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# Bilateral Export and Import Demand Functions of Bangladesh: A Cointegration Approach

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The past attempts to investigate whether the Marshall-Lerner condition is fulfilled by using aggregate data in Bangladesh suffer from aggregation bias. This paper estimates trade elasticities using bilateral data between Bangladesh and its major trading partners. The results, using data covering 1973-2009, confirm long run relationships of volumes of export and import with real exchange rate and real income. The study unveils that the Marshall-Lerner condition holds only in case of the United States. As such, the depreciation of real exchange rate may not be effective in improving the trade balance of Bangladesh in the long run.

**Key words:** Bilateral Marshall-Lerner condition, Cointegration, Exchange Rate, Bangladesh.
**JEL Classification:** C32, C51, F13, F15, F31.

## I. INTRODUCTION

Although bilateral trade balance is a controversial issue, Mankiw (2010) provoked the notion as an irrelevant approach from macroeconomic point of view. Trade elasticities on bilateral basis are relevant to develop trade policies and international linkages as well (Marquez 1990). In fact, overall trade balance is an aggregation of bilateral trade balance; hence, any change of bilateral trade influences the aggregate trade balance. However, due to heterogeneity among trading nations, the determinants of overall trade balance may lose its essence for bilateral trade balance. For example, the price elasticity of overall trade balance may be inelastic, while it may be elastic for particular nations, even it may appear in perverse sign. Therefore, bilateral trade elasticity or more precisely bilateral export and import demand functions would be an effective pathway to design trade policy.

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Over the last two decades, a large number of studies have been conducted to estimate bilateral trade elasticities, such as Prasad and Ranade (1996), Shirvani and Wilbratte (1997), Bahmani-Oskooee (1999), Jiranyakul and Brahmasreme (2002), Hatemi-J and Irandoust (2005), Bahmani-Oskooee and Cheema (2009), and Thorbecke and Komoto (2010). All of these studies show heterogeneous results of bilateral trade elasticities for each nation. Furthermore, a few studies estimate bilateral trade elasticities on the perspective of Bangladesh (e.g., Nur, Wijeweera, and Dollery 2007, and Wijeweera, Nur and Dollery 2008). They also found assorted results. These heterogeneities provide evidence for consideration of measurement of bilateral trade elasticities.

The aim of this study is to estimate export and import demand functions separately on the basis of bilateral trade and examine whether foreign exchange market is stable or not by incorporating the Marshall-Lerner (M-L) condition.

From the principle of parsimony, only six of the trading partners of Bangladesh are considered in this paper i.e., United States, United Kingdom, Germany, India, Hong Kong, and Japan. The rest of the countries are excluded either their shares are smaller than the six country, or bilateral trade data over the sample period (1973-2009) are unavailable, or shares are not consistent over the years. However, Table I shows that the six trading countries explain 49.14 per cent of total export, 25.93 per cent of total import and 35.32 per cent of overall trade in 2008-09.

TABLE I
**BANGLADESH'S EXPORT AND IMPORT SHARE WITH ITS TRADING PARTNERS, 2008-09**

| Country | Share in Export (%) | Share in Import (%) | Share in Total Trade (%) |
|---|---|---|---|
| USA | 23.42 | 2.28 | 10.84 |
| UK | 8.66 | 0.68 | 3.91 |
| Germany | 13.94 | 2.69 | 7.25 |
| Hong Kong | 0.70 | 4.28 | 2.83 |
| India | 1.20 | 10.36 | 6.65 |
| Japan | 1.21 | 5.63 | 3.84 |
| Total | 49.14 | 25.93 | 35.32 |

**Source:** *Statistical Year Book 2009*, BBS.

In this paper both cointegration and vector error correction model (VECM) are incorporated to investigate the short run speed of adjustment and long run relationships among the concerned variables. CUSUM and CUSUMSQ tests are assimilated as well to test structural stability of the model.

The outline of this paper is as follows: after introducing issues in section I, section II provides literature review, while section III postulates the theoretical framework. The methodology is presented in section IV and the empirical results are reported in section V. Finally section VI provides the summary and conclusion of the present study.

## II. LITERATURE REVIEW

Nationally and internationally a large number of studies have been done on export and import demand function by using aggregate and disaggregate time series data. As a large number of studies have already been completed in the perspective of Bangladesh, this section attempts to survey those studies that were done in the context of Bangladesh. Most of the studies are on aggregate data. However, several studies are on tradable commodity basis and a few studies investigate on bilateral trade basis. There are also some studies that investigate M-L condition and J-curve effect using aggregate time series data.

Kabir (1988) has found that Bangladesh's export and import demands are exchange rate inelastic while income elasticity is greater than unity. Emran and Shilpi (1996), by using Johansen and Juselius approach, found that income elasticity was higher than price elasticity. Choudhury (2001) found that income elasticity was sufficiently higher than price elasticity of major fifteen trading partners of Bangladesh. Islam and Hassan (2004) estimate income elastic and price inelastic import demand function. Nur, Wijeweera, and Dollery (2007) estimate bilateral export demand elasticities of Belgium, France, Germany, United States and United Kingdom. The authors also incorporated trade liberalisation effect on export and found heterogeneous income and price elasticities for the five partner countries. Aziz (2008) found that the real exchange rate has a significant impact on trade balance both in the short run and long run. Wijeweera, Nur and Dollery (2008) estimate bilateral import demand functions for India, Japan, Singapore, USA, and Malaysia by incorporating stationary data. The authors found heterogeneous income and price elasticities for the concerned countries. Hay and Mashkoor (2010) estimate import demand function by using ARDL approach to cointegration and rolling window regression method. The authors found that income elasticity is larger than relative price elasticity. Alam (2010) estimates aggregate export demand function and did not find any long run relationship between real depreciation of Taka and export.

Hossain (2000) and Islam (2010) found the fulfillment of M-L condition. On the contrary, Tang (2002) estimated the determinants of aggregated import demand function using bounds testing approach and unrestricted error correction model and found that M-L condition is unlikely to be satisfied. Khatoon and Rahman (2009) suggest a positive influence of devaluation on trade balance both in the short run and long run. The authors also found a bidirectional casual relationship between devaluation and trade balance. But J-curve did not confirm.

However, the major shortcoming of these studies is that most of these are based on aggregate data, and hence suffer from "aggregation bias" problem. Another shortcoming is that until the 2000s most of the studies may be subject to spurious regression problem while considering non-stationary time series data. Finally, none of the studies examine M-L condition on bilateral basis.

The paper attempts to remedy the drawbacks of the early studies as mentioned above and examine M-L condition for Bangladesh on bilateral basis satisfying all required advanced time series properties.

## III. THEORETICAL FRAMEWORK

To estimate bilateral export and import demand elasticities, export and import price indices on a bilateral basis are required. Due to unavailability of such indices, exchange rate is frequently used. Dornbush (1980) adopted the real exchange rate to estimate import demand function. According to Houthakker and Magee (1969), trading partner's income is another dominant factor to influence volume of export to trading partner. Consequently, the following functions are frequently used to estimate trade elasticities:

$$X_{i,t} = \left(RER_{i,t}\right)^{\eta} . \left(Y_{i,t}\right)^{\varphi} \tag{1}$$

$$M_{i,t} = \left(RER_{i,t}\right)^{\eta'} . \left(Y_{BD,t}\right)^{\varphi'} \tag{2}$$

Where $X_{i,t}$ is real export at time t to the trading partner *i* from Bangladesh and $M_{i,t}$ is real import at time t from the trading partner *i* to Bangladesh. $RER_{i,t}$ is real bilateral exchange rate between Bangladesh and the trading partner *i* at time *t*. $Y_{BD}$ denotes real domestic income and $Y_i$ denotes real income of trading partner. $\eta$ and $\eta'$ are the real exchange rate elasticities for exports and imports, $\varphi$ and $\varphi'$ are the real income elasticities for exports and imports respectively.

To construct an empirical model for the estimation of long run cointegrating relationship among the concerned variables, constant and error term are incorporated. Thus equation (1) and (2) can be expressed in the following natural log form:

$$\ln X_{i,t} = \alpha_0 + \eta \ln RER_{i,t} + \varphi \ln Y_{i,t} + \varepsilon_t \quad (3)$$

$$\ln M_{i,t} = \alpha_0' + \eta' \ln RER_{i,t} + \varphi' \ln Y_{i,t} + \varepsilon_t' \quad (4)$$

As an increase in real exchange rate depreciates the domestic currency and also affects terms of trade, the expected signs of the real exchange rate elasticities are $\eta > 0$ and $\eta' < 0$. From earlier experience the income elasticity of export and import is expected to be positive i.e., $\varphi > 0$, and $\varphi' > 0$.

Marshall-Lerner (M-L) condition postulates foreign exchange market stability if sum of price elasticities of demand for export and demand for imports, in absolute terms, is greater than unity. According to the model used in the paper, $\{|\eta| + |\eta'|\} > 1$ implies stable foreign exchange market. In the case of any bilateral trade, if M-L condition holds, then depreciation of real exchange rate will improve trade balance in the long run. The key concern of this paper is to investigate whether M-L condition holds among the selected nations on the basis of bilateral trade.

## IV. METHODOLOGY

### 4.1 Unit Autoregressive Root Tests

In order to test for short run dynamics and long run relationship among time series variables, the time series properties of each variable are estimated by the unit autoregressive tests i.e., whether a time series variable is stationary. In this paper two procedures are employed for detecting a unit autoregressive root: (i) The Augmented Dickey-Fuller (ADF) Test (Dickey and Fuller 1981) and the Phillips–Perron (PP) Test (Phillips and Perron 1988).

#### *4.1.1 Augmented Dickey-Fuller Test*

The ADF test for a unit autoregressive root tests the null hypothesis $H_0$: $\delta = 0$ against the alternative $H_1$: $\delta < 0$ in the following regression:

$$\Delta Y_t = \beta_0 + \delta Y_{t-1} + \sum_{j=1}^{\rho} \gamma_j \Delta Y_{t-j} + u_t \quad (5)$$

Where $\Delta$ is the first difference operator and $u_t$ is a white noise error term and $\rho$ is the number of lags in the dependent variable. In the hypothesis testing $H_0$

implies $Y_t$ has a stochastic trend, while $H_1$ implies $Y_t$ is stationary. The ADF statistic is obtained from the OLS t-statistics testing $\delta = 0$ in equation (5).

If $Y_t$ is stationary around a deterministic linear time trend, then the trend 't' i.e., the number of observation must be added as an explanatory variable. Alternatively (5) can be written as

$$\Delta Y_t = \beta_0 + \alpha_0 t + \delta Y_{t-1} + \sum_{j=1}^{\rho} \gamma_j \Delta Y_{t-j} + u_t \qquad (6)$$

In the equation (6) $Y_t$ is a random walk with drift around a stochastic trend. Here $\alpha_0$ is an unknown coefficient and the ADF statistic is the OLS t-statistic testing $\delta = 0$ in (6).

### *4.1.2 The Phillips–Perron Test*

The results are also verified by Phillips and Perron (1988) test. The test regression for the PP tests is:

$$Y_t = \beta_0 + \delta_t + \gamma_1 Y_{t-1} + \sum_{j=1}^{\rho} \gamma_j \Delta Y_{t-j} + \varepsilon_t \qquad (7)$$

Where, $\delta_t$ may be 0, $\mu$, or $\mu + \beta_t$ and $\varepsilon_t$ is I(0) and may be heteroskedastic. The PP tests correct for any serial correlation and heteroskedasticity in the error term $\varepsilon_t$ by directly modifying the test statistics $t_\pi = 0$ and $T\hat{\pi}$ . The hypothesis testing procedure is the same asymptotic distributions as the ADF test.

### 4.2 Cointegration Test

To identify whether a long run equilibrium relationship exists among time series variables, Johansen (1988) maximum likelihood approach is readily used.

The time series variables of export demand functions for the trading partners of Bangladesh, incorporated in this paper, are considered to follow the first order Vector Auto Regressive (VAR) representation defined as:

$$\begin{aligned}
\ln X_{i,t} &= \Pi_{11} X_{i,t-1} + \Pi_{12} \ln Y_{i,t-1} + \Pi_{13} \ln REX_{i,t-1} + \varepsilon_{X_{i,t}} \\
\ln Y_{i,t} &= \Pi_{21} X_{i,t-1} + \Pi_{22} \ln Y_{i,t-1} + \Pi_{23} \ln REX_{i,t-1} + \varepsilon_{Y_{i,t}} \qquad (8) \\
\ln REX_{i,t} &= \Pi_{31} X_{i,t-1} + \Pi_{32} \ln Y_{i,t-1} + \Pi_{33} \ln REX_{i,t-1} + \varepsilon_{REX_{i,t}}
\end{aligned}$$

Now, subtracting lagged dependent variables from equations (8), the following matrix notation can be constructed:

$$\begin{bmatrix} \Delta \ln X_{i,t} \\ \Delta \ln Y_{i,t} \\ \Delta \ln REX_{i,t} \end{bmatrix} = \begin{pmatrix} \Gamma_{11} & \Gamma_{12} & \Gamma_{13} \\ \Gamma_{21} & \Gamma_{22} & \Gamma_{23} \\ \Gamma_{31} & \Gamma_{32} & \Gamma_{33} \end{pmatrix} \begin{bmatrix} \ln X_{i,t} \\ \ln Y_{i,t} \\ \ln REX_{i,t} \end{bmatrix} + \begin{bmatrix} \varepsilon_{\ln X_{i,t}} \\ \varepsilon_{\ln Y_{i,t}} \\ \varepsilon_{\ln REX_{i,t}} \end{bmatrix} \quad (9)$$

Where $\Gamma_{11} = \Pi_{11}-1$, $\Gamma_{22} = \Pi_{22}-1$, $\Gamma_{33} = \Pi_{33}-1$, $\Gamma_{12} = \Pi_{12}$, $\Gamma_{13}=\Pi_{13}$, $\Gamma_{21} = \Pi_{21}$, $\Gamma_{23} = \Pi_{23}$, $\Gamma_{31} = \Pi_{31}$, $\Gamma_{32} = \Pi_{32}$ and $lnX_{it}$, $lnY_{it}$, and $lnREX_{it}$ are integrated of order one i.e., *I(1)*. Johansen recommends two different likelihood ratio tests of the significance of the canonical correlations and thereby the reduced rank of the matrix: the trace test and maximum eigen value test i.e.,

$$\lambda_{trce(r)} = -T \sum_{i=r+1}^{k} \ln(1-\hat{\lambda}_i) \quad (10)$$

$$\lambda_{\max(r,r+1)} = -T \ln(1-\hat{\lambda}_{r+1}) \quad (11)$$

Here $T$ is the sample size and $\hat{\lambda}_i$ is the $i^{th}$ largest canonical correlation. The trace tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of n cointegrating vectors. The maximum eigenvalue test, in contrast, tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of $r+1$ cointegrating vectors. Asymptotic critical values can be obtained from Johansen and Juselius (1990). Analogously the time series variables of import demand functions for the trading partners of Bangladesh are also tested to investigate the long run relationship among the variables.

### 4.3 Vector Error Correction Model

The cointegration among variables solely exhibits a long run equilibrium relationship. In fact, there may be disequilibrium in the short run. To investigate the short run dynamics among the concerned time series variables, Vector Error Correction Model (VECM) should be developed. Therefore, an unrestricted VECM considering up to ρ lags both for export demand functions and import demand functions are respectively as follows:

Export Demand Function:

$$\Delta \ln X_{i,t} = \delta_0 + \sum_{j=1}^{\rho} \theta_k \Delta \ln X_{i,t-j} + \sum_{j=1}^{\rho} \eta_k \Delta \ln Y_{i,t-j} + \sum_{j=1}^{\rho} \varphi_k \Delta \ln REX_{i,t-j}$$
$$+\lambda[\ln X_{i,t-1} - \hat{\beta}_0 - \hat{\beta}_1 \ln Y_{i,t-1} - \hat{\beta}_2 \ln REX_{i,t-1}] + \varepsilon_{i,t} \quad (12)$$

Import Demand Function:

$$\Delta \ln M_{i,t} = \delta_0' + \sum_{j=1}^{\rho} \theta_k' \Delta \ln M_{i,t-j} + \sum_{j=1}^{\rho} \eta_k' \Delta \ln Y_{BD,t-j} + \sum_{j=1}^{\rho} \varphi_k' \Delta \ln REX_{i,t-j}$$
$$+\lambda' [\ln M_{i,t-1} - \hat{\beta}_0' - \hat{\beta}_1' \ln Y_{BD,t-1} - \hat{\beta}_2' \ln REX_{i,t-1}] + \varepsilon_{i,t}' \qquad (13)$$

Where Δ is the first difference operator, $\lambda$ and $\lambda'$ depict the speed of adjustment from short run to the long run equilibrium, $\varepsilon_t$ and $\varepsilon_t'$ is a purely white noise term.

## V. EMPIRICAL RESULTS[1]

Tables 1 and 2 in appendix A3 report that all the variables are stationary in the first differenced series i.e., *I(1)* in all the cases. The results provide the basis for the test of long run relationship among the variables.

Table 3 reports Johansen–Juselius Cointegration results both for export and import demand functions on the basis of bilateral trade. The results show that the null hypothesis of no cointegration, i.e., r = *0*, is rejected for both export and import demand functions of Bangladesh for its six trading partners. This is because either $\lambda_{trace}$ or $\lambda_{\max}$ is larger than the critical value at least at the 5% significance level. The results provide evidence that there is at least one cointegrating vector in each case. In some cases there is even more than one vector.

Table 4 in appendix 3 reports the estimating coefficients of all the vectors normalized on $lnX_i$ and $lnM_i$ by setting their coefficients to -1 along with adjustment parameters (λ), and the structural stability test results respectively.

The income elasticities of export and import demand functions are relatively larger in maximum cases as most of the earlier studies found. The income elasticities of export are all positive and statistically significant. The elastic real income elasticity of export for United States, United Kingdom, Germany, and Japan recommends that the exporters as well as the policy makers should keep their eyes on the pattern of business cycle of the trading partners and should predict it cautiously. When their economies move toward peak, Bangladesh should produce and export sufficiently to satisfy their additional demand. In the case of import demand function, the income elasticities carry positive sign and

[1] All of the results carried out by STATA (Version 10) and the results are presented in appendix A3.

also statistically significant only for Germany and Hong Kong. Although the coefficients of income elasticities for United States, United Kingdom, and Japan are significant, the sign is contrary to the hypothesis. These findings are readily comparable with Wijeweera *et al.* (2008). The income elasticities of import for United States, India and Japan in Wijeweera *et al.* (2008) are respectively -1.44, -0.29, and -0.86. Theoretically income elasticity can be negative for inferior goods. However, in the case of advanced economies, it may not be accepted as a suitable justification. Hence, it deserves further rigorous empirical investigation.

The signs of the price elasticities of export are consistent with theory and statistically significant for United States, United Kingdom and Germany. The result advocates that real depreciation of Taka will enhance the volume of export for the three trading partners. In this regard the adverse impact of inflationary pressure must be considered. On the contrary, the price elasticity of export for India is negative but significant. It implies that an appreciation of real exchange rate of Taka will enhance volume of export. The signs of the price elasticities of import are theoretically consistent and statistically significant for United States, Hong Kong, and Japan. In particular, for these countries, as the real exchange rate depreciates, import becomes expensive in terms of Taka as relative price changes and the residents of Bangladesh will try to purchase more domestically produced goods and services. However, the price elasticity of import is more than unity for United States and Hong Kong, while for Japan it is approximately unit elastic. Among the six trading partners price elasticities of export and import demand functions are theoretically as well as statistically significant only in the case of United States and the summation of the coefficients is more than unity. Therefore, M-L condition is fulfilled only in the case of United States.

The coefficients of the adjustment parameters in the export demand function carry expected sign and are also statistically significant in the case of United States, United Kingdom, Germany, India and Hong Kong. Among the five trading partners, the speed of adjustment is lowest in the case of Germany. The value -0.28 implies that 28 per cent of the deviation from the long run equilibrium level can be corrected annually. In the import demand function, except United Kingdom, all of the coefficients of the adjustment parameters hold expected sign and are also significant. Among the five trading partners, the speed of adjustment is the lowest in the case of Hong Kong. The value -0.24 implies that 24 per cent of the deviation from the long run equilibrium level can be adjusted in a year. The coefficient of United Kingdom reveals perverse sign and is not statistically significant.

The CUSUM and CUSUMSQ tests for the residuals of both export and import demand functions provide evidence of the structural stability of the short run as well as the long run elasticities. Here "S" denotes the estimated model is stable and "U" denotes the estimated model is unstable. In case the of United States and India, export demand functions are stable. Moreover, United Kingdom and Hong Kong just pass CUSUM and CUSUMSQ tests respectively. On the other hand, in the case of import demand functions, United Kingdom, Germany, and Japan are stable. Furthermore, United States and India just pass only CUSUM and CUSUMSQ tests respectively. None of the trading partners yield to sufficient evidence on the structural stability of short run and long run elasticities in case of both export and import demand functions.

## VI. SUMMARY AND CONCLUSION

Earlier research on Bangladesh relied on aggregate trade data for checking fulfillment of M-L condition. The present study attempts to remedy this shortcoming by using bilateral trade data between Bangladesh and its six trading partners.

The Johansen-Juselius cointegration approach provides evidence on the existence of long run relationship among the variables of bilateral export and import demand functions between Bangladesh and its six trading partners, i.e., United States, United Kingdom, Germany, India, Hong Kong and Japan. The income elasticities of export demand functions for all of the six trading partners are consistent with theory and statistically significant. The income elasticities of import demand functions for Germany and Hong Kong are positive and significant. Although the income elasticities of import demand functions for United States, United Kingdom, and Japan are statistically significant, their sign is contrary to the hypothesis. It deserves further research for justification. The price elasticities of export demand functions are positive and significant for United States, United Kingdom and Germany. Only the exchange rate elasticity of India carries perverse sign. The clarification of the perverse sign is beyond the scope of the paper. Among the six trading partners the price elasticities of import demand functions are theoretically consistent and statistically significant for United States, Hong Kong, and Japan. The divergent values of the parameters and their divergent signs indicate that real depreciation of bilateral exchange rates of taka may not improve Bangladesh's trade balance in the long run.

The real exchange rate elasticities suggest that among the six trading partners,M-L condition is fulfilled only in the case of United Sates. Therefore, the depreciation of Taka will improve the bilateral trade balance of Bangladesh with the United States in the long run. The value of the short run adjustment parameter provides evidence of the stability of equilibrium relationship, although the CUSUM and CUSUMSQ tests fail to provide strong evidence on the structural stability of the short run and long run elasticities of the United States during the sample period.

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## APPENDICES

### A1. Data Sources and Definition

All data are yearly for the period 1973-2009 and are collected from the following sources:

a. Statistical Year Book, published by Bangladesh Bureau of Statistics.

b. Bangladesh Economic Review, published by the Ministry of Finance, Bangladesh.

c. International Financial Statistics of the International Monetary Fund, CD- ROM.

d. World Development Indicator, published by the World Bank.

e. Key Indicators for Asia and the Pacific, published by Asian Development Bank.

### A2. Variables

$Y_{BD}$ = Bangladesh Real GDP. The Nominal GDP is deflated by the GDP Deflator.

$Y_i$ = the trading partner *i* Real GDP. The Nominal GDP is deflated by the GDP Deflator.

$REX_i$ = Real bilateral exchange rate between Bangladesh and trading partner *i*. It has been computed as, [(Bilateral Nominal Exchange Rate×GDP $Deflator_i$)/GDP $Deflator_{BD}$ ]

$X_i$ = Bangladesh real exports to trading partner *i*. The nominal value of exports is deflated by the export price index.

$M_i$ = Bangladesh real imports from trading partner *i*. The nominal value of imports is deflated by the import price index.

## A3. Empirical Results

TABLE 1
**UNIT ROOT TEST WITH TREND**

| Variable | ADF Test | | PP Test | |
|---|---|---|---|---|
| | Level | First Difference | Level | First Difference |
| Bangladesh | | | | |
| ln Y (2) | 0.112 | -4.429*** | 0.235 | -10.008*** |
| United States | | | | |
| ln Y (2) | -1.959 | -4.125*** | -1.968 | -4.819*** |
| ln REX (3) | -2.904 | -5.688*** | -4.967*** | -5.554*** |
| ln X (1) | -1.441 | -4.655*** | -1.736 | -5.486*** |
| ln M (4) | -2.304 | -4.311** | -5.534*** | -10.301*** |
| United Kingdom | | | | |
| ln Y (3) | -2.378 | -3.396* | -2.097 | -4.775*** |
| ln REX (3) | -2.913 | -5.152*** | -1.879 | -4.781*** |
| ln X (5) | -3.205 | -3.792** | -3.729** | -6.787*** |
| ln M (1) | -2.877 | -5.224*** | -4.205** | -8.725*** |
| Germany | | | | |
| ln Y (2) | -0.133 | -3.413* | -0.594 | -4.489*** |
| ln REX (2) | -2.694 | -4.742*** | -3.363* | -4.934*** |
| ln X (1) | -2.353 | -5.117*** | 2.624 | -6.907*** |
| ln M (4) | -3.175 | -4.512*** | -5.636*** | -8.911*** |
| India | | | | |
| ln Y (1) | -0.643 | -5.073*** | -0.831 | -7.203*** |
| ln REX (2) | -1.771 | -6.395*** | -2.762 | -6.099*** |
| ln X (2) | -3.003 | -4.810*** | -3.881** | -8.045*** |
| ln M (1) | -2.277 | -4.885*** | -2.613 | -6.227*** |
| Hong Kong | | | | |
| ln Y (1) | -1.216 | -5.404*** | -1.769 | -5.760*** |
| ln REX (1) | -1.150 | -5.171*** | -0.856 | -5.245*** |
| ln X (1) | -3.094 | -4.277** | -3.160 | -5.456*** |
| ln M (1) | -1.565 | -4.398*** | -1.951 | -4.458*** |
| Japan | | | | |
| ln Y (2) | 0.623 | -3.877** | 0.344 | -4.840*** |
| ln REX (4) | -1.298 | -4.898*** | -2.031 | -5.223*** |
| ln X (1) | -1.789 | -5.514*** | -2.486 | -7.235*** |
| ln M (1) | -2.654 | -5.668*** | -2.700 | -7.182*** |

**Notes:** (i) figures within parentheses indicate lag lengths chosen by the Akaike Information Criterion (AIC); (ii) *, **, and *** denote rejection of the null hypothesis of unit root at the 10%, 5%, and 1% significance level respectively.

TABLE 2
**UNIT ROOT TEST WITHOUT TREND**

| Variable | ADF Test | | PP Test | |
|---|---|---|---|---|
| | Level | First Difference | Level | First Difference |
| Bangladesh | | | | |
| lnY (2) | 5.451*** | -2.699*** | -3.855*** | -7.366*** |
| United States | | | | |
| ln Y (2) | -1.422* | -4.184*** | -1.109 | -4.890*** |
| ln REX (3) | -2.044** | -5.826*** | -1.432 | -5.833*** |
| ln X (1) | -1.587* | -4.650*** | -1.394 | -5.533*** |
| ln M (4) | -0.226 | -4.402*** | -1.772 | -10.239*** |
| United Kingdom | | | | |
| ln Y (3) | -0.964 | -3.335*** | -0.326 | -4.602*** |
| ln REX (3) | -3.870*** | -4.719*** | -1.501 | -4.507*** |
| ln X (5) | -2.225** | -3.863*** | -2.523 | -6.923*** |
| ln M (1) | -1.173** | -5.183*** | -2.629* | -8.700*** |
| Germany | | | | |
| ln Y (2) | -1.998** | -2.997*** | -1.039 | -4.516*** |
| ln REX (2) | -1.423* | -4.860*** | -1.285 | -5.046*** |
| ln X (1) | -0.473 | -5.344*** | -0.495 | -7.009*** |
| ln M (4) | -1.180 | 4.620*** | -4.560*** | -8.709*** |
| India | | | | |
| ln Y (1) | -2.875*** | -4.014*** | -3.051** | -5.976*** |
| ln REX (2) | -1.854** | -6.758*** | -2.929* | -6.128*** |
| ln X (2) | -3.190*** | 4.736*** | -3.906** | -8.093*** |
| ln M (1) | -0.860 | -4.715*** | -0.960 | -6.231*** |
| Hong Kong | | | | |
| ln Y (1) | -2.059** | -4.127*** | -2.954* | -5.323*** |
| ln REX (1) | -1.987** | -4.453*** | -1.425 | -4.910*** |
| ln X (1) | -2.341** | 4.348*** | -2.351 | -5.569*** |
| ln M (1) | -1.430* | 4.364*** | -1.011 | -4.567*** |
| Japan | | | | |
| ln Y (2) | -3.339*** | -1.482* | -3.328** | -4.115*** |
| ln REX (4) | -1.784** | -2.158** | -1.185 | -4.985*** |
| ln X (1) | -1.159 | -4.969*** | -1.656 | -7.226*** |
| ln M (1) | -1.258 | -5.249*** | -1.533 | -6.923*** |

**Notes:** (i) figures within parentheses indicate lag lengths chosen by the Akaike Information Criterion (AIC); (ii) *, **, and *** denote rejection of the null hypothesis of unit root at the 10%, 5%, and 1% significance level respectively.

TABLE 3
**JOHANSEN AND JUSELIUS COINTEGRATION RESULT FOR EXPORT AND IMPORT DEMAND**

| | $\lambda_{trace}$ | | | $\lambda_{max}$ | | |
|---|---|---|---|---|---|---|
| Null | r = 0 | r ≤ 1 | r ≤ 2 | r = 0 | r ≤ 1 | r ≤ 2 |
| Alternative | r = 1 | r = 2 | r = 3 | r = 1 | r = 2 | r = 3 |
| United States | | | | | | |
| Export (3) | 42.85** | 7.06 | 2.16 | 35.78** | 4.90 | 2.16 |
| Import (3) | 70.29** | 21.75** | 6.67** | 48.53** | 15.07* | 6.67** |
| United Kingdom | | | | | | |
| Export (4) | 41.89** | 20.04* | 4.18* | 21.85* | 15.85* | 4.18* |
| Import (3) | 62.84** | 24.57** | 10.41** | 38.27** | 14.16* | 10.41** |
| Germany | | | | | | |
| Export (4) | 69.63** | 24.18** | 3.85* | 45.45** | 20.33** | 3.85* |
| Import (3) | 38.44** | 7.33 | 2.21 | 31.11** | 5.11 | 2.22 |
| India | | | | | | |
| Export (2) | 39.11** | 12.02 | 4.37* | 27.09** | 7.65 | 4.37* |
| Import (2) | 62.57** | 29.65** | 5.50* | 32.92** | 24.15** | 5.50* |
| Hong Kong | | | | | | |
| Export (3) | 48.63** | 13.25 | 3.69 | 35.38** | 9.56 | 3.69 |
| Import (4) | 39.24** | 6.67 | 1.81 | 32.58** | 4.86 | 1.81 |
| Japan | | | | | | |
| Export (3) | 57.19** | 15.61** | 6.55* | 41.41** | 9.06 | 6.55* |
| Import (1) | 34.92** | 8.16 | 1.65 | 26.76** | 6.51 | 1.65 |

**Notes:** (i) r = number of cointegrating vectors; (ii) The lag order for each VAR is chosen by AIC as shown in parenthesis; (iii) * and ** denote rejection of the hypothesis at the 5% and 1% significance level respectively.

TABLE 4

**EXPORT AND IMPORT DEMAND ESTIMATE OF BANGLADESH WITH ITS TRADING PARTNERS**

**Panel A:** Export Demand Estimates

| $Country_i$ | Cointegrating coefficient Long-Run Coefficient Estimates | | | ECM $\lambda$ | CUSUM | CUSUMSQ |
|---|---|---|---|---|---|---|
| | $lnY_i$ | $lnREX_i$ | Constant | | | |
| United States | 2.47 (0.000) | 2.87 (0.000) | -18.38 | -0.31 (0.013) | U | S |
| United Kingdom | 1.52 (0.000) | 0.43 (0.009) | -12.93 | -0.34 (0.006) | S | U |
| Germany | 2.43 (0.000) | 0.99 (0.002) | -70.70 | -0.28 (0.005) | U | U |
| India | 0.31 (0.007) | -1.09 (0.000) | -7.60 | -3.11 (0.000) | S | S |
| Hong Kong | 0.52 (0.000) | 0.65 (0.231) | -13.81 | -0.35 (0.016) | U | S |
| Japan | 1.68 (0.004) | 0.85 (0.144) | -176.16 | -0.01 (0.910) | U | U |

**Notes:** (i) The vectors are normalized for export demand; (ii) figures within parentheses represent asymptotic *p*-values associated with the tests.

**Panel B:** Import Demand Estimates

| $Country_i$ | Cointegrating coefficient Long-Run Coefficient Estimates | | | ECM $\lambda'$ | CUSUM | CUSUMSQ |
|---|---|---|---|---|---|---|
| | $lnY_{BD}$ | $lnREX_i$ | Constant | | | |
| United States | -2.50 (0.000) | -1.21 (0.004) | -54.57 | -1.05 (0.000) | S | U |
| United Kingdom | -3.23 (0.000) | -0.69 (0.190) | -21.60 | 0.12 (0.090) | S | S |
| Germany | 0.98 (0.000) | -0.41 (0.080) | -22.83 | -1.69 (0.000) | S | S |
| India | -1.05 (0.334) | -1.95 (0.043) | -27.89 | -0.31 (0.001) | U | S |
| Hong Kong | 1.78 (0.002) | -1.50 (0.000) | -35.85 | -0.24 (0.003) | U | U |
| Japan | -1.04 (0.000) | -0.99 (0.000) | -27.00 | -0.38 (0.025) | S | S |

**Notes:** (i) The vectors are normalized for import demand; (ii) figures within parentheses represent asymptotic *p*-values associated with the tests.