the largest partner, the U.S. If we were to rely upon the nonlinear model only, we would have concluded that the real rate has no long-run effects on the trade balance of Bangladesh with the U.S. However, the nonlinear model predicts that while Taka depreciation will have no effect, Taka appreciation will hurt Bangladesh's trade balance with the U.S. On the other hand, the linear Bangladesh-Canadian model predicts that Taka depreciation against Canadian dollar will improve the bilateral trade balance and Taka appreciation will hurt it. However, the nonlinear model reveals that there is no room for Taka depreciation to be effective but Taka appreciation will hurt the bilateral trade balance.

All long-run estimates reviewed above as well as significant long-run income elasticities are valid since co-integration among variables of both models are supported by the F test. As can be seen, all F statistics reported in Panel C are significant. We have also reported a few additional diagnostic statistics in Panel C. To test for autocorrelation, we have reported the Lagrange Multiplier statistics as LM. Since it is insignificant in all models, residuals are autocorrelation free in every linear and nonlinear model. To identify misspecified models, we have reported Ramsey's

RESET test. It is significant only in the bilateral models with Germany, leaving the remaining optimum models as correctly specified. To establish stability of short-run and long-run coefficient estimates we have applied the well-known CUSUM and CUSUMSQ and indicated these tests by CS and CS^2 in Panel C. Stable estimates are identified by "S" and unstable ones by "UNS". As can be seen, most estimates are stable. Lastly, the size of adjusted R^2 is reported to judge the goodness of fit.

4. Summary and Conclusion

The link between the trade balance and the real exchange rate has now entered into a new path due to introduction of possibility of asymmetric response of the trade balance to exchange rate changes. The evidence in the literature is abundant enough to expect asymmetric response. Since asymmetry analysis necessitates application of nonlinear models, nonlinear adjustment of the real exchange rate is said to be the main contributing factor. In this paper we add to the growing literature by considering experience of Bangladesh, a country that has been ignored by most previous studies, perhaps being small or due to lack of continuous time-series data.

Using quarterly data over the period 1985Q1-2015Q4 we consider the bilateral trade balances of Bangladesh with each of her 11 major trading partners. Together, these 11 partners engage in 65% of Bangladesh trade and the list ranked in terms of declining order include the U.S. (12.28%), India (7.7%), Canada (7.32%), Japan (5.87%), Germany (5.62%), Singapore (5.06%), U.K. (4.78%), Korea (2.89%); France (2.61%), Canada (2.1%), and Malaysia (1.64%).

When we applied the linear ARDL approach of Pesaran *et al.* (2001) to 11 trade balance models, we were able to find support for the J-curve effect, i.e., negative or insignificant short-run effects combined with significantly positive effects of exchange rate on the trade balance, only in

the model with Canada. However, when we separated currency appreciations from depreciations and relied upon Shin *et al.*'s (2014) nonlinear ARDL approach, support for the J-curve increased to three countries, i.e., U.S., Canada, and Malaysia. Estimates of the nonlinear models yielded additional information with regards to asymmetric effects of exchange rate changes. With most partners, short-run effects were asymmetric but long-run asymmetric effects were limited to a few partners only. Future research should concentrate on Bangladesh trade with each major partner but disaggregate trade flows by commodity in order to determine how each industry responds to asymmetric effects of exchange rate changes.

Appendix
Data Definition and Sources

Quarterly data over the period 1985Q1-2015Q4 are used to carry out the empirical exercise for all the countries. The following sources were used to collect the required data:

a. International Financial Statistics, IMF.
b. Bangladesh Bureau of Statistics.
c. Direction of Trade Statistics (DOTS), IMF
d. European Central Bank webpage,
    https//wwwecb.europa.eu/press/pr/date/1998/html/pr98123-2.en.html

Variables:

TB_i = Bangladesh's trade balance with partner i. This is defined as Bangladesh imports from the partner i over her exports to partner i. *(M^i/X^i)*. Data come from source c.

Y_i = Real GDP of partner i (base year 2010). The data come from source a.

Y^{BD} = Real GDP of Bangladesh. Quarterly real GDP data are not available for Bangladesh, they were generated following an interpolation method by Bahmani-Oskooee (1986, p. 23).

REX = Real bilateral exchange rate defined as (P^{BD}. NEX)/P^i where NEX is the nominal bilateral exchange rate defined as the number of units of partner i's currency per unit of Taka. Thus, a decline in REX reflects a real depreciation of the Bangladeshi Taka. Consumer Price Index (CPI) of Bangladesh is from Source b and for other countries the source is a. The base year price level for all countries is 2010.

All nominal bilateral exchange rates between Taka and country i's currency were generated using the rates against the U.S. dollar. All data come from source a.
For Germany, Euro per USD was created for the pre 1998 period using conversion rate of 1.95583 Deutsche Mark = 1 Euro and for France, 6.55957 Fr Frank = 1 Euro. These conversion rates come from source d.

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Table 1: Full-Information Estimates of Both Linear ARDL (L-ARDL) and Nonlinear ARDL (NL-ARDL) Models (notes at the end)						

Panel A: Short–Run Estimates						
	i = USA		i=Canada		i=UK	
	L - ARDL	**NL - ARDL**	**L - ARDL**	**NL - ARDL**	**L - ARDL**	**NL - ARDL**
	Coefficient	**Coefficient**	**Coefficient**	**Coefficient**	**Coefficient**	**Coefficient**
$\Delta \ln Y_{BD,t}$	0.38 (0.89)	0.45 (1.08)	1.95 (2.83)**	2.04 (2.85)**	-0.22(0.61)	-0.28 (0.78)
$\Delta \ln Y_{BD,t-1}$	0.31 (0.52)	0.28 (0.48)		-1.01 (0.99)	-0.71(1.82)*	-0.81 (2.09)**
$\Delta \ln Y_{BD,t-2}$	1.45 (2.53)**	1.35 (2.26)**		-2.23 (2.38)**		
$\Delta \ln Y_{BD,t-3}$	1.12 (2.00)**	1.21 (2.09)**		-1.42(1.97)**		
$\Delta \ln Y_{BD,t-4}$	0.73 (1.70)*	0.99 (2.27) **				
$\Delta \ln Y_{i,t}$	1.87 (0.35)	3.95(0.66)	-4.55 (0.69)	-11.22 (1.35)	0.10(1.66)*	0.13 (1.98)*
$\Delta \ln Y_{i,t-1}$				12.09 (1.54)		0.03(0.41)
$\Delta \ln Y_{i,t-2}$						0.12(1.80)*
$\Delta \ln Y_{i,t-3}$						
$\Delta \ln REX_{i,t}$	1.80(0.94)		2.43(1.33)		-0.67 (0.84)	
ΔPOS_t		-23.49 (2.63)**		-6.01 (1.78)*		0.28 (0.20)
ΔPOS_{t-1}		-18.68(2.54)**				
ΔPOS_{t-2}		-14.33(2.61)**				
ΔPOS_{t-3}		-7.72 (1.81)*				
ΔNEG_t		5.11(0.83)		4.26(1.07)		-0.61(0.39)
ΔNEG_{t-1}		4.04(0.89)				-1.14 (0.51)
ΔNEG_{t-2}		7.14(2.23)**				-1.67 (1.35)
Panel B: Long–Run Estimates						
ln Y $_{BD}$	0.92 (1.79)*	1.10 (2.24)**	0.90 (1.04)	1. 94(1.91)*	0.68(1.83)*	0.69 (2.36) **
ln Y_i	-2.25 (2.87) **	3.02 (3.81) ***	-2.07(1.99)**	-2.23(2.04)**	0.15(0.30)	-0.02(0.30)
ln REX_i	0.70 (1.21)		0.86 (1.80)*		-0.17(0.53)	
POS		22.85(2.53)**		7.13(1.91)**		-2.65(1.66)*
NEG		-5.93(0.81)		-0.15 (0.03)		1.03(0.32)
Constant	23.23 (3.24)**	27. 94(3.95)**	47.29(2.18)**	41.44(2.00)**	-4. 27(1.36)	-3.42(2.27)**
Panel C: Diagnostic Statistics						
F	25.00**	21.24**	15.57**	13.40**	5.53***	4.47***
LM	0.53	1.21	0.50	0.81	6.48	1.92
RESET	1.32	0.89	1.85	1.95	0.82	1.66
AdjustedR^2	0.52	0.54	0.47	0.48	0.28	0.29
CS (CS^2)	S(S)	S(UNS)	S(S)	S(S)	S(S)	S(S)
WALD – S		6.22**		2.84*		0.98
WALD – L		8.09**		0.80		0.92

Notes:

a) Numbers inside the parentheses are absolute value of the t-ratios. ***, ** and * indicate, 1%, 5% and 10% significance levels, respectively.

b) The upper bound critical value of the F-test for cointegration when there are three exogenous variables is 3.77 (4.35) at the 10 % (5%) statistical level. These come from Pesaran et al (2001, Table CI, Case, P 300)

c) The critical value for significance of ECM_{t-1} is -3.47 (-3.82) at the 10 % (5%) level when k = 3. The comparable figures when k = 4 are -3.67 and 4.03, respectively. There come from Banarjee et al (1998, Table 1)

d) LM is the Lagrange multiplier test for serial correlation. It has a $\chi 2$ distribution with 4 degrees of freedom. The critical value at the 5% level of significance is 9.48.

e) RESET is Ramsey's specification test. It has a $\chi 2$ distribution with one degree of freedom. The critical value at the 5% level of significance is 3.84 and at the 10% level it is 2.70.

f) f) Both WALD tests also have a $\chi 2$ distribution with one degree of freedom. The critical value is 3.84 at the 5 % level and 2.70 at the 10% level. .

	i = France		i=Germany		i=China	
	L - ARDL	**NL - ARDL**	**L - ARDL**	**NL - ARDL**	**L - ARDL**	**NL - ARDL**
Panel A: Short–Run Estimates						
$\Delta\ln Y_{BD,t}$	0.94(1.61)	1.81(2.55)**	0.37(0.77)	0.24(0.54)	-1.47(1.71)*	-0.65(0.93)
$\Delta\ln Y_{BD,t-1}$		1.77(1.98)*			-0.04(0.03)	
$\Delta\ln Y_{BD,t-2}$		1.44(1.95)*			-1.92(1.55)	
$\Delta\ln Y_{BD,t-3}$					-0.93(0.91)	
$\Delta\ln Y_{BD,t-4}$					-1.48(2.02)**	
$\Delta\ln Y_{i,t}$	-5.85(0.48)	-15.51(1.09)	2.52(1.72)*	2.69(1.50)	0.03(0.06)	-0.25(0.55)
$\Delta\ln Y_{i,t-1}$		18.64(1.23)				-0.47(0.95)
$\Delta\ln Y_{i,t-2}$		22.13(1.46)				-0.47(1.32)
$\Delta\ln Y_{i,t-3}$		-35.10(2.44)**			-0.40(0.80)	0.04(0.22)
$\Delta\ln Y_{i,t-4}$						-0.28(1.61)
$\Delta\ln REX_{i,t}$	0.58(0.58)		-2.77(3.25)**		0.61(2.123)**	
$\Delta\ln REX_{i,t-1}$			0.62(0.82)		0.08(0.28)	
$\Delta\ln REX_{i,t-2}$			0.57(0.82)		-0.10(0.38)	
$\Delta\ln REX_{i,t-3}$			-1.15(1.64)*		-0.80(2.97)**	
ΔPOS_t		0.40(0.89)		-2.99(1.97)*		0.05(0.08)
ΔPOS_{t-1}		0.19(0.32)				
ΔPOS_{t-2}		0.79(1.84)*				
ΔPOS_{t-3}						
ΔNEG_t		3.31(1.36)		-2.01(1.19)		-0.17(0.32)
ΔNEG_{t-1}				3.58(1.79)*		-0.30(0.59)
ΔNEG_{t-2}				3.44(2.38)**		
Panel B: Long-Run Estimates						
$\ln Y_{BD}$	0.84(1.36)	0.15(0.61)	-1.18(2.45)**	-1.30 (3.41)**	-0.44(0.42)	-0.87(1.44)
$\ln Y_i$	-3.78(2.04)**	-2.74(2.41)**	-0. 92(2.00)*	-0.92(2.11)**	0.02(0.07)	0.12(1.35)
$\ln REX_i$	-0.06(0.18)		-0.08(0.28)		0.08(0.23)	
POS		-0.67(0.78)		-2.55 (1.55)		1.47(1.48)
NEG		-2.37(0.72)		-4.83 (1.57)		0.41(0.35)
Constant	11.23(1.37)	10.70(2.85)**	5.42(1.54)	6.35(3.30)**	3.04(0.59)	4.90(1.51)
Panel C: Diagnostic Statistics						
F	8.78**	5.94**	4.06**	4.45**	20.34**	15.18**
LM	2.25	1.92	0.02	0.09	0.43	0.42
RESET	2.87	1.66	4.71**	4.27**	0.45	1.68
AdjustedR^2	0.42	0.46	0.33	0.35	0.39	0.40
CS (CS^2)	S(UNS)	S(UNS)	S(UNS)	S(UNS)	S(UNS)	S(UNS)
WALD – S		0.01		3.30*		0.38
WALD – L		5.05**		0.36		1.70

Table 1 continued.

Table 1 (Continued)						
	i = India		i=Japan		i=Korea	
	L - ARDL	**NL - ARDL**	**L - ARDL**	**NL - ARDL**	**L - ARDL**	**NL - ARDL**
Panel A: Short–Run Estimates						
ΔlnY$_{BD,t}$	-0.26(0.59)	-0.01(0.01)	0.15(0.40)	0.03(0.07)	-0.77(1.07)	-7.16(2.86)*
ΔlnY$_{BD,t-1}$			1.30(2.68) **	0.69(1.73)*		-0.55(0.3)
ΔlnY$_{BD,t-2}$			0.63(1.67)*			-0.89(0.49)
ΔlnY$_{BD,t-3}$						-1.93(1.06)
ΔlnY$_{BD,t-4}$						5.76(2.12)**
ΔlnY$_{i,t}$	-3.47(2.17)**	-3.21(2.05)**	-3.07(0.95)	- 5.02(146)	0.15(0.34)	0.11(0.25)
ΔlnY$_{i,t-1}$	0.42(0.29)	1.10(0.80)	-0.54(0.17)			
ΔlnY$_{i,t-2}$	0.29(0.13)	0.54(0.40)	6.45(2.13)*			
ΔlnY$_{i,t-3}$	0.77(0.54)	-0.54(0.41)				
ΔlnY$_{i,t-4}$	3.48(2.29)**	3.60(2.49)**				
ΔlnREX$_{i,t}$	0.06(0.37)		0.36(0.51)		0.03(0.20)	
ΔlnREX$_{i,t-1}$						
ΔlnREX$_{i,t-2}$						
ΔlnREX$_{i,t-3}$						
ΔlnREX$_{i,t-4}$						
ΔPOS$_t$		0.00(0.00)		-0.63(0.45)		0.51(2.01)**
ΔPOS$_{t-1}$				1.66(0.98)		
ΔPOS$_{t-2}$				2.89(2.04)**		
ΔPOS$_{t-3}$						
ΔPOS$_{t-4}$						
ΔNEG$_t$		0.09(0.32)		-1.79(0.60)		0.05(0.16)
ΔNEG$_{t-1}$		0.09(0.22)		-1.21(0.54)		0.05(0.11)
ΔNEG$_{t-2}$		-0.29(0.08)		-1.48(0.80)		0.34(0.83)
ΔNEG$_{t-3}$		-0.47(1.76)*		1.95(1.80)*		-0.04(0.10)
ΔNEG$_{t-4}$						0.59(2.03) **
Panel B: Long-Run Estimates						
ln Y $_{BD}$	-0.52 (0.96)	-0.12(0.23)	-0.64(2.02)**	-0.31(1.12)	0.06(0.14)	0.15 (0.37)
ln Y$_i$	0.07(0.37)	-0.05(0.28)	0.39(0.83)	-0.18(0.30)	-0.25(1.44)	-0.51(2.25)**
lnREX$_i$	0.02(0.22)		0.31(0.99)		-0.17(2.02)**	
POS		-0.36(1.07)		-3.69(1.60)		0.07(0.22)
NEG		0.58(1.04)		0.35(0.11)		0.18(0.32)
Constant	3.28(1.17)	1.38(0.57)	1.84(1.22)	3.07(1.39)	3.23(1.45)	3.77(1.70)*
Panel C: Diagnostic Statistics						
F	5.99**	7.45**	15.76**	9.26**	15.07**	11.01**
LM	0.63	1.44	0.68	0.07	0.06	1.68
RESET	0.32	0.27	2.10	2.01	1.03	0.27
AdjustedR^2	0.19	0.24	0.36	0.36	0.24	0.28
CS (CS^2)	US(UNS)	US(UNS)	S(S)	S(S)	S(S)	S(S)
WALD – S		0.11		0.97		0.37
WALD – L		2.00		0.82		0.31

	i=Singapore		i=Malaysia	
Table 1 (Continued)				
	L - ARDL	**NL - ARDL**	**L - ARDL**	**NL - ARDL**
	Panel A: Short–Run Estimates			
$\Delta \ln Y_{BD,t}$	-0. 48(0.85)	-0.52(0.86)	0.83(1.41)	0.74(1.25)
$\Delta \ln Y_{BD,t-1}$		-0.22(0.29)	0.32(0.38)	-0.08(0.10)
$\Delta \ln Y_{BD,t-2}$		0.88(1.45)	-0.87(1.07)	-1.18(1.46)
$\Delta \ln Y_{BD,t-3}$			-0.05(0.07)	-0.26(0.34)
$\Delta \ln Y_{BD,t-4}$			1. 05(1.72)*	1.01(1.69)*
$\Delta \ln Y_{i,t}$	-3.18(1.38)	-3.85(1.63)*	-4.15(1.59)	-6.12(2.29)**
$\Delta \ln Y_{i,t-1}$	-3.67(1.59)		-5.34(2.57)**	-7.32(3.36)**
$\Delta \ln Y_{i,t-2}$			-0.12(0.01)	-3.60(1.55)
$\Delta \ln Y_{i,t-3}$			-1.44(0.68)	-3.61(1.71)*
$\Delta \ln Y_{i,t-4}$			5.54(2.13)**	4.16(1.66)*
$\Delta \ln REX_{i,t}$	-2.30(1.09)		-0.30(0.22)	
$\Delta \ln REX_{i,t-1}$			3.52(2.45)**	
ΔPOS_t		-1.16(0.32)		-0.90(0.50)
ΔPOS_{t-1}		-6.51(1.82)*		2.95(1.14)
ΔNEG_t		5.62(1.61)		2.64(0.80)
ΔNEG_{t-1}				-7.93(2.39)**
	Panel B: Long-Run Estimates			
$\ln Y_{BD}$	-1.18(2.06)**	-0.57(1.05)	0.38(0.64)	0.37(0.66)
$\ln Y_i$	0.79(2.81)*	0.39(1.77)*	0.10(0.47)	0.17(0.85)
$\ln REX_i$	0.95(1.36)		0.30(0.42)	
POS		3.59(0.66)		-7.03(2.65)**
NEG		6.63(1.45)		10.74(2.06)**
Constant	8.24(2.01)**	2.52(1.08)	-0.21(0.05)	-0.75(0.31)
	Panel C: Diagnostic Statistics			
F	16.30**	5.23**	13.83**	13.91**
LM	0.04	2.02	0.03	0.16
RESET	1.52	0.55	0.03	0.65
AdjustedR^2	0.29	0.31	0.47	0.50
CS (CS^2)	S(S)	S(S)	S(S)	S(S)
WALD – S		3.71*		1.16
WALD – L		0.14		8.03**