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Price and Income Elasticity of Imports in Bangladesh: An ARDL Bounds Test Approach

Md. Abdul Kayum

Md. Abdul Karim

Md. Omor Faruq

Monetary Policy Department

Bangladesh Bank

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Md. Abdul Kayum*
Md. Abdul Karim**
Md. Omor Faruq**

* Means Deputy General Manager and ** denotes Joint Director in the Monetary Policy Department of Bangladesh Bank. The views expressed here, however, are authors' own and do not necessarily reflect those of the central bank. Contact persons email address is omar.faruq@bb.org.bd.

Abstract

The primary objective of the paper is to examine the long-run price and income elasticity of import demand in Bangladesh over 1977-2015. This study uses a relatively recent cointegration test, the bounds test, based on the estimation of an unrestricted error-correction model . The result shows that the long run income elasticity of import demand is 1.54, suggesting a rise in import if income increases. The long run price elasticity is -0.73, which indicates a fall in import if the price increases. Additionally, the estimated short run elasticity of imports with respect to income and the relative price are 1.18 and -0.58, respectively, vindicating the similar direction of import demand in response to income and price in both the long and short run. The coefficient of the error correction term is - 0.72, which indicates that it takes less than two years for the long run relationship to restore after a shock that deviates the relationship. Thus, this study has policy implications for the imports in Bangladesh as well as in other developing nation.

1. Introduction

Import is one of the predominant components of international trade and plays an important role in a country's economic growth, employment generation and development. Bangladesh is a developing country. Its current account is open and capital account is being liberalized gradually. International trade can, therefore, play a significant role in its economic development. Studies on the topic of international trade can broadly be divided into two categories. One is in favor of export-led growth and other concludes that imports are helpful for achieving growth and development (Ali Amjad et. al., 2013). However, these have remained a topic of debate so far and demand an empirical investigation in the Bangladeshi scenario. Any policy issues regarding international trade will, therefore, require a critical, judicious evaluation. Understanding how import flows react to changing economic conditions in a country is necessary for formulating trade and exchange rate policies. There is a widespread agreement that imports generally react more swiftly than exports, resulting in short run current account imbalances.

Estimation of import demand functions has always been an active area of research. The reason is the concern of policy makers for the resolution of trade deficits and volatility in exchange rates and thereby to design effective trade policies. Import demand function investigation has implications for a wide range of important macro-economic policy issues. These include the impact of expenditure-switching through exchange rate management and commercial policy on a country's trade balance.

The relative price/price ratio (imported goods price/domestically produced goods price) plays a significant role in the determination of trade flows and policies of devaluation as a way to correct trade imbalance (Reinhart, 1995). The role of income elasticity of imports is as important as its price elasticity. If in a two-country model, prices are constant and income growth is the same in both countries, then the trade balance between them can still change over time if their respective income elasticity of demand for import differs. It indicates that income elasticity of import demand is also an important policy variable (Johnson, 1958). The estimation of import demand functions is usually based on conventional demand theory, which indicates that the quantity of imports demanded is a function of income, the price of the imported commodity and the price of domestic substitutes.

Empirical literature of international economics shows that many studies have investigated estimation of import demand function in the developed and developing countries. However in the context of Bangladesh, a few studies have been conducted on an aggregate import demand function. Also, these studies found different results regarding price and income elasticity of imports. Dutta and Ahmed (1999) found an inelastic import demand with respect to price (from -0.77 to -0.81) while with respect to income is highly elastic (from +5.70 to +6.69). Hussain (2000) found that, long run relative price and income elasticity are -0.94 and 1.21 respectively but short run relative price elasticity is -1.09 (which is elastic). Hoque and Yusop (2010) found that long run income is elastic (1.64 to 1.57) but short run income elasticity is very high (4.28 to 6.39). Hye & Mashkoor (2010) found that income is inelastic (0.93). It is

clear from the above discussion that the results of earlier studies are inconclusive.

The earlier studies cannot adequately contribute to explaining the recent import demand of Bangladesh as these studies have many shortcomings. All the earlier studies focus on time period before the year 2008. Many studies suffer from methodological deficiencies such as small sample bias, improper conversion of data frequency, use of weak proxies; and found conflicting results. Zaman and Talukder estimated import demand with annual data set of only 16 years (1984-1999) using the two stage least square method. Hossain estimated import demand for annual data sample of only 22 years (1974-1996) using Engle-Granger co-integration approach. Dutta and Ahmed used quarterly data for the period of 1974-1994 and applied Johansen co-integration and error correction mechanism . Quarterly data is not available for Bangladesh for all variables for the whole sample period. Therefore, they generate quarterly data on the GDP variable following a linear interpolation method. For unit value indices of imports for the periods (1974-82 and 1991-94) they used indices of non-oil Asian developing countries as a proxy.

Hoque and Yusop used yearly data from FY1973 to FY2005. They used wholesale price index (WPI) as a proxy to domestic price index. As the total time series data for WPI of Bangladesh are unavailable, they took the average of the WPI of agricultural goods and WPI of industrial goods for Bangladesh. Hoque and Yusop, and Dutta and Ahmed found very high and surprising short run income elasticity of import (from 4.28 t0 6.69). It indicated that a 1 percent increase in income will result in about a 4-7 percent increase in import demand. They did not give any explanation for such high income elasticity of import in the short run. Similarly, their results showed that short run price elasticity of import is higher than that of the long run.. At first sight it seems to be reasonable that short run price elasticity is more volatile than long run elasticity. However, if we look into the nature and process of our import demand it is difficult for importers to change their demand in the short run as price changes but it is possible in the long run. Importers will respond to a time lag as price changes. As such, it is quite reasonable that long run elasticity will be higher compared to the short run one.

This study overcomes these shortcomings, and adopts a relatively recent approach with recent date series to reinvestigate both short run and long run import elasticity in Bangladesh. Our results are robust and consistent with import patterns of Bangladesh.

The next of the paper is organized as follows: Section 2 provides a brief description of the import scenario of Bangladesh; Section 3 discusses literature review; Section 4 analyzes the data and methodology; Section 5 describes the model specification; Section 6 is about empirical results and analysis: Section 7 provides findings and policy suggestions; and finally, Section 8 gives the concluding remarks.

2. Import Scenario of Bangladesh

The country's import volume has been increasing over time since its independence. In view of the low base of industrialization, low manufacturing levels and the non-availability of industrial raw materials, Bangladesh is heavily dependent on imports. Imports are also essential for government infrastructure development projects, industrial production and manufactured consumer goods. Import as percent of GDP rose to 24.0 in FY2015 from only 8.4 in FY1975. On the other hand, export as percent of GDP increased to 17.3 in FY2015 from 2.7 in FY1975.

Table-1: Export and Import as percent of GDP in Bangladesh

Items	FY75	FY80	FY85	FY90	FY95	FY00	FY05	FY10	FY15[p]
Exports as percent of GDP	2.7	5.8	6.0	5.0	8.6	10.5	13.7	14.7	17.3
Imports as percent of GDP	8.4	17.9	16.5	12.4	15.4	17.4	21.8	23.7	24.0

Source: Economic Trend, Bangladesh Bank. P= provisional.

It is noteworthy to mention that export receipts of Bangladesh increased 37 times from Tk. 61 billion in FY1991 to Tk. 2,265 billion in FY2015 while imports payments increased 25 times from Tk. 125 Billion in FY1991 to Tk. 3,142 billion in FY2015 (Chart-1). However, the trade gap (export minus imports) increased over time as exports remained smaller than imports. The major import items of Bangladesh include petroleum, oil and lubricant (POL), textile and articles thereof, iron, steel and other base metals, raw cotton, plastic, rubber and articles thereof, edible oil, yarn textiles, chemicals, food grains (rice, wheat) etc. The country - wise import analysis showed that in terms of the value of total imported commodities, China occupied first position in FY15 (July-December) with 19.6 percent share and India came second position with 14.1 percent share, Singapore secured third position with 6.1 percent share followed by Malaysia (3.7 percent share) and Japan (3.6 percent share).

The composition of imports has changed slowly. The composition of our imports showed that consumer goods and intermediate goods comprise a very low share of only 13 percent in FY2015 which was 11 percent in FY2000. In contrast, investment goods consist of about 60 percent in FY2015 which was 47 percent in FY2000 (Chart-3). These investments goods are basically needed for production of export goods particularly for RMG products. RMG products comprise almost 84 percent of export earnings which are highly import-dependent and we actually make some value addition. The knitwear garments covering 49 percent share of total RMG exports have larger value addition of almost 75 percent in FY2015. Oven garments covering 51 percent share have smaller value addition of 26 percent. This indicates that the overall RMG sector has almost 50 percent value addition from imported inputs needed for RMG products. Therefore, there exists similar pattern of exports and imports in Bangladesh with a time lag. When import growth is higher, export growth is also higher and vice versa (Chart-2). Though the

nature of import goods largely determined elasticity other factors are also important. The empirical knowledge about the value of import elasticity is crucial for adopting any import promoting policies whether it be exchange rate, tariff or price policies. It is clear from the above discussion that Bangladesh imports are largely essentials.

Figure 1: Development of Exports and Imports in Bangladesh

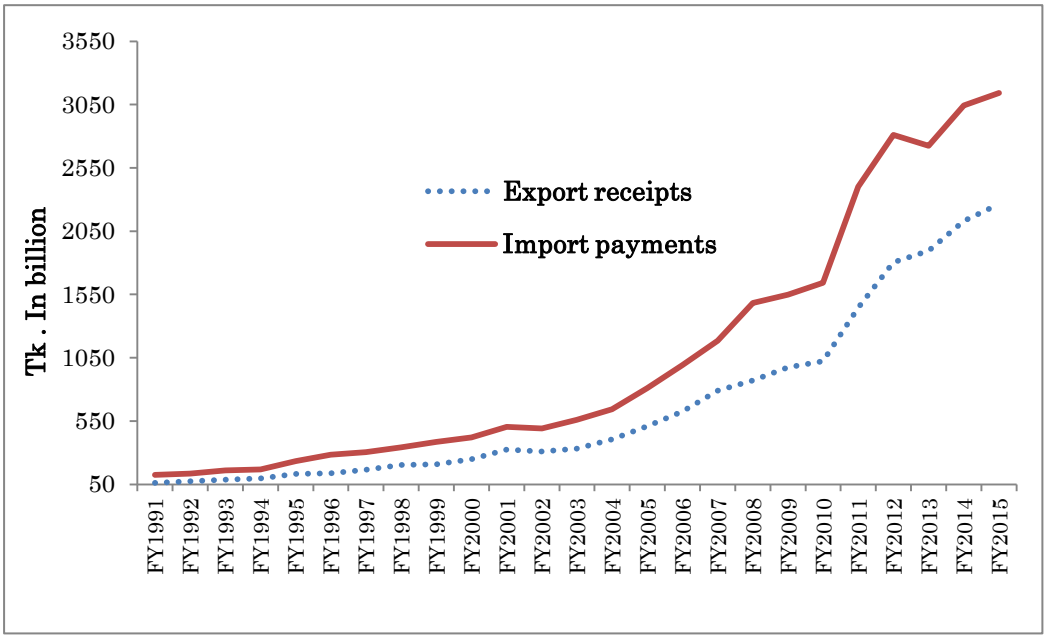


Figure 2: Exports and Imports Growth Rates (Y-o-Y)

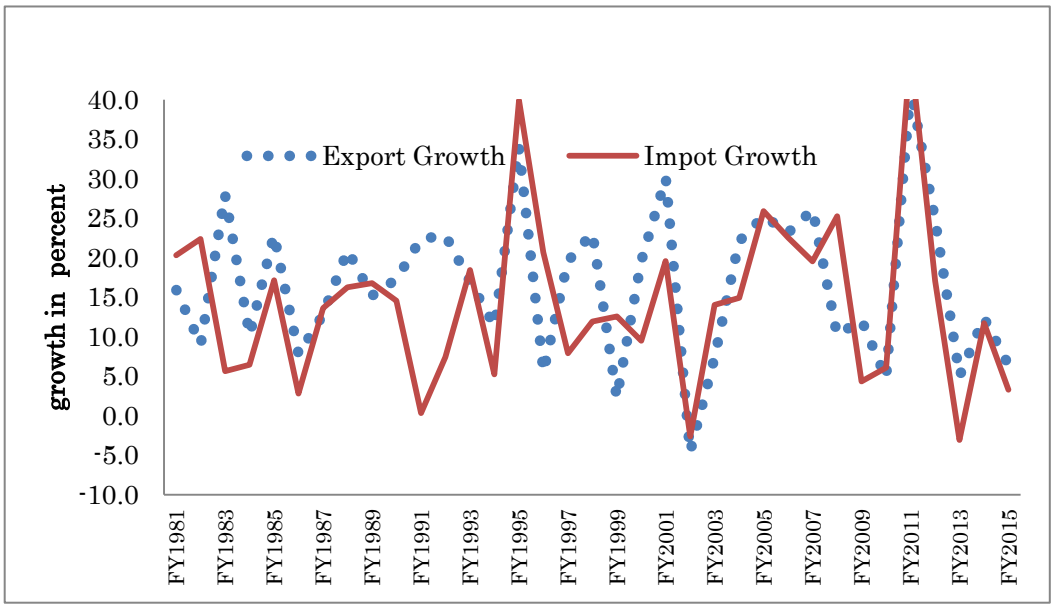
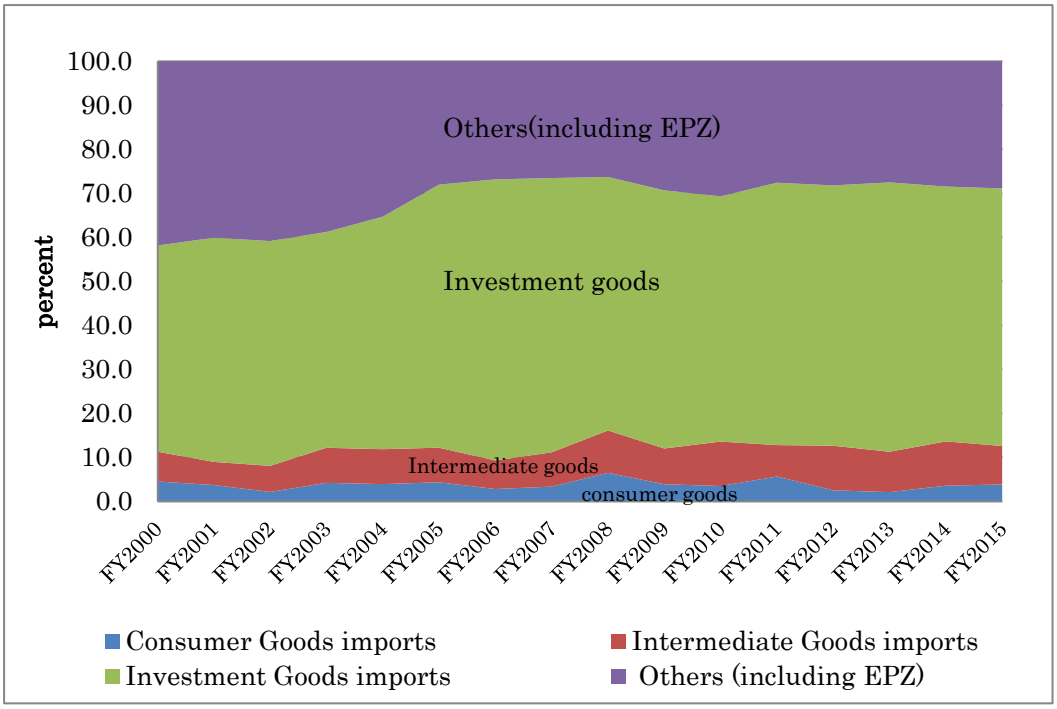


Figure 3: Composition of Imports



Note: Consumer Goods includes rice and wheat; Intermediate Goods comprise of milk, spices, oil seeds, edible oil, pulses and sugar and Investment Goods consist of clinker, crude petroleum, POL, chemical, Pharmaceuticals products, fertilizer, raw cotton, yarn, textile, iron, steel and capital machinery.

3. Literature Review

The empirical literature on estimation of the elasticity of aggregate import demand is vast. Narayan and Narayan (2003), estimated the import demand elasticity for Mauritius and South Africa for the period 1963-1995 and 1960-1996 respectively. Based on the bounds testing procedure for co-integration, they found the relationship that the import-demand function for Mauritius is both price-inelastic (-0.43) and income-inelastic (+0.87), while the import-demand function for South Africa is price-inelastic (-0.61) but income-elastic (+1.19).

Dutta and Ahmed (2006) investigated the behavior of Indian aggregate imports during the period 1971-1995, using co-integration and error correction modeling approaches. They found that import volume is co-integrated with relative import price and real GDP. Their estimates suggest that the import-demand function for India is price inelastic (-0.47) and income elastic (+1.48), implying that import-demand is largely explained by real GDP, and is less sensitive to import price changes.

Shareef and Tran (2007) estimated the aggregate import demand function for Australia over the period 1959Q3-2006Q3. They conducted different co-integration tests namely the Engle-Granger's residual-based test, the Johansen and Juselius multivariate test and the bounds test and found consistent results. In the long run, the price elasticity is found to be close to unity and import demand is found to be fairly income elastic. In the short-run, Australian import demand is both price and income inelastic; price is more elastic than income. Their findings suggest income is a dominant factor in the long run while

price is dominant factor in the short run for determining quantity of Australian import demand.

Baluch and Bukhari (2012) estimated the elasticity of imports with respect to relative prices and income for Pakistan from 1971 to 2009 using ARDL bound test procedure. The estimated long run elasticity of imports with respect to relative prices and income were -0.53 and 1.22, respectively.

Zhou and Dube (2011) adapt bounds testing approach in five import demand models for four CIBS (China, India, Brazil, South Africa) countries during the period 1970-2007. They found that the long run income elasticity (ranges from 1.5 to 4.2) is much higher compared to earlier studies and are higher than the short run counterparts for CIBS. They also found that price elasticity is either significantly positive or statistically insignificant for the four countries which is contrary to traditional wisdom.

Although various studies have examined the determinants and implications of import demand functions for both developed and developing countries, only a few studies have focused on Bangladesh's import functions. Hossain (2000) estimated the import demand function for Bangladesh using the Engle-Granger co-integration approach. The estimated values for long run relative import price and income elasticity are - 0.94 and +1.21, respectively. Zaman and Talukder (1996) constructed an import demand function for Bangladesh in the context of the structural adjustment program using the two stage least square method. They found that instead of GDP, prices measured by a ratio of import price and domestic price indices, is the most important determinant of import demand. Their estimated price and income elasticity are -0.84 and +0.21, respectively.

Dutta and Ahmed (1999) investigated the long-run aggregate merchandise import demand function for Bangladesh during the period 1974-94. They applied the co-integration and error correction modeling approaches. Results suggest that there exists a unique long run or equilibrium relationship among real quantities of imports, real import prices, real GDP and real foreign exchange reserves. Import demand is found price inelastic (from -0.77 to -0.81) but highly income elastic (from +5.70 to +6.69).

Hoque and Yusop (2010) estimated the impact of trade liberalization on aggregate import of Bangladesh using the autoregressive distributed lag (ARDL) bounds test approach with annual time series data from 1972-1973 to 2004-2005. They found that price, income, foreign exchange reserves, import duty rate and the trade liberalization dummy all significantly influence import demand in Bangladesh with consistent signs. In the long run, income exhibits the highest positive impact (1.64); while price (-0.43) and foreign exchange reserves (-0.14) show low negative impacts on the aggregate import. But, in the short run, the aggregate import is significantly influenced by income (4.38), price (-1.14) and the import duty rate (-1.10).

Hye and Mashkoor (2010) estimated aggregate import demand function for Bangladesh economy with the data of 1980 to 2008 using an ARDL approach to co-integration and rolling window regression method. The estimation result confirmed the long run relationship between imports, relative price and economic activity, and long run economic growth elasticity is (0.93) positive and relative price elasticity in the long run is negative (-0.29). The regression results of the rolling window method demonstrated that the long run elasticity of national income variable vary in the range of 0.81 to 0.96 and the relative price elasticity are negative well consistent with theory except a few exceptions.

4. Data and Methodology:

4.1 Data:

This study uses the annual data of real imports, real GDP and relative price of imports from FY1977 to FY2015. We could not use the data before FY1977 because of unavailability of information on import prices. We derive the real imports data by dividing the nominal imports value by import price index. The import price index is deflated by GDP deflator in order to calculate price ratio/relative price. We used the GDP deflator for calculating price ratio instead of CPI or WPI as it covers a wider range of domestically produced goods and services. Moreover, we found that the estimated result is not different even when we used the CPI (Annex 2, Table A). In addition, WPI is not available in case of Bangladesh for the sample period. Unit of measurement of all variables are in crore taka. The sources of all data used in this study are from different sources such as, Bangladesh Bank Annual Report (various issues), Economic Trends (different issues). The variables used in the equations are measured in FY1995-96 = 100 prices. The rationale for using the annual series for this study period is the non-availability of comprehensive quarterly or monthly data series on GDP and import Price Index.

4.2 Methodology:

The study will test the short run as well long run price and income elasticity separately by using a modern time series co-integration based on the autoregressive distributed lag (ARDL) bounds test approach developed by Pesaran, Shin, and Smith (2001), with annual time series data from FY'77 to FY'15, having 39 observations.

In this study we use the ARDL bounds test for the rationality of the co-integration among the variables in the import demand function rather than Johansen's co-integration test. The rationale of taking on the ARDL Bounds testing approach can be explained by several factors.

First, this approach is pertinent whether the explanatory variables are stationary or not (Pesaran et al., 2001). The Johansen's co-integration method requires that all variables must be co-integrated in the same order for co-integration test but ARDL Bounds test can be used whether the variables are I(1) or I(0) or mutually co-integrated.

Secondly, the Johansen's co-integration methods requires a large sample for its validity but ARDL Bounds tests can be used in case of small sample and efficiently determines the co-integrating relationship among the variables.

In our study we have 39 annual observations. That's why the ARDL Bounds test approach is very relevant method for this study. Thirdly, the choices in Johansen's method are limited; when using the ARDL a large number of choices can be made including decisions regarding the number of endogenous and exogenous variables, if any, for inclusion, the treatment of deterministic elements, as well as the order of VAR, and the optimal number of lags to be used (Pahlavani et al., 2005; Pesaran and Smith, 1998).

We will first test for the unit root in respective series using the Augmented Dickey-Fuller (ADF)

(1979, 1981) tests. Given the variables are I(0) or I(1), we test for co-integration utilizing the Pesaran et al. (2001) bounds test methodology. If co-integration is present we estimate the long run coefficients from the UECM of ARDL. For short run dynamics we transform the equation into an ECM.

To implement the ARDL bounds test approach we used the F- statistics (according to the Pesaran et al., 2001) to test the significance of the lagged levels of the variables in the conditional unrestricted error correction model (UECM). First, we estimate the UECM version of the ARDL model with appropriate lags by the OLS method and get a general ARDL model. After that, from the general ARDL estimate, we get the appropriate model.

To perform, The ARDL bounds test approach we use the two-step procedure followed by Pesaran and Shin (1999). The first step is to determine the long run co-integrating relationship among the variables in the equation. The long run relationship among the variables is determined using the F-test. If the estimated F-statistic value be larger than the upper bounds of critical value which indicates that the null hypothesis of no co-integration is rejected, the variables included in this model are co-integrated. On the other hand, if the computed F-static is smaller than the lower bounds of critical value which indicates the null hypothesis of no co-integration cannot be rejected, the variables in this model are not co-integrated. Furthermore, if the F-statistic value lies between the upper bounds and lower bounds, then the decision is inconclusive regarding the null hypothesis of no co-integration. The critical values contain upper bounds and lower bounds covering five possible classifications of the variables into I(1) or I(0) and mutually co-integrated. The second step is to estimate the elasticity of the long run relationship and determine their values. If we find any long run relationship in the first step on the basis of F-statistic then we run the second step. If there is any long run relationship among the variables then an error correction term appears. We also calculated the short run elasticity from the coefficients of the first difference variables of the ARDL model.

To determine the goodness of fit of the ARDL model, we conducted a set of relevant diagnostic tests and stability tests. The relevant diagnostic tests are; normality test, serial correlation test, and heteroscedasticity test associated with the model. The stability test is conducted by employing Ramsey's RESET test, cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUM- SQ) tests.

We also split the data into two different sample sets from FY1977-FY2000 and FY1995-FY2015 and estimated two models for two sample periods to see if there are any significant changes in elasticity during the periods.

5. Model Specification

The formulation that has been used in most empirical studies for the estimation of the aggregate import demand function can be expressed by the following standard relationship:

$$\text{Imports}_{\text{demand}} = \{ \frac{Price\ of\ Imported\ goods}{Price\ of\ domestically\ produced\ goods}, \text{Income} \}$$

Let us denote the above equation as:

$$M_d = \int \{ \frac{P_{im}}{P_d}, Y \}$$

That is, import demand is a function of price ratio (P_{im}/P_d) and income (Y). In this model we consider only two variable prices and real GDP for import demand for the parsimonious model. We did not take the exchange rate to avoid endogeniety problem. We expect a positive relationship between import demand and income while we expect a negative relationship between price ratio and imports.

Khan and Ross (1977) and Salas (1982) have preferred the log linear model over the linear model. The log transformation is also advocated by Gujrati (1995) who states that compression of the scale minimizes the hetroskedasticity problem. Moreover, the coefficient of the equation gives us the elasticities because of its log linear transformation. For empirical estimation we log-linearize the above equation as

$$\ln M^d = \beta_0 + \beta_1 \ln Y + \beta_2 \ln \frac{Pim}{Pd} + \mu \qquad (1)$$

That is, import demand is a function of price ratio (P_{im}/P_d) and income (Y). We expect a positive relationship between import demand and income while we expect a negative relationship between relative prices and imports.

Denoting the log transformation in small letters, (1) can be written with time-series subscript as:

$$m_t = \beta_0 + \beta_1 y_t + \beta_2 p_t + \nu_t \qquad (2)$$

Where, $P_t = \frac{P_{im}}{P_d}$

5.1 ARDL Bounds Test Approach

It is generally used error correction model (ECM) to estimate short run and long run elasticity in the presence of co-integation. But, Inder (1992) presents a comparison of different approaches to estimate long run economic relationships and concludes that Unrestricted Error Correction Models (UECM) give precise estimates and valid t tests even in the presence of endogenous variables.

A relatively recent alternative approach to co-integration analysis has been put forth in a series of studies by Pesaran and Pesaran (1997), Pesaran and Smith (1998) Pesaran and Shin (1999), and Pesaran et al. (2001). This approach employs ARDL procedure using the bounds test for co-integration analysis. This approach has been advocated to correct for the small sample bias (see Pesaran and Shin, 1999).

The ARDL bounds test approach is based on the ordinary least square (OLS) estimation of a conditional unrestricted error correction model (UECM) for co-integration analysis developed by Pesaran et al. (2001). It is used here to test for the existence of a long run relationship as well as to make an estimation of long and short run coefficients for the study. From the ARDL we can derive a dynamic error correction model (ECM) following a simple linear transformation (Bannerjee, Dolado, Galbraith and Hendry, 1993), where the ECM integrates short run dynamics with long run equilibrium without losing long run information (Shrestha and Chowdhury, 2005).

The above specification in (2) is transformed into ARDL specification as in Pesaran et al. (2001):

$$\Delta m_t = \beta_0 + \sum_{i=0}^{n} \beta_{1i} \Delta y_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta p_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta m_{t-i} + \beta_4 y_{t-1} + \beta_5 p_{t-1} + \beta_6 m_{t-1} + \varepsilon_t \quad (3)$$

Where; Δ shows the first differences of the variables. We then test for co-integration using the bounds test procedure. The bounds test is based on the Wald or F-Statistic and follows a non- standard distribution (Pesaran, 2001). The null hypothesis is: no co-integrating relationship among the variables. The null hypothesis of no co-integration is tested by using ARDL UECM in (3) without the difference-lagged variables.

The ARDL restricted ECM model is defined as:

$$\Delta m_t = \beta_0 + \sum_{i=0}^{n} \beta_{1i} \Delta y_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta p_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta m_{t-i} + \gamma ecm_{t-1} + \varepsilon_t \quad (4)$$

The coefficients of the lagged difference variables provide the short run dynamics of the model converging to the equilibrium path while we expect γ to be < 0 for it implies stability of the model. The coefficient of the *ecm* term signifies the speed of adjustment to equilibrium after a shock.

6. Empirical Results and Analyses

6.1 Graphical Presentation of the Data

The first step in any time series data is to inspect of the graphical presentation of the data in order to understand the features of the data such as forms of trend, direction of trend, structural breaks and stationarity. The graphical presentation of the data in the natural log form for the variables of the aggregate demand function is given in figure 4 and figure 5.

The figure shows that the main variables; namely real import variable and the real income are upward and deterministic trend. On the other hand, relative price has both upward and downward trend and no deterministic trend. It is mentionable that during the period of 1981-1990, relative price trended down sharply because of higher inflation in that period in Bangladesh. None of the variables has structural break.

Figure 4: Imports and Income (in log)

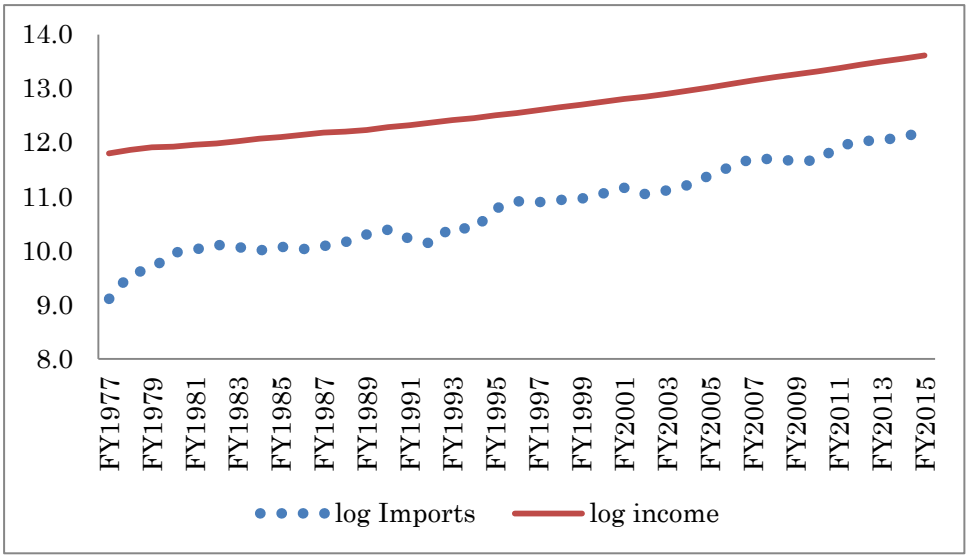
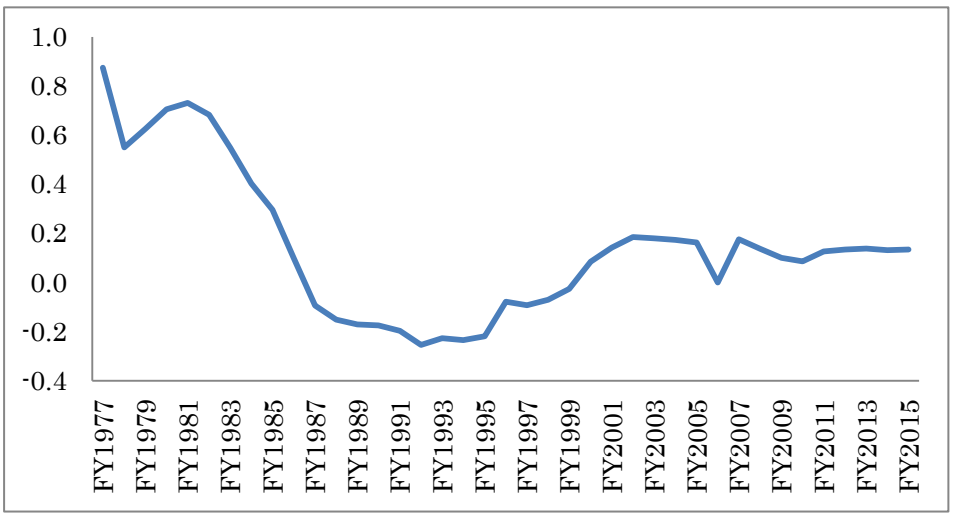


Figure 5: Relative Price (in log)



6.2 Unit Root Test for Stationarity:

The choice of the most appropriate unit root test is difficult in practice. Enders (1995) suggested that a safe choice is to use both types of unit root tests the Augmented Dickey-Fuller (ADF) (1981) test and the Phillips Perron (PP) (1988) test. If they reinforce each other, then we can have confidence in the results. Therefore, to test stationarity, we conducted the two widely used methods of unit root tests the ADF and the Phillips Perron (PP) test on the variables in the aggregate import demand function for Bangladesh. The unit root tests were performed at level and at first difference for both with the intercept, and with the intercept and trend term. The optimum lag was selected by using the Schwartz Information Criterion (SIC) (as suggested by Pesaran and Shin, 1997). A summary of the ADF and PP unit root tests results are presented in Table-1 and Table- 2 respectively. The ADF test result shows that relative price (lnp) and real gdp (lny) are non-stationary at level term at the 5 percent level of significance but real

imports (lnm) are stationary at level term at the 5 percent level.

Table - 1: Augmented Dickey Fuller Test of Unit root

Variables	Model	Level	First Difference	Integration
LNY	Intercept and trend	-0.484[0.98]	-9.765[0.00]**	I(1)
LNM	Intercept and Trend	-3.736[0.03]*		I(0)
LNP	intercept	-2.646[0.09]	-5.558[0.00]**	I(1)

* = significant at 5percent, **= significant at 1percent

Table - 2: Phillips Perron Unit root Test

Variables	Model	Level	First Difference	Integration
LNY	Intercept and Trend	-0.739[0.96]	-8.98[0.00]**	I(1)
LNM	Intercept and Trend	-3.729[0.03]*		I(0)
LNP	Intercept	-2.511[0.12]	-5.54[0.00]**	I(1)

* = significant at 5percent, **= significant at 1percent

6.3 Results of the ARDL Bounds Tests:

In order to determine the presence of a long run relationship among the variables in the import demand function, the bounds test is conducted. The result of bounds test is presented in Table-3.

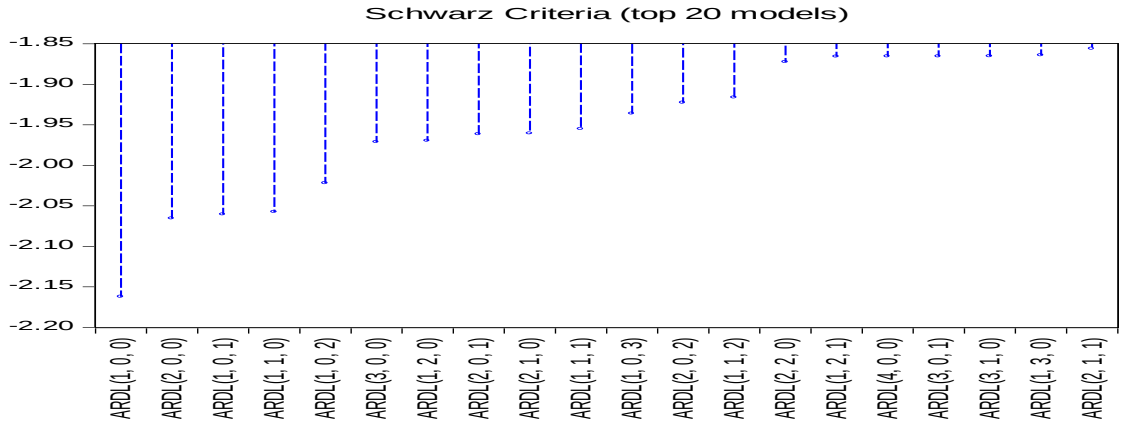
Table-3: Bounds Test Result for Aggregate Import Demand Function

F-statistic =17.46		
Level of Significance	Lower Bound Value	Upper Bound Value
10 percent	2.63	3.35
5 percent	3.1	3.87
2.5 percent	3.55	4.38
1 percent	4.13	5

It is evident from Table-3 that the computed F-statistic based on the Wald test is 17.46, which exceeded the all upper bound values. It suggests that the null hypothesis of no co-integrating relation is rejected for the import demand function. The analysis of data confirmed the presence of a long run relationship among the aggregate import, real GDP (LNY) and relative price. As the co-integration exists among the variables used in the model, therefore, the result presented for the long run are reliable.

6.4 Model Selection Criteria:

The criterion for variables lag order selection is presented in the following graph. On the basis of the Schwarz Information Criterion (SIC) the optimal lag length has been selected. According to the SIC, among the top 20 model our best model for this study is ARDL (1, 0, 0) model.



The long run results are reported in Table-4. These results represent long run elasticity of import demand with respect to real GDP (lnY) and relative price (lnP). The results show that long run coefficient of lnY and lnP variables have theoretically correct signs and are highly significant. It is evident from this result that income elasticity of import demand is elastic (1.536) while relative price of import demand is inelastic (-0.726) for the import demand.

As a large portion of our imported items includes essential items it is reasonable that the elasticity of import demand with respect to relative price is inelastic. In the case of real GDP, import demand is elastic and positive. This is because when income of a country increases, people of the country tend to use high quality imported items. In this way, demand for imported items increase in the long run.

Table-4: Long Run Elasticity

Dependent Variable = LNM				
Variables Name	Coefficient	Std. Error	T-Ratio	P-Value
LNY	1.536	0.036	42.177	0.000
LNP*	-0.726	0.061	-11.802	0.000
C	-12.943	0.447	-28.892	0.000

* Import price index is deflated GDP deflator

When the long run co-integration among the variables is proved, we can use ECM to test the short run relationship of the variables. Table-5 shows the short run results. Coefficient of real GDP is positive and highly significant while the coefficient of relative price has theoretically correct sign negative and also significant. The estimated short run elasticity of import with respect to income is 1.181 and estimated short run elasticity of import with respect to price is -0.584. The estimated coefficient of error correction mechanism (ECM) is 0.72 and statistically significant at 1 percent level with appropriate

sign. This result justifies the long run equilibrium relationship among the variables. It indicates that the system tends to correct its previous period of disequilibrium by 72 percent a year.

It is also evident that the estimated long run price elasticity of imports is higher than that of the short run, reflecting the nature of our importable items. Basically most of our importable items are essential commodities, which are supposed to have less price elasticity. Moreover, the data used here are yearly and import process takes times to respond to any changes in the price of importable items, that is why import price elasticity in the long run is greater than that in the short run.

Table-5: Short Run Elasticity and ECM

Dependent Variable = D(LNM)				
Variables Name	Coefficient	Std. Error	T-Ratio	P-Value
D(LNY)	1.181	0.257	4.594	0.0001
D(LNP)	-0.584	0.134	-4.343	0.0001
CointEq(-1)	-0.717	0.138	-5.170	0.0000
Cointeq = LNMA - (1.5364*LNY -0.7263*LNPDEF -12.9435)				

6.5 Diagnostic Tests

The validity of the estimated equations is confirmed by employing relevant diagnostic tests such as the Jarque–Bera normality test, the Breusch–Godfrey serial correlation LM test, the Breusch-Pagan-Godfrey test for heteroscedasticity, the Ramsey RESET test for model specification, and stability tests such as the CUSUM and CUSUM of Squares test. The diagnostic tests suggest that the import demand function has desired econometric properties.

The Jarque-Bera statistic confirmed the normality behavior of the estimated residual series of the equations. The ARDL model is found to be robust against residual autocorrelation. The Breusch-Pagan-Godfrey test confirms that the residuals are homoscedastic, and the RESET test confirms the correct functional form of the equations. The CUSUM and CUSUM-SQ tests suggest that the parameters were stable over the sample period. The results of the CUSUM and CUSUM-SQ tests are presented in Fig. a and b respectively (Appendix-1).

Though our estimated model is robust, we re-estimate the model by splitting the data into two sample periods (FY1977-FY2000 and FY1995-FY2015) to see whether the nature of elasticity has changed over the time.

Table-6: Diagnostic Test for Aggregate Import Demand Function

Name of the Test	F -Version [p-value]
Breusch-Godfrey Serial Correlation LM Test	0.050[0.950]
Heteroskedasticity Test: Breusch-Pagan-Godfrey	0.489[0.692]
Ramsey RESET Test	2.309[0.138]
Jarque-Bera Normality Test = 1.38[.500]	

We found that the estimated results of splitting samples are also robust and broadly consistent with that of the whole sample period. The estimated coefficients of price and income elasticity of import for both sample periods are highly significant with expected sign. The income elasticity is elastic while price elasticity is inelastic for both sample periods. The estimated price elasticity are - 0.60 and -0.96 for the sample period FY1977-FY2000 and FY1995-FY2015 respectively (Appendix 2, Table B and Table C). It is evident from the estimated result that the price elasticity is relatively higher for the later sample period. Gradual innovations of domestic substitutes for importable items, trade liberalization, exchange rate floatation; and increased value additions of garment exports which created option for domestic production or import of accessories and raw materials could have led to increase import price elasticity in the later part of the sample period.

7. Findings and Policy Recommendations:

Our estimated model revealed the following findings which can be used for policy recommendations. The major findings of this study are:

- Import demand is mainly influenced by real GDP. The income elasticity is significantly greater than unity implying that there is a degree of trade off between GDP growth and the trade balance.
- The price elasticity is less than unity (different from Hossain's findings of greater than unity), indicating consistency with the nature of our importable commodities which are mostly essential and input items.
- The long run price elasticity of imports is higher than that of the short run, reflecting the nature of our import process from opening a back-to-back letter of credit to actual imports which usually takes time.
- The estimated coefficient of ECM is 0.72 which indicates that it takes approximately 1 year and 4 months to fully realign after any shock.

Based on the above findings we may recommend some policy suggestions for monetary authority as well as fiscal authority:

- The significant relative price variable indicates that domestic price plays an important role in influencing imports. Maintaining a relatively low level of inflation would be a better policy to retain the aggregate import in order to improve the trade balance.
- As imports are income elastic, an increase in income will enhance the volume of imports more than proportionately. Therefore, Government policies can be geared towards encouraging domestic import competing industries. Tax rebates and other subsidies should be provided to import substitution industries. Development of such industries will lessen the import bill and reduce the trade deficit as well as raise employment and income level.
- Given the import demand is income elastic and relatively price inelastic, revenue could be gained through duties and taxes on imports. The inelastic price elasticity of import implies that exchange rate and tariff policies may be used to a limited extent to improve current account balance.

8. Conclusion:

This study investigated import elasticity with respect to income and relative price for the Bangladesh economy for the time period of FY1977 to FY2015. During the investigation, we conducted the unit root rest to check the stationarity of the variables. In so doing, we found the imports variable is I(0) and other two variables - real income and relative price - are integrated at I(1). As the variables are not integrated in the same order and given a relatively small sample size (39 observations), ARDL approach to co-integration testing was preferred to the other methods. The bounds co-integration test was utilized in this research effort and it found evidence to co-integrating relationships among the variables. From the ARDL model stable long run estimates of elasticity were derived. The long run elasticity of imports was estimated to be 1.54 with respect to income and -0.73 with respect to relative prices. We then derived the ECM. About 72 percent of the disequilibrium caused by an external shock to the system will be corrected over the course of a year implying speedy adjustment in the process.

The outcome of the study holds policy implications for the monetary as well as the fiscal authorities. Our estimates are relatively robust and consistent with traditional wisdom. However, further research on the issue could be done, accompanying disaggregated analysis (group/item wise imports) as well as more frequency of data (quarterly or monthly series) analysis of the same.

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Appendix-1

Representation of CUSUM & CUSUMSQ:

Figure-A

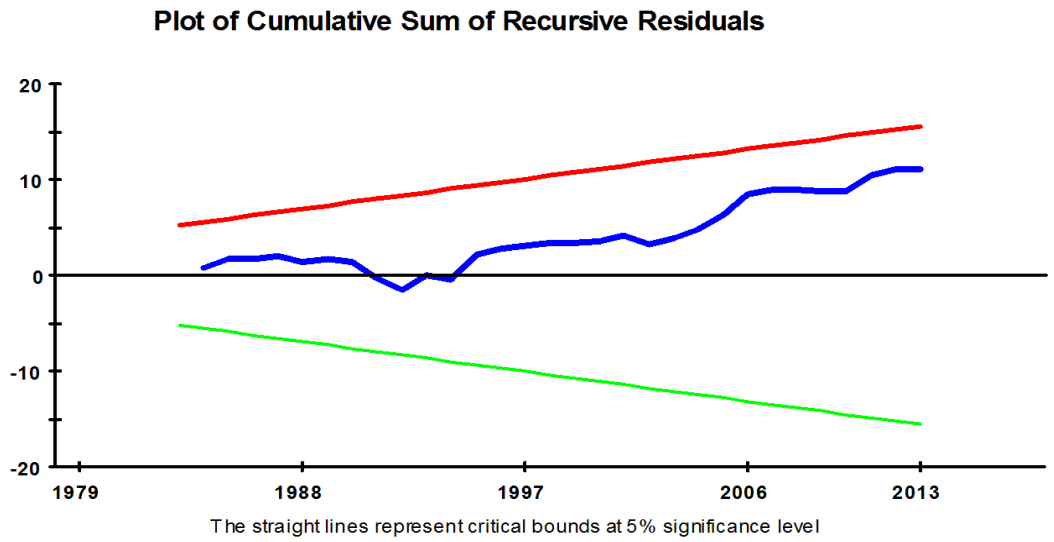
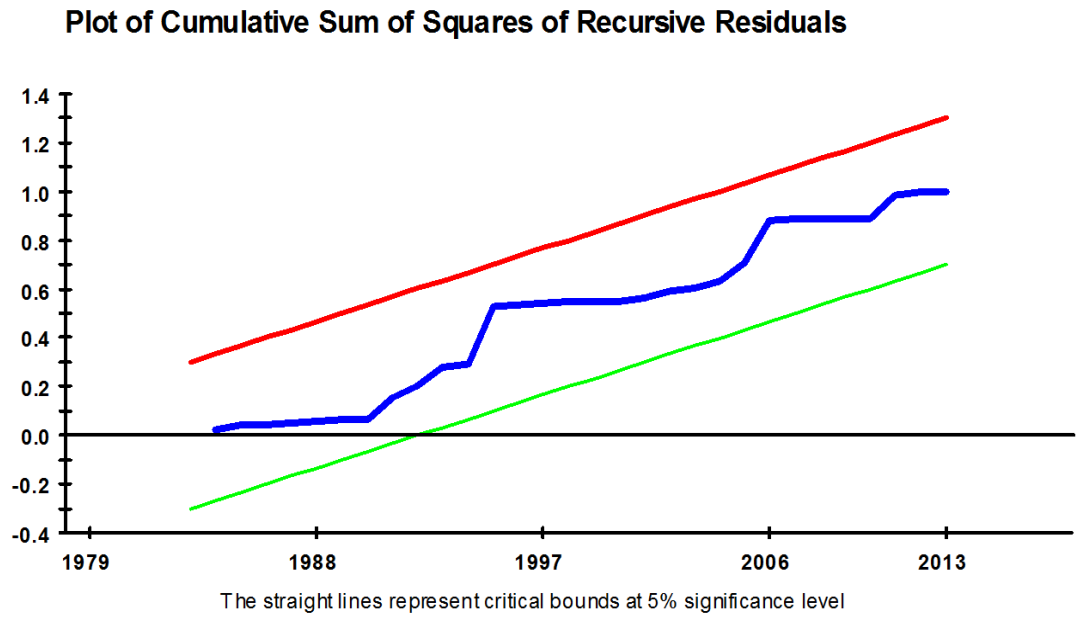


Figure-B



Appendix-2

Table A: Long Run Price and Income Elasticity (using CPI)

Dependent Variable = LNM				
Sample : 1977- 2015				
Variables Name	Coefficient	Std. Error	T-Ratio	P-Value
LNY	1.470	0.028	51.828	0.000
LNP[#]	-0.709	0.049	-14.369	0.000
C	-12.147	0.351	-34.617	0.000

Import price index is deflated CPI.

Table B: Long run Price and Income Elasticity for Sample Period 1977-2000

Dependent Variable: LNM				
Sample (adjusted): 1978- 2000				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-15.609275	1.198915	-13.019507	0.0000
LNY	1.760420	0.100547	17.508514	0.0000
LNP	-0.604843	0.071035	-8.514736	0.0000

Table C: Price and Income Elasticity for Sample Period 1995-2015

Dependent Variable: LNM				
Sample: 1995-2015				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-10.966802	0.346397	-31.659605	0.0000
LNY	1.343852	0.032705	41.090723	0.0000
LNP	-0.955161	0.092013	-10.380699	0.0000