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MODELLING OF IMPORT DEMAND FUNCTION FOR A DEVELOPING COUNTRY: An Empirical Approach

M. Nusrate Aziz*

ABSTRACT

The study focuses on the empirical modelling of aggregate import demand function for developing countries. Both traditionally suggested in existing literature as well as some additional but empirically plausible determinants of import demand are examined in the paper. Various cointegration techniques and the error correction mechanism are employed. In addition to the real income and the relative prices of imports, foreign exchange reserves are also found to be a significant determinant of import demand for developing countries. Export demand, which is overlooked by the existing literature, is found to be significant determinant in both the short-run and long-run for developing countries, especially the countries which imports 'capital goods' for their exporting industries.

Keywords: *Import demand, export demand, foreign exchange reserves, cointegration, error correction mechanism.*

***JEL Classification Code**: C22, F14, F41.*

1. INTRODUCTION

Existing literature indicates that relative prices and domestic income variables are significant determinants of imports demand for both developed (see, for example, Carone, 1996; Giovannetti, 1989; Marston, 1971; Tang, 2003) and developing countries (see, for example, Bahmani-Oskooee and Rhee, 1997; Dutta and Ahmed, 1999; Emran and Shilpi, 1996; Hossain, 1995; Islam and Hassan, 2004; Mah, 1997; Sinha, 2001). However, some important determinants of import demand for developing countries seem to have escaped attention in existing theoretical and empirical literature. This study aims at fulfilling this vacuum by employing those unconventional but empirically plausible determinants of imports demand for developing counties with appropriate theoretical basis.

Production capacity of developing countries is an important issue for their expected amount of export supply. It is observed that most of the developing countries have been importing capital goods for their exporting firms. Hence, any devaluation/depreciation in domestic currency leads to an increase in export demand (but not necessarily the export supply at the first place) and thereby increases the import demand of capital goods for exporting industries of developing countries. Moreover, due to reduction of tariff, quota and other quantitative restrictions coupled

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with an export-led growth strategy pursued by the developing countries, any devaluation of exchange rate leads to an increase in import demand of capital goods. This fairly indicates that any increase in export demand due to devaluation/depreciation in exchange rates immediately raises import demand of the country. This again suggests the existence of a positive correlation between the exchange rate and import demand. This particular dimension of exchange rate implication is, however, yet to be established empirically.

Although Senhadji (1998) suggests a 'current activity variable' which is defined as $GDP - X$ (where, X is export), and Obstfeld and Rogoff (1994), Sheffrin and Woo (1990), and Xu (2002) suggest a 'national cash flow' variable which they define as $GDP - I - G - EX$ (where, I is investment, G is government expenditure and EX is export), Giovannetti (1989) is perhaps the only literature which proposes the final expenditure components such as final consumption expenditure, $FCG = C + G$ (where, C is private consumption expenditure, G is government expenditure), expenditures on investment goods (EIG) and export (X) variables (instead of GDP alone) as determinants of import demand. Although the prime focus of Giovannetti (1989) has not been testing the export demand as one of the determinants of import demand, the study estimates aggregate import demand function for Italy using final expenditure components including export demand as determinants of import demand. Although there are large number of literatures which have theoretically and empirically looked into the import demand function of both developed and developing countries, however, to the best of my knowledge very few studies (except Tang, 2005 who uses ARDL model in South Korean context) have given attention into this specific issue that export demand may significantly affect the import demand of developing countries.

South Asian countries India, Pakistan, Sri Lanka especially Bangladesh (see, for example, Islam, 2003; Younus and Chowdhury; 2006, Aziz, 2012) have been pursuing an active exchange rate policy from the 1980s. The principal objective of the exchange rate policy was to maintain competitiveness of Bangladeshi products in the world markets, and maintain a viable external account position (Financial Sector Review, Bangladesh Bank, 2006). This indicates that enhancement in exports is one of the prime targets of exchange rate policy of Bangladesh. However, since Bangladesh imports capital goods for its exporting industries, any change in the exchange rate first affects its imports demand. For example, readymade garment and footwear industry, which control about 80 per cent of total export earnings of Bangladesh (see, Export trend 2009-10, Export Promotion Bureau, Bangladesh), requires the 'textiles and textile articles' (capital goods) for production. Import costs for 'capital goods' explains more than 50 per cent of total import costs on average (see, for example, Import, by HSC, Key Indicators 2006-07, ADB) and 'textiles and textile articles' alone explains 75 per cent of total RMG earnings (see, Siddiqi, 2004). Hence, devaluation of currency may increase the exports demand of RMG industry immediately (but not exports supply) which leads to an increase in the demand for 'textiles and textile articles' and related machineries in the first place. However, none of the empirical studies investigate whether the export demand is a significant determinant for import demand in Bangladesh context.

Secondly, availability of sufficient foreign exchange reserves may also be an important determinant for developing countries' imports demand. This is because exporters to developing countries, particularly to least developed ones, seek to be assured about the security of payments. Understandably, the exporters will not be interested to supply their products to a country that is not visibly able to pay for its external obligations. Sufficient foreign exchange reserves of a country can be a kind of guarantee of the ability to pay for imports. A group of literature (such as Arize and Osang, 2007; Emran and Shilpi, 2001 and Khan and Knight, 1988) therefore suggests the 'foreign exchange reserves' as one of the determinants for imports demand of developing countries. This study therefore estimates the import demand function including foreign exchange reserves as one of the determinants.

It is worth mentioning that trade liberalization has been a significant policy for Bangladesh since the mid-1980s. To attain desired economic growth and sustainable development, Bangladesh, under the auspices of the IMF, initiated the Structural Adjustment Facilities and the Extended Structural Adjustment Facilities in 1986 and 1989, respectively. Although trade liberalization has gradually taken place since the mid-1980s, the policy gained its momentum during the early 1990s by a huge reduction in tariff rates, quantitative restrictions, and convertibility in exchange rates (see, Dutta and Ahmed 1999). This study therefore examines whether trade liberalization plays any significant role in import demand.

Although this study particularly uses Bangladesh as a case study, it has a wider application in the sense that the majority of growing small open economies imports capital goods for their exporting industries as well as pursue a kind of managed floating exchange rate arrangement. The remaining sections are organized as follows: Section II presents the data, theoretical framework and estimation; Section III illustrates empirical results; and finally, Section IV concludes the study.

II. MODEL, DATA AND ESTIMATION

The simple and widely used traditional aggregate import demand function (see, for example, Carone, 1996; Khan and Rose, 1975 and Mah, 1997) takes the following theoretical form:

$$M_t = f(Y_t, RP_t);\ \text{where } f_1 > 0\ f_2 < 0 \qquad (1)$$

M_t is quantity demand for import at time t; Y real income; RP relative prices (the ratio of import prices and domestic price); f_i is the expected partial derivatives; where $i = 1, 2$.

However, as mentioned earlier that export demand and foreign exchange reserves are most likely to be significant determinants for import demand for developing countries which were ignored in the existing literature. The study therefore overcome the drawback of existing literature and empirically estimates the following two different import demand functions. Since the first empirical model (i.e., equation 2) employs GDP as one of the explanatory variable, it cannot include the GDP components separately in the same model (to avoid the multicolinearity problem). However, the study estimates the second empirical model (i.e., equation 3) where GDP components (including export demand) are employed as explanatory variables.

The first empirical model includes the foreign exchange reserves in addition to the relative price and domestic income variables as the determinants of import demand. Emran and Shilpi (1996) also suggest incorporating foreign exchange reserves variable in import demand function for Bangladesh.

It is worth noting that two basic structural adjustments in Bangladesh regarding the trade liberalization process have taken place in mid-1980s and late-1980s. However, Dutta and Ahmed (1999) suggest a structural shift dummy for trade liberalization of the country. Dutta and Ahmed (1999) demonstrate that the structural adjustments effectively were felt by Bangladesh economy only from 1992. Besides, this study finds that there is a high degree of multicollinearity (0.88) between GDP and trade-GDP ratio, and GDP is one of the explanatory variables in our import demand function. Hence, the study appropriately employs a binary dummy (instead of trade-GDP ratio) to examine the impact of trade liberalization on imports demand where the dummy equals zero upto 1991 and one subsequently. The empirical model is given as follows:

$$\ln M_t = \alpha_0 + \alpha_1 \ln Y_t + \alpha_2 \ln RP_t + \alpha_3 \ln R_t + \alpha_4 Dum_{1992} + u_t \quad (2)$$

where, M is volume of imports which is constructed by dividing the value of imports (current local currency prices) by the import price index which is collected from the Statistical Bulletin of Bangladesh (SBB) of the Bangladesh Bureau of Statistics (BBS); Y is constant GDP of Bangladesh at local currency price, $RP = \left(\frac{P_m}{P}\right)$ is relative prices of import, where, P_m is import prices index, P is domestic price which is proxied by the consumer price index and which is collected from the BBS and R is (real) foreign exchange reserves (minus gold).

The second empirical model comes from the idea of Giovannetti (1989) who suggests including the final expenditure components instead of a single real income variable as the determinants for import demand for developing country. Export demand which is the main focus of this study is one of the explanatory variables of import demand in the model.

$$\ln M_t = \beta_0 + \beta_1 \ln FCE_t + \beta_2 \ln EIG_t + \beta_3 \ln X_t + \beta_4 \ln RP_t + \beta_5 Dum_{1992} + \varepsilon_t \quad (3)$$

Where, FCE is (real) final consumption expenditures, which includes both private consumption expenditure and government expenditure, EIG is (real) expenditures on investment goods, and X is (real) exports.

It is worth noting that Bangladesh has been receiving substantial amount of aid and remittance from abroad. Why then this study has not included aid and remittance as determinants of import demand might be a valid question. However, the study has not included these two variables for the following reasons -

Aid is mainly a special or climactic issue for Bangladesh. When there is some large natural calamities (for example, prolonged floods in 1988, 1998, 2007) which hit the economy to a large extent, the country receives major amounts of aid and concessionary finance from its donors, which comes as large amount on the specific year (of disaster) and partly it is paid step-by-step later. Besides, the aid variable is found to be stationary at level. So, we cannot include this variable with other non-stationary variables in the long-run import demand function.

The foreign exchange reserves (FER) variable indirectly captures the effect of remittance inflows which is raised when remittances rise. The impact of FER, which is a stock (wealth) variable rather than remittance flows, is more important for Bangladeshi imports. Besides, similar to the aid variable, the remittance variable is also found to be stationary at level which does not allow us to include the remittance variable into the Engle-Granger and Johansen cointegration structure.

It is worth noting that although this study estimates two empirical models, there are appropriate theoretical footings of these models (see, Emran and Shilpi, 1996 and Giovannetti, 1989). Moreover, Model (2) allows us to test a conventional wisdom saying that the unit coefficient of income holds in developing country's import demand function (see, Bahamani-Oskooee and Rhee, 1997; Dutta and Ahmed, 1999; Emran and Shilpi, 1996; Hossain, 1995; Islam and Hassan, 2004; Mah, 1997).

The study uses annual data from 1978 fo 2008 because quarterly data for the relevant variables are not available in the existing data sources. Data come from the 'World Development Indicators (Edition: April 2010)' of the World Bank and the World Economic Outlook of the IMF (Edition: April 2010), Economic Trends (various issues) published by the Bangladesh Bank, and Statistical Bulletin of Bangladesh (various issues) published by the Bangladesh Bureau of Statistics (BBS). All variables are in real term and all data are in local currency.

III. ESTIMATED RESULTS

The study tests the stationarity of individual series using widely used the Augmented Dickey-Fuller (ADF), the Phillips-Peron (PP), and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) statistics. Subsequently two different types of Cointegration testing procedures namely, the Engle-Granger's (Engle and Granger, 1987) residual-based two-step procedure and the Johansen (1988) full-information maximum likelihood estimating technique are applied. Finally, the specific parsimonious equations are derived from the general dynamic models by sequentially eliminating the most insignificant variables and their lags.

Unit Root Tests

As mentioned, the study employs the PP, ADF and KPSS test statistics in order to examine the order of integration of each series. The null hypothesis for the ADF and the PP tests are (same), 'unit root'. However, the null hypothesis for the PKSS test is, 'stationary'. The tests results indicate that at 5% level of significance all series ($\ln M_t$, $\ln RP_t$, $\ln Y_t$, $\ln FCE_t$, $\ln EIG_t$, $\ln X_t$, and $\ln R_t$) are non-stationary at level and stationary at first difference, i.e., they are $I(1)$ series. The test results are presented in Table 1.

Cointegration and Weak Exogeneity Tests

The study uses the 'trace' and 'maximum eigenvalue' statistics based Johansen's multivariate cointegration approach in each model. Both the 'trace statistic' and the 'eigenvalue test' leads to the rejection of the null hypothesis of $r = 0$ (no cointegrating vectors) against the alternative hypothesis $r > 0$ (one or more cointegrating vectors) while the null of $r \leq 1$ against the alternative of $r > 1$ (two or more cointegrating vectors) cannot be rejected at 5% level of significance for Model (2). The 'trace statistic' for the Model (3) shows two cointegrating vectors, however, the 'maximum eigenvalue' statistic confirms one cointegration relation at 5% level of significance. Since, there is no consensus whether the 'trace statistic' or the 'maximum eigenvalue' is superior

Table 1
Unit Root Tests

Series	*ADF*		*PP*		*KPSS*	
	Level	*1st Difference*	*level*	*1st difference*	*level*	*1st difference*
ln M_t (constant)	-1.502	-7.366 ***	-1.89	-7.883***	0.766**	0.387
(Constant & trend)	-3.467	-7.815 ***	-3.288	-14.498***	0.171**	0.190
ln RP_t (constant)	-1.627	-4.012 ***	-1.812	-4.012***	2.240***	0.658
(constant & trend)	-2.176	-4.983***	-2.176	-4.983***	2.499***	0.057
ln Y_t (constant)	1.975	-3.764 ***	7.234	-7.652***	1.088***	0.609
(Constant & trend)	-0.714	-9.189 ***	0.094	-18.113***	0.171**	0.166
ln FCE_t (constant)	1.717	-8.347***	2.625	-8.267***	1.137***	0.369
(constant & trend)	-0.901	-4.352 **	-1.431	-22.972***	0.150**	0.145
ln EIG_t (constant)	0.556	-6.291***	0.550	-5.717***	0.776***	0.157
(constant & trend)	-1.194	-8.358***	-1.301	-8.358***	0.181**	0.082
ln X_t (constant)	0.489	-6.758***	1.053	-7.394***	13.35***	0.162
(constant & trend)	-3.267	-6.966***	-2.930	-9.606***	0.158**	0.056
ln R_t (constant)	-0.682	-6.042 ***	-0.833	-12.888***	0.724**	0.069
(constant & trend)	-2.818	-5.948 ***	-4.176	-12.585***	0.129*	0.032

Note: ***, ** and * denote significance levels at 1%, 5% and 10% respectively. Critical values for the ADF and the PP tests are -3.71, -2.98 and -2.63 (intercept); -4.36, -3.595, and -3.23 (intercept and trend) at 1%, 5% and 10% level of significance respectively, which is taken from MacKinnon (1996) one-sided p-values. The critical values for the KPSS test are 0.739, 0.463 and 0.347 (intercept); 0.216, 0.146 and 0.119 (intercept and trend) at 1%, 5% and 10% level of significance, respectively. Critical values for this test statistic is taken from Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1).

to its counterpart, the study accepts the 'maximum eigenvalue' results for model (3). Hence, it can be concluded from estimation that there is one cointegration relation in both models. The results are given in Table 2.

The paper then uses the Engle-Granger (EG) two-step procedure for cointegration test. In the first step, long-run equilibrium relations among variables are estimated by regressing import demand on the determinants explained in the Model (2) and the Model (3). The study then obtains the residuals for each model and subsequently tests the 'unit root' for the residuals using the ADF statistic. The Engle-Granger residuals are found stationary in levels for both models. The t-ADF values of the residuals for the Model (2) are -4.45** at 1st lag and -6.16** at zero lag and the residuals for the Model (3)-are -4.01** at first lag and -5.22** at zero lag. Hence, the Engle-Granger cointegration test results simplify the interpretation of the one cointegrating vector as a stable long-run relationship among the variables in both models.

The study also imposes the 'weak exogeneity' restrictions using the Johansen approach (see, Johansen 1992) which confirms a long-run relationship for both models where import demand is identified as the dependent and all other variables are as explanatory variables in Model (2) and Model (3). The χ^2 based weak-exogeneity test results are: $\chi^2 = 0.473$ [Prob.: 0.925] and $\chi^2 = 8.161$ [Prob.: 0.086] for the Model (2) and the Model (3), respectively. The study then tests the 'unit coefficient of income' restriction in Model (2). The test result,

Table 2
Johansen's Multivariate Cointegration Tests

Null hypothesis	*Alternative hypothesis*	*Trace test* Statistic	95% critical value	*Maximum Eigenvalue* Statistic	95% critical value
Model (2): ln M_t; ln Y_t; ln RP_t; ln R_t; Dum 1992					
r = 0	r = 1	93.83**	79.34	50.97**	37.16
r ≤ 1	r = 2	42.85	55.25	21.41	30.82
r ≤ 2	r = 3	21.44	35.01	10.32	24.25
r ≤ 3	r = 4	11.12	18.40	9.24	17.15
r ≤ 4	r = 5	1.88	3.84	1.88	3.84
Model (3): ln M_t; ln FCE_t; ln EIG_t; ln X_t; ln RP_t; Dum 1992					
r = 0	r = 1	104.58**	79.34	45.56**	37.16
r ≤ 1	r = 2	59.02**	55.25	26.72	30.82
r < 2	r = 3	32.31	35.01	18.10	24.25
r ≤ 3	r = 4	14.21	18.40	14.19	17.15
r ≤ 4	r = 5	0.02	3.84	0.021	3.84

Note: **reject null hypothesis at 5% level of significance. 'r' implies the number of cointegrating vectors and critical values are given from the MacKinnon-Haug-Michelis table (1999).

$\chi^2 = 2.633$ [Prob.: 0.621] suggests that the 'unit coefficient of income' hypothesis holds for Bangladesh's import demand function.

The results of the Engle-Granger's first-step and the Johansen weak exogeneity tests are presented in Table 3.

Table 3
Results of the Engle-Granger and the Johansen Cointegration Tests

	Engle-Granger			*Johansen FIML*	
	Model (2)	*Model (3)*	*Model (2a)*	*Model (2b) (when $\beta_1 = 1$)*	*Model (3)*
Constant	-4.01	2.18	-	-	
ln Y_t	1.12	-	1.12	1.00	-
ln RP_t	-0.51	-0.54	-0.44	-0.36	-0.42
ln FCE_t	-	0.52			0.62
ln EIG_t	-	0.05	-	-	-0.11
ln X_t	-	0.30	-	-	0.34
ln R_t	-0.04	-	-0.03	0.01	-
Dum1992	0.05	-0.08	0.09	0.10	-0.05

Note: The unit coefficient of income hypothesis in Model (2) is tested within the Engle-Granger as well. Both the χ^2 (p-value: 0.15) and the F – statistic (p-value: 0.17) based Wald test results cannot reject the unit coefficient of income hypothesis in import demand function at 5% level of significance.

Hence, both the Engle-Granger and the Johansen tests for Model (2) suggest that the relative prices of import is negative and inelastic (approximately -0.5) in the long-run. The result is consistent with the reported results by Islam and Hassan (2004), Dutta and Ahmed (1999), and Emran and Shilpi (1996). The estimated results also demonstrate that real income is positively associated with import demand and the elasticity of real income variable is approximately one. The study could not reject the 'unit coefficient of income' hypothesis in Model (2) as well. In EG Cointegration test, I impose the unit coefficient of income restriction and employ the Wald testing system to examine whether the restriction is correct. However, in case of the Johansen Cointegration test we impose the unit coefficient of income restriction within the Cointegrating vector. The χ^2 based the weak exogeneity test could not reject the restriction. Hence, statistically we cannot reject conventional wisdom - the unit coefficient of income hypothesis is valid in developing countries specifically Bangladesh's import demand function. Similar to Dutta and Ahmed (1999), and Islam and Hassan (2004), the foreign exchange reserves variable comes out with an unexpected negative sign initially when the restriction of the 'unit co-efficient of income' has not been imposed. However, when the 'unit coefficient of income' restriction along with the 'weak-exogeneity' restrictions is imposed, the sign for the foreign exchange reserves variable appears to be positive which suggests that foreign exchange reserves has a positive and significant impact on import demand in the long-run. Similarly, we cannot reject a positive coefficient of the foreign exchange reserves variable in the Engle-Granger's cointegration test as well. P-values of the χ^2 and the $F-statistic$ are found to be 0.25 and 0.24, respectively. These, therefore, statistically validate a positive relationship between imports demand and foreign exchange reserves.

The estimated results for Model (3) demonstrate that final consumption expenditure (0.52), expenditures on investment goods (0.051) and export (0.30) are positively associated with aggregate import demand which is evident from the Engle-Granger approach. The Johansen approach suggests that final consumption expenditure (0.62) and export (0.34) are positively related with import demand. However, unlike the EG approach the expenditures on investment goods comes up with a negative sign (-0.11) in the Johansen approach. This may take place if a country encourages its investors to invest in imports substitute sectors. However, both the Engle-Granger and Johansen approaches affirm that the export demand is a positive and significant determinant for aggregate import demand in the long-run.

Error Correction Mechanism and Robustness Tests

The short-run dynamics of the Model 2, and Model 3 are estimated following Hendry's (1979) general-to-specific modelling approach. Given that all variables are in their first difference and using appropriate lag structure, the study derives the specific models from the following two general models, Model (4) and Model (5):

$$\Delta \ln M_t = \alpha_0 + \sum_{i-1}^{1} \alpha_i \Delta \ln M_{t-i} + \sum_{i=0}^{1} \beta_i \Delta \ln Y_{t-i} + \sum_{i-0}^{1} \delta_i \Delta \ln RP_{t-i}$$

$$+ \sum_{i-0}^{1} \phi_i \Delta \ln R_{t-i} + \lambda EC_{t-1} + \partial Dum_{1992} + \varepsilon_t \qquad (4)$$

$$\Delta \ln M_t = a_0 + \sum_{i=1}^{1} a_i \Delta \ln M_{t-i} + \sum_{i=0}^{1} b_i \Delta \ln FCE_{t-i} + \sum_{i=0}^{1} c_i \Delta \ln RP_{t-i}$$
$$+ \sum_{i=0}^{1} d_i \Delta \ln EIG_{t-i} + \sum_{i=0}^{1} e_i \Delta \ln EIG_{t-i} + gEC_{t-1} + hDum_{1992} + u_t \quad (5)$$

The study sequentially eliminates the insignificant lags and variables from the general model. The error correction terms for both equations come from the Engle-Granger residuals. The parsimonious equations (note, equation (6) and equation (7) are derived from Model 4 and Model 5, respectively) are reported as follows (standard errors are in parentheses):

$$\Delta \ln M_t = 0.05 - 0.70\, \Delta \ln RP_t + 0.23\, \Delta \ln RP_{t-1} - 0.66 EC_{t-1}$$
$$(0.01) \quad (0.085) \qquad (0.09) \qquad (0.21) \quad (6)$$
$$R^2 = 0.83 \quad F = 32.5^{**} \quad DW = 2.06$$

Diagnostic Test Results [p-value in parenthesis]	
AR 1-2 test	F = 0.506 [0.611]
ARCH 1-1 test	F = 0.144 [0.708]
Normality test	χ^2 = 1.031 [0.597]
hetero test	F = 0.649 [0.690]
hetero-X test	F = 0.416 [0.899]
RESET test	F = 1.66 [0.213]

** implies statistically significant at 5% level.

$$\Delta \ln M_t = -0.03 - 0.66 \Delta \ln RP_t + 0.23 \Delta \ln X_t - 0.69 EC_{t-1}$$
$$(0.01) \quad (0.09) \qquad (0.06) \qquad (0.24)$$
$$R2 = 0.86 \qquad F = 39.47^{***} \qquad DW = 1.88 \quad (7)$$

Diagnostic Test Results [p-value in parenthesis]	
AR 1-2 test:	F = 0.121 [0.887]
ARCH 1-1 test:	F = 0.020 [0.900]
Normality test:	χ^2 = 2.381 [0.304]
hetero test:	F = 0.285 [0.934]
hetero-X test:	F = 0.301 [0.957]
RESET test:	F = 0.068 [0.797]

Both the parsimonious equation (6) and equation (7) indicate that relative price is a significant determinant of import demand in the short-run. However, the parsimonious equation (7) suggests that among the GDP components export demand is the only significant determinants of import demand. The coefficient of the exports demand variable is positive and the elasticity is found to be smaller in the short-run (0.21) compare to the long-run (0.34). The coefficient of EC_{t-1} appears to be negative, which is a feature necessary for models' stability. The speed of adjustment back to the equilibrium is about -0.65 which implies a very rapid speed of adjustment similar to Alias and Tang (2000) for Malaysia (-0.64).

Diagnostic test statistics suggest that empirical models are stable. Specifically, the AR test examines up to 2nd order serial correction which suggests that there is no autocorrelation at 5% level of significance. The ARCH and the Hetero tests suggest that there is no heteroscedasticity. The Jarque-Bera 'normality test' indicates that residuals contain all the properties of classical linear regression model. The regression error specification (RESET) test suggests that linear specifications of the empirical models are not incorrect.

Figure 3: Actual and Fitted Import Demand for Model 4

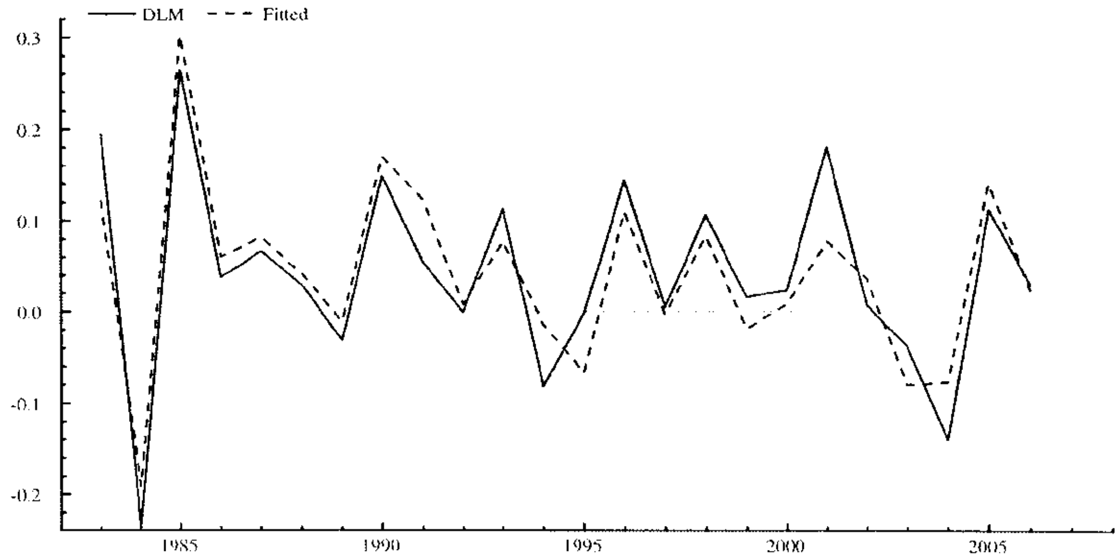


Figure 4: Actual and Fitted Import Demand for Model 5

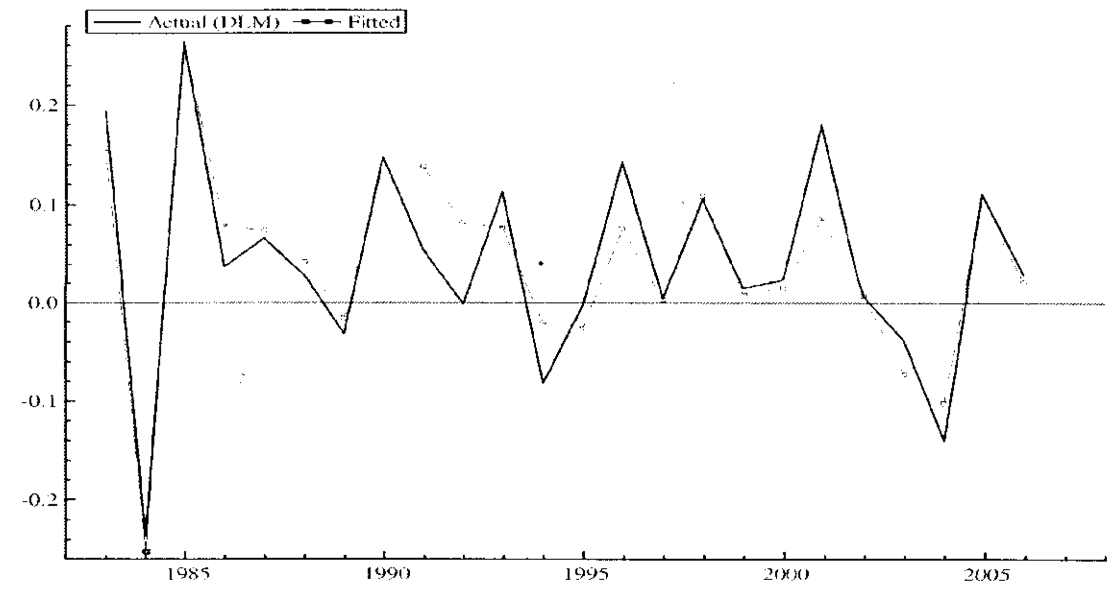


Figure 5: Beta Coefficients for Model 4

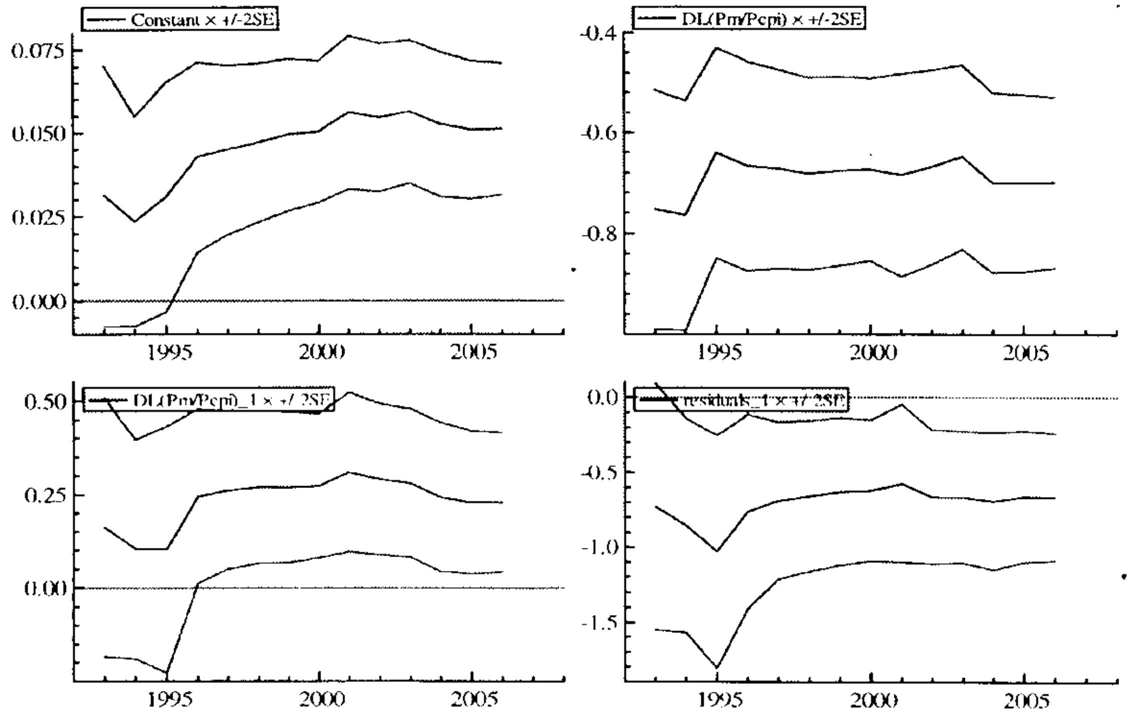


Figure 6: Beta Coefficients for Model 5

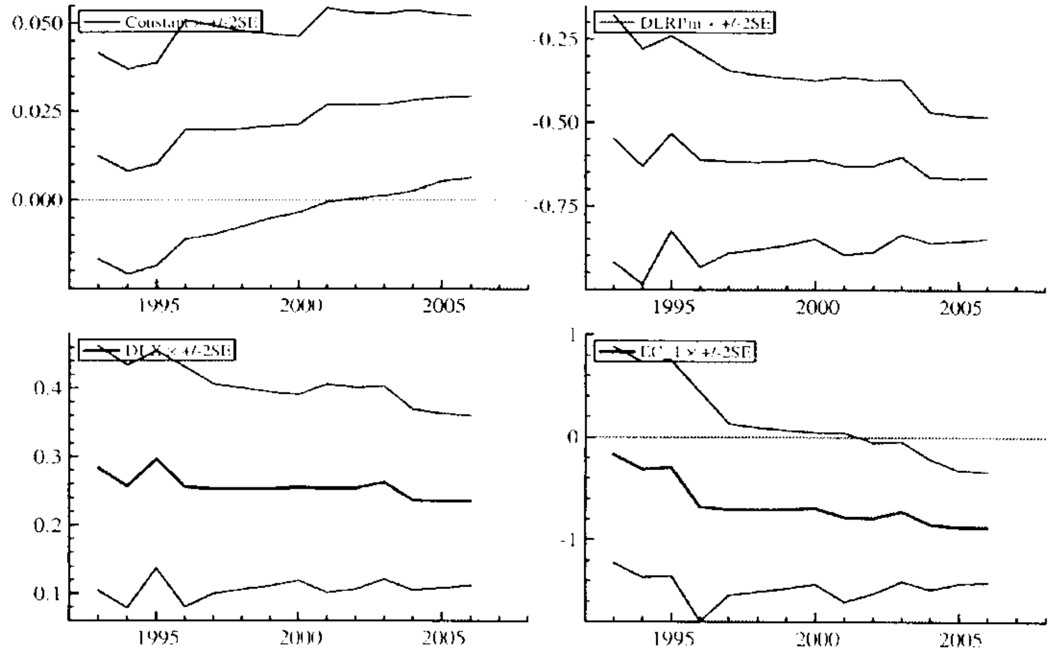


Figure 7: Structural Instability Test for Model 4

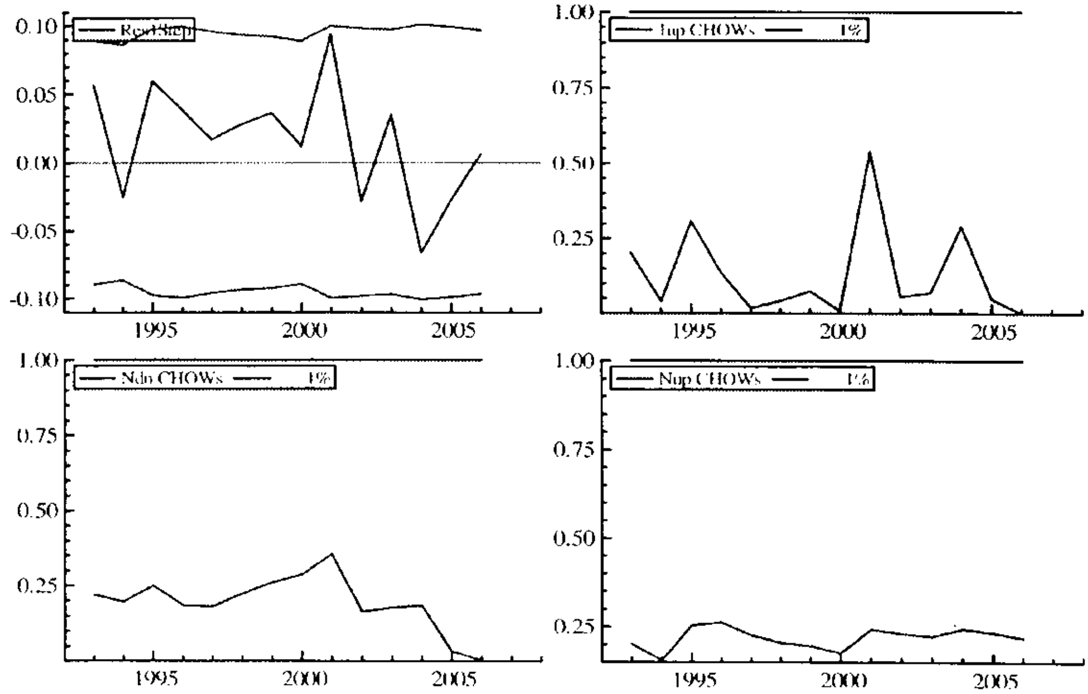
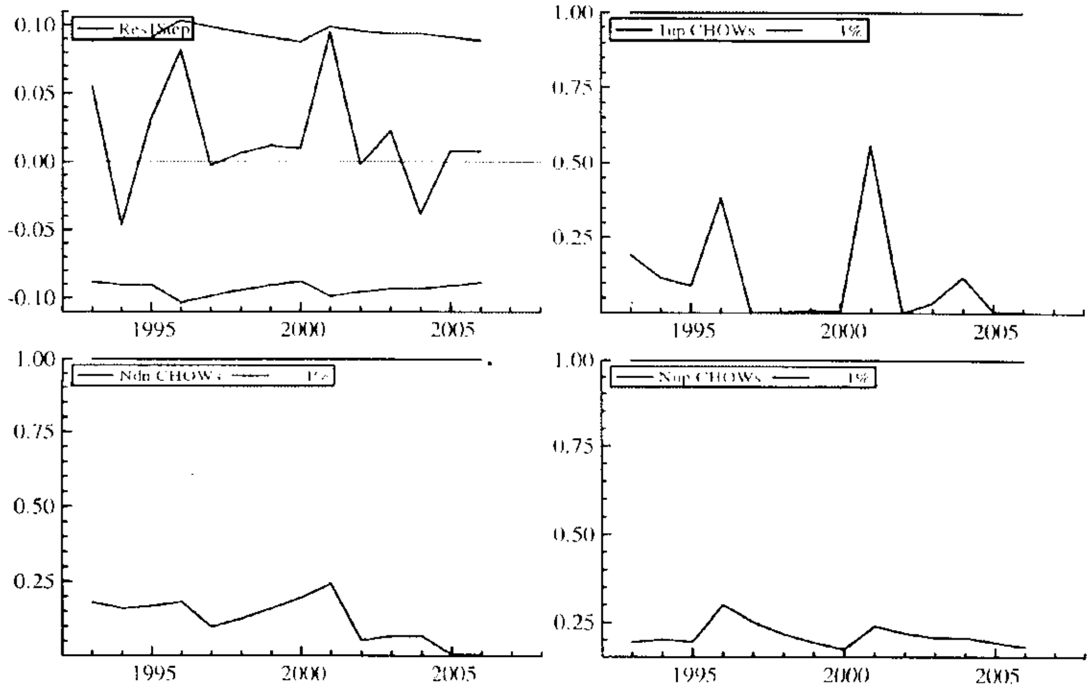


Figure 8: Structural Instability test for Model 5



The study also graphically tests the actual and fitted imports demand, beta coefficients, and the tests of models' stability. Figure 3 and Figure 4 suggest that the estimated models explain the changes of import demand accurately. Figure 5 and Figure 6 show the value of beta coefficients within their ± 2 standard errors. All of them seem to be in between the standard errors for the entire period with very small movements which indicates the stability of the estimated models. Moreover, the 1-step residual test within ±2 standard errors band, and '1-step chow', 'beak-point chow' and 'forecast chow' tests suggests the structural stability of the models (see, Figure 7 and Figure 8).

IV. CONCLUSION

Being a small open economy, Bangladesh requires import of capital goods for exporting industries to develop and grow. The country also has to maintain a good foreign exchange reserves position to convince the trade partners about its ability to pay for imports. The study consequently estimates import demand functions and employs a number of time series econometric techniques to identify whether real exports and foreign exchange reserves, in addition to traditionally used relative prices and domestic income, are significant determinants of import demand. The paper employs the Engle-Granger and the Johansen cointegration techniques to estimate import demand functions in the long-run. Subsequently, dynamic parsimonious equations are derived from general import demand equations using the error correction mechanism.

The estimated results indicate that there is long-run cointegration relation among the volume of import, real income, relative prices and foreign exchange reserves. Instead of a combine 'real GDP' variable, the final expenditure components of GDP such as the final consumption expenditure, expenditure on investment goods, and expenditure on exports, are used separately in the import demand model. The aggregate import demand, foreign exchange reserves and the final activity variables, in addition to relative prices are found to be cointegrated in the long run. The study suggests that foreign exchange reserves, real GDP as well as the GDP components (i.e., final consumption expenditure, expenditures on investment goods and export demand) are positively while relative prices are negative and significantly associated with aggregate import demand. Relative prices, export demand are found significant both in the long- and short-run. However, unlike some other existing studies (see, Datta and Ahmed, 1999; and Islam and Hassan, 2004) who find a wrong sign for foreign exchange reserves, this study finds positive coefficient of the foreign exchange reserves variable in the long-run. The paper also tests the unit coefficient of income phenomenon for Bangladesh and could not reject the hypothesis. The study depicts that real exports are significant determinant of imports demand in both short- and long-run. Hence, the above findings suggests that when Bangladesh devalue its currency to find competitiveness in its exports sector and improve the trade balance, the policy-makers need to consider the increased demand of capital goods both in the short-run and long-run.

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