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Thoughts on Banking and Finance

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Bangladesh Bank Training Academy
Mirpur-2, Dhaka-1216

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Contents

Editorial Note

The current issue of the "BBTA Journal: Thoughts on Banking and Finance" covers a broad spectrum of macroeconomic and financial issues that are most substantial to policymakers as well as to researchers and academicians. Topics included in this issue are exchange rate depreciation and its effect on trade balance, green banking and sustainable development, profitability of nonbank financial institutions, yield curve of treasury bills and bonds, price transmission dynamics in the rice market of Bangladesh, and government expenditure and GDP per capita. Empirical examination of relevant theories on these issues is expected to prompt further scientific discourses and provide some policy insights.

The first paper examines whether there exists any J-curve effect of real exchange rate depreciation on export, import and trade balance of Bangladesh applying unrestricted Vector Autoregression on monthly data of relevant variables for the period June 2003-June 2014. Given the importance of trade balance in a country's external sector, and the effect of exchange rate depreciation on trade balance, it appears that results from such study may provide meaningful information to policy makers to make appropriate policy responses for external sector stability and sustained economic growth.

The second paper investigates the effect of exchange rate depreciation on trade balance using the Marshal-Learner hypothesis. Exchange rate appreciation or depreciation affects trade flows by altering relative price of exports and imports and policymakers are, therefore, particularly concerned about how trade balance responds to exchange rate fluctuations. Recognizing this, the paper on Marshall-Lerner condition tested the nexus between trade balance and exchange rate for Bangladesh during the period 1985-2014 and found support in favor of the claim that Marshall-Lerner condition holds for Bangladesh in the long run. This finding may be useful to policymakers since it implies that exchange rate appreciation or depreciation may induce export demand.

The third paper explores the nature of yield curve of treasury bills and bonds in Bangladesh and its role as an important variable in determining interest rate, exchange rate, CPI inflation rate and GDP growth. Specifically, the information on yield curve can be used for calculating deposit and lending rates of banks considering the liquidity position of the economy and liquidity management stance of Bangladesh Bank.

The fourth paper in the current issue conducts a panel study on the profitability of nonbank financial institutions (NBFIs) which are growing not only in numbers but also in their impacts on the economy. Using panel data the study seeks to determine the relative contribution of assets, non-interest revenue and equity on profitability and observed that their model accounted for most of the variability in profits. The authors find that both size of NBFIs and their equity have negative effects on their profit.

The fifth paper delve into the price transmission mechanism of the commodity 'rice' between Bangladesh and India, which is a major source of Bangladesh's rice imports. Since rice is a staple food, the price transmission between the two countries is telling significance on food security that Bangladesh wants to ensure. The study finds that the price shock in the Indian rice market transmits to the Bangladeshi rice market over the short run as well as the long run. The findings in the paper suggest that maintaining food security requires recognition of the prevailing price transmission mechanism and the internal determinants of the price of rice.

The sixth paper in this issue discusses how green banking practices may promote sustainable development. As the world is facing climate change and its adverse consequences, mitigating the risk of climate change, by no surprise, has occupied a central place in the discourses on sustainable development policy on a global scale. Recognizing this reality, Bangladesh Bank has not only started green banking campaign, it also has taken decisive policy actions by establishing green banking/sustainable finance department and formulated required policy guidelines for banks and financial institutions to comply with.

The final paper tests the validity of Wagner's Law which shows the short-run and long-run relationship between government expenditure and GDP per capita. The authors apply cointegration techniques on the panel data of government expenditure and GDP per capita in South Asian region for the period 2001-2014. The study validated both short- and long-term relationships between government expenditure and GDP per capita, as implied by Wagner's Law.

Finally, I would like to express my heartfelt thanks to authors, reviewers, the Editorial Advisory Board, and the members of the Editorial Board of BBTA Journal. Our efforts will be worthwhile if the articles published in this issue prove to be useful to readers. We appreciate constructive criticism and feedback for further improvement of the journal in future.

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Real Exchange Rate and its Impact on Export, Import and Trade Balance: Is there any J-curve Effect in Bangladesh?

Sayera Younus[1]
Md. Maidul Islam Chowdhury

Abstract

The intention of this paper is to examine whether Real Exchange Rate (RER) depreciation has any impact on export, import and trade balance of Bangladesh. Real exchange rate is calculated using Tk./dollar nominal exchange rate with the consumer price index of US and Bangladesh. Trade-weighted real effective exchange rate (REER) has also been used to examine the effects of depreciation on the variables. The real effective exchange rate is calculated by using eight (8) major trading partner countries exchange rate and the consumer price Index. The industrial production index of Bangladesh and trading partners are used as a proxy for the domestic and foreign income. Cointegration test, Vector Error Correction model (VECM), and Impulse Response Functions (IRFs) derived from the unrestricted VAR have been used to estimate the models using monthly data for the sample period from June 2003 to June, 2014. The empirical results show short-run and long-run relationship between trade balance, RER, and domestic income. An evidence of reverse L-shaped impact is observed while estimating the model with RER implying that real exchange rate depreciation is effective in influencing export, import and trade balance in Bangladesh. However, this study does not find any impact of trade-weight real effective exchange rate on the trade balance and imports though J curve effect is noticed with respect to exports.

Keywords: Real exchange rate, real effective exchange rate, J-curve, cointegration, VECM, impulse response functions.

JEL Classification : C22, F31, F32

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*Suggestions/comments for the improvement of the article sent to the corresponding author would highly be appreciated.

1 The author of this article are Dr. Sayera Younus and Mr. Maidul Islam Chowdhury who are General Manager and Deputy Director of Research Department of Bangladesh Bank respectively. Email address of Mr. Chowdhury: mmic.e12@gmail.com. Views expressed in the article are the authors own and do not necessarily reflect the views of Bangladesh Bank. Authors would like to thank Ms. Musarrat Jahan, General Manager, Monetary Policy Department and Economic Adviser of Bangladesh Bank for their helpful comments in the earlier version of this article. However, any remaining errors are the authors' own.

I. Introduction

The intention of this paper is to examine the impact of the real exchange rate changes on exports, imports and the trade balance in Bangladesh. Bangladesh pursued active exchange rate policies since independence in 1971 to improve its trade balance. Like other developing countries devaluation of the currency as a policy tool used by the decision makers in Bangladesh. Bangladeshi currency Taka went through several regimes change since 1972 to 2002 to improve its trade balance. Bangladesh floated its exchange rate and followed a market-based exchange rate for the Taka effective from 31st May, 2003 in place of a policy of occasionally adjusting the exchange rate. Under the present arrangement, the exchange rate is determined on the basis of demand and supply of the respective currencies.

In this regard, due to the importance of the real exchange rate depreciation on economy, this paper attempts to examine whether real exchange rate (RER) changes have any impact on export, import and the trade balance in Bangladesh. An attempt has also been made to examine whether trade-weighted real effective exchange rate (REER) changes had any impact on exports, imports, and the trade balance. Finally, the presence of the J curve effect where a country's trade balance deteriorates with its currency devaluation or depreciation initially but improves eventually examined for Bangladesh.[2]

The paper is organized as follows: after introduction in section I, section II describes empirical studies done in other countries. Section III, contains data analysis, methodology, model specifications, variables and empirical results of the study. Finally, conclusion and comments are in section IV.

I.1 Exchange Rate Policy in Bangladesh

Following independence in 1971, Bangladesh's currency, the Taka continued to be pegged to UK's pound sterling, the latter being the intervention currency. Government of Bangladesh imposed restrictions on foreign exchange to control capital flight after independence. In the controlled exchange regime, a secondary market developed to satisfy the excess demand for foreign currency. In the secondary market, the exchange price was much higher than the official exchange rate. In May 1975, a major step towards efficient exchange management took place with a massive devaluation (by 37 percent) of the Bangladeshi Taka. Since then, the central bank pursued a policy of devaluating the Taka to improve the balance of payment deficits. It is worthwhile to mention that Bangladesh devalued her currency (BDT) about 130 times from 1972 to 2002 (Younus and Chowdhury, 2006) to reduce the balance of payment deficits.

2 The J-curve is a phenomenon where a country's trade balance deteriorates with its currency devaluation or depreciation initially but improves eventually.

In 1985, the intervention currency was changed to the U.S. dollar because most of the official trades in Bangladesh took place in the U.S. dollar rather than the pound sterling. A real effective exchange rate (REER) index introduced to determine the strength of the BDT against foreign currency in 1985, after that the nominal exchange rate of BDT in relation to the U.S. dollar is determined daily by monitoring the REER index.

Under the 'Structural Adjustment Program' and the 'Financial Sector Reform Program,' Taka made convertible on the current account beginning March 24, 1994 (Bangladesh Bank Annual Report, 1994-95). The exchange rate occasionally adjusted by monitoring the trend of REER to maintain competitiveness of export. Trade-weighted basket of currencies of major trading partner countries acted as a benchmark for the banks to set their rates. Finally, Bangladesh authorities decided to float the currency and abandoned the pegged exchange rate regime moved to a floating exchange rate system on May 31, 2003. Since then the exchange rate is determined in the inter-bank market in Bangladesh by supply and demand pressures for foreign currencies at a point in time and at large by macroeconomic fundamentals. Bangladesh Bank intervenes in the inter-bank market from time to time, but these interventions are only to reduce excessive volatility in the market. This action is temporary as the injections are subsequently re-purchased, but help in avoiding harmful disruptions and preventing risks of speculative opportunities.

II. Literature Review

Trade can play an important role in increasing economic growth of a country. In this connection, a large number of literatures focused particularly on examining the impact of exchange rate devaluations on the trade balance for both developed and developing countries. For example, Ng Yuen-Ling et al. (2008), Aziz (2012), Shirvani and Wilbratte (1997), Dhasmana (2012) argued for the improvement of trade balance following devaluation or depreciation of the exchange rate. While others such as Weliwita and Tisujii (2000), Perera (2009), Bhattarai and Armah (2005) found no or worsening effect of exchange rate fluctuations on the trade balance. A few researches explain the dynamics of the real effective exchange rate changes in the context of Bangladesh, mainly due to the limitations or unavailability of relevant data particularly REER index data in Bangladesh. This study made an attempt to fill in the gap in the literature with real data as opposed to constructing the REER index.

Ng Yuen-Ling et al. (2008) explored the relationship between the real exchange rate and the trade balance in Malaysian economy employing annual observations for the period from 1955 to 2006 find the impact of the real effective exchange rate impact on the trade balance. The study also concludes relevance of Marshall-Lerner condition and the absence

of J-curve effect6 in Malaysia.[3]

In contrast, Weliwita and Tisujii (2000) delineated the responsiveness of Sri Lanka's trade deficit to devaluation using quarterly data from 1978.I to 1997.IV. Three explanatory variables: domestic income, real effective exchange rate and the rest of the world income have been used to explain trade balance in Sri Lankan economy. Using cointegration techniques, impulse response functions from a VAR model, the authors conclude that persistent devaluation of the Sri Lankan currency (rupee) could not affect the trade balance. The rest of the world income has a positive effect on the Sri Lankan trade balance. On the other hand, applying autoregressive distributed lagged (ARDL) model Perera (2009) examine the impact of real depreciation of Sri Lankan Rupee on the trade balance using quarterly bilateral time series data from 1996:Q1 to 2008:Q2. The empirical results show that the trade balance between Sri Lanka & its trading partners does not hold the J-curve phenomenon. To examine the relationship between India's real exchange rate and its trade balance with her major trading partners, Dhasmana (2012) uses quarterly trade data for 15 countries over the period 1975Q1-2011Q1 and finds positive association of real exchange rate depreciation with the trade balance.

Aziz (2012) examine the impact of real devaluation on the trade balance of Bangladesh using annual data from 1976 to 2009. The author uses error correction model, multivariate cointegration tests, and impulse response functions to test the impact in both the short and long-run on export, import and trade balance. The estimated results of Aziz (2012) supports the significant positive impact of real effective exchange rate devaluation on the trade balance in Bangladesh. Aziz study also finds evidence of J-curve effect in Bangladesh while using real effective exchange rate (REER).

Ali and Kamal (2012) examine the way exchange rate fluctuations affect economy's overall balance of trade using evidence from the bilateral trade between Bangladesh and India, the EU; Norway and the US. Authors also examine the role of Marshall-Learner's condition and J-curve phenomenon in influencing a country's trade balance comparing Kuwait's trade balance with the U.S. using monthly data for the period from 2006 to 2009. The paper finds that an appreciation of domestic currency leads to the deterioration of the trade balance of Bangladesh and improvement in the trade balance for depreciation.

Khan and Hossain (2010) evinced the impact of democracy on the trade balance of Bangladesh. Their model incorporated real effective exchange rate (REER), domestic income, foreign income, and a democracy index as independent and the trade balance as a dependent variable. Both the long-run and short-run patterns in the relationship between

3 The Marshall-Lerner condition, which states that currency devaluation will only lead to an improvement in the balance of payments if the sum of demand elasticity for imports and exports is greater than one, is named after English economist Alfred Marshall (1842-1924) and the Romanian born economist Abba Lerner (1905 - 1985). 6 The J-curve is a phenomenon where a country's trade balance deteriorates with its currency devaluation or depreciation initially but improves eventually.

variables of the model tested using annual time series observations for the period from 1977 to 2006. The study finds that more democracy leads to an improvement in the trade balance of Bangladesh.

Backus et al. (1994) explain cross-correlation between net exports and the terms of trade for 11 developed countries (Australia, Austria, Canada, Finland, France, Germany, Italy, Japan, Switzerland, United Kingdom and United States). The study finds uniformly countercyclical and negative correlation of the trade balance with current and future variations in the terms of trade, but positive correlation with the past changes. The cross-correlation function found in the authors' theoretical structure of two countries economy is S-shaped, but the economy produces a tent-shaped cross-correlation function in the absence of capital in the economy.

Miles (1979) examines the statistical relationship between devaluation and both the trade balance and the balance of payments for 16 devaluations of 14 countries for the period 1956-72. The paper finds improvement in balance of payment following devaluation.

Kalyoncu et al. (2009) examine the impact of devaluation on the trade balance using Johansen Juselius cointegration(1992) test and impulse response function. Using quarterly data for four countries: Brazil (1991-2005), Argentina (1993-2005), Mexico (1981-2005) and Peru (1979-2005), the paper concludes that J-curve pattern available for Argentina and Peru.

Bhattarai and Armah (2005) observed the consequence in the trade balance resulting from exchange rate fluctuations for Ghana applying annual data from 1970 to 2000. Trade balance is addressed as a function of real exchange rate, domestic and foreign income in the paper. Authors used cointegration analyzes of both single equation models & VAR-error correction models ratifying a firm relationship between trade balance and exchange rate in the long-run for Ghana.

Guechari (2012) estimates the effects of Real Effective Exchange Rate (REER) on Algeria's Trade Balance (TB). The paper includes REER, foreign income and real domestic income in the model to examine the behavior of the trade balance in the general case (Algeria-world) and particular cases (Algeria-France and Algeria-US). Author uses cointegration techniques, error correction model (ECM) and impulse response function for time series data covering 1981.Q1-2009.Q4. The empirical results show that REER effects significantly and positively in the long run while negatively in the short run on the Algeria's bilateral trade balance with respect to US and France.

From the above literature review it is evident that the impacts of export, import and REER on trade balance varies country to country, exchange rate regime, sample period, model variables. In this paper, guided by the above literature we used the variables that mostly explain trade balance in Bangladesh.

III. Data Analysis, Model Specification, Model variables, Methodology

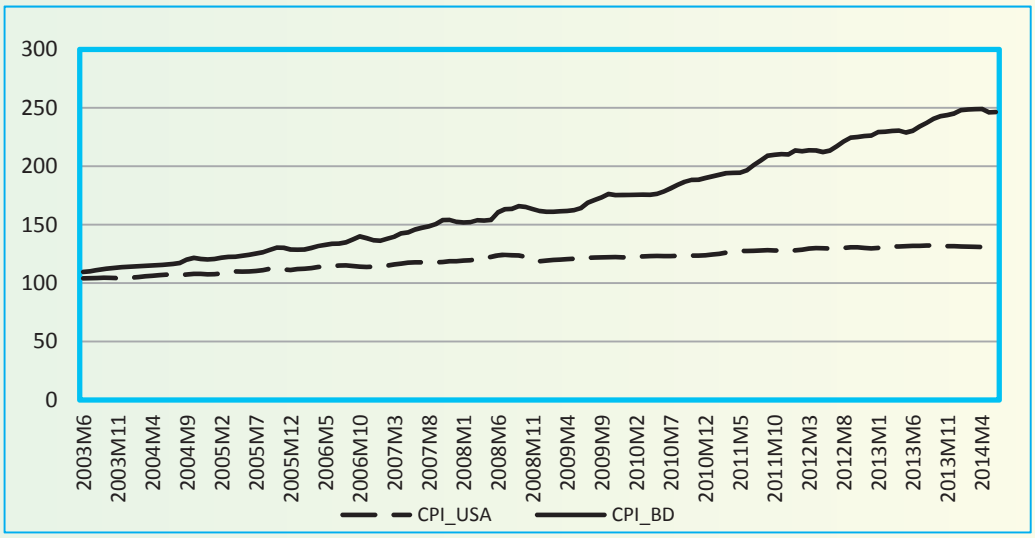
This study seeks to examine whether real exchange rate and real effective exchange rate changes have any impact on exports, imports and trade balance in Bangladesh. Monthly data for the sample period from 2003:6 to 2014:6 is used to estimate the models. Two models using four variables namely, RER/REER, domestic income, and foreign income are employed. Impulse response functions derived from VAR used to examine the J curve impact. Base year 2000-01 is used for CPI, REER, Industrial Production, and RER. All the variables are in log form and local currency. This model has the similarity with the model used by Aziz (2012). However, the current study differs from that of Aziz (2012) in several ways, such as in data frequency, data constructions, the sample period, model variables and model specifications.

III.1 Real Exchange Rate

Data Analysis

In order to estimate the model, monthly data from June 2003 to June 2014 have been used to examine the impact of real exchange rate depreciation, foreign income and domestic income on exports, imports and the trade balance of Bangladesh. The data for real exchange (RER) rate is constructed using CPI of Bangladesh, CPI of USA, multiplied by taka-dollar nominal exchange rate. Chart-1 shows the trends of domestic price level and USA price level. In this study weighted average industrial production (IP) for major trading partner countries has been used as a proxy for foreign income to capture trading partner's income/ output effects.

Chart-1: Trends in CPI_USA and CPI_BD



The present study uses IPs for seven trading partner countries of Bangladeshi. For example, India, Japan, Euro Area, China, Singapore, the USA and the U.K., these countries altogether explain 94.01% of total trade with Bangladesh. The weighted average IP of each month for the trading countries of Bangladesh got through summation of IPs multiplied with respective country's trade weight for the individual month.

Chart-2: Trends in NER and RER

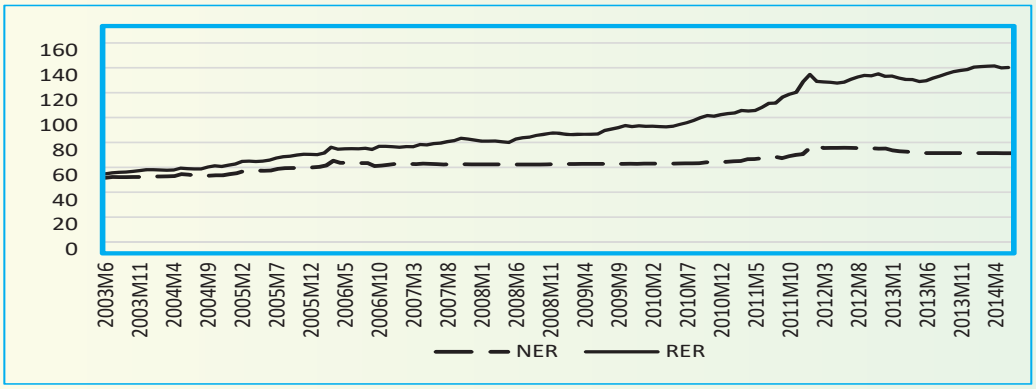
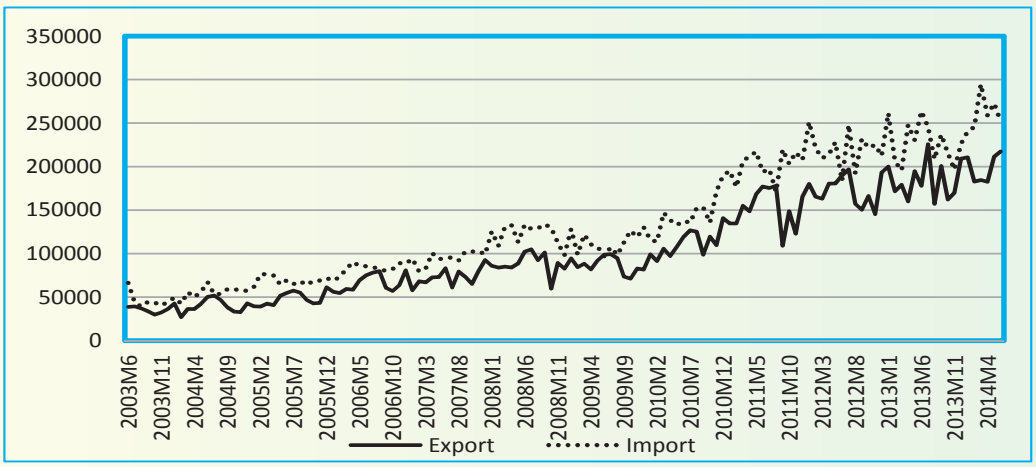


Chart-2 depicts the trends of Taka/Dollar nominal exchange rate and real exchange rate. The real exchange rate increased faster than nominal exchange rate as because domestic price level increased relatively faster than foreign price level.

Chart-3: Trends in Export and Import



The trends of exports and imports (Chart-3) also showed similar movements since 2003. However, imports increased faster than exports since 2010, worsening trade balance.

Model Variables

The following variables used to perform cointegration test by Johansen (1988) to examine any long-run relationship among the variables.

ln_R_TB=log of real trade balance (log real export-log real imports) ln_REAL_EX=log of real exports (Exports/CPI_BD)

ln_REAL_IM=log of real imports (IMPORTS/CPI_BD)

ln_RER=log of (Tk/$*(CPI_USA/CPI_BD)

Model Specification

The theoretical basis of the empirical model can be given as follows:

$$TB=f(RER,Y,Y^{*})$$

TB=Trade balance

Y=Domestic Income

Y*=Foreign Income

RER=Real Exchange Rate is used as a proxy for relative prices of export and import in the real exchange rate.

A log-linear time series specification of the model stated as follows:

$$lnTB = \beta_0 + \beta_1 lnRER + \beta_2 lnY + \beta_3 lnY^{*} + \varepsilon t$$

The expected sign for $\beta 1 < 0, \beta 2 > 0\ or < 0$, and $\beta 3 < 0$

Test for Order of Integration

The Augmented Dickey-Fuller (ADF) and the Kwiatkowski-Phillips- Schmidt-Shin (KPSS) tests have been used to check the unit root for all the variables in log level. The tests results indicate that all variables are non-stationary at log level except for trade balance; however, they are stationary at their first difference. The test result is given as follows.

Table 1: UNIT ROOT TESTS

		ADF		KPSS	
		No Trend	**With Trend**	**No Trend**	**With Trend**
Test for I (0)	**$lnTB_t$**	-9.7	-7.72	0.3	0.04
	ln RER_t	-0.53	-1.94	1.4	0.14
	lnY_t	0.62	-1.2	1.23	0.12
	lnY^{t*}	-1.35	-2.24	0.84	0.11
	LN_REER	-1.13	-2.53	0.79	0.2
	LN_REAL_EX	-1.25	-1.72	1.33	0.12
	LN_REAL_IM	-1.62	-4.04	0.31	0.10
Test for I (1)	$\Delta lnTB_t$	-8.18	-8.15	0.19	0.17
	$\Delta lnRER_t$	-9.29	-9.39	0.06	0.06
	ΔlnY_t	-10.63	-10.63	0.05	0.04
	ΔlnY^{t*}_t	-4.37	-4.29	0.11	0.06
	ΔLN_REER	-8.63	-8.73	0.21	0.04
	ΔLN_REAL_EX	-2.94	-2.94	0.16	0.15
	ΔLN_REAL_IM	-19.08	-18.99	0.07	0.06

Note: The critical values for ADF are -3.65 (no trend),-4.26 (trend) at 1%, -2.96 (no trend) -3.56 (trend) at 5% and -2.62 (no trend), -3.21 (trend) at 10% level of significance which is tabulated from Mackinnon (1996) one-sided p-values. The critical values for KPSS are 0.739 (no trend), 0.216 (trend) at 1% 0.463(no trend), 0.146 (trend) at 5% and 0.347 (no trend), 0.119 (trend) at 10% level of significance.

Co-integration Test for Exports

Johansen (1988) multivariate approach, to examine long-run relationship between log of export, log of imports, log of RER, log of domestic income and the log of income of the trading partners. Instead of the trade balance, export is used to examine whether exports has any long run relationship with real exchange rate, domestic and foreign income. Both the 'trace' statistic and 'maximum eigen value' test leads to the rejection of the null hypothesis of (no co-integrating vectors) against the alternative hypothesis (one or more cointegrating vectors) while the null of against the alternative cannot be rejected at 5% level of significance.

Empirical Results

Table 2: JOHANSEN'S COINTEGRATION TESTS for Exports

Null Hypothesis	Alternative Hypothesis	Trace Test		Maximal Eigen value Test	
		Statistics	95% Critical Value	Statistics	95% Critical Value
r=0	r=1	47.21*	47.08	31.96*	27.07
r≤1	r=2	18.94	29.68	10.97	20.97
r≤2	r=3	7.97	15.41	7.87	14.07
r≤3	r=4	0.10	3.76	0.10	3.76

Trace test indicates 1 cointegrating equation(s) at both 5% and 1% levels Max-eigenvalue test indicates 1 cointegrating equation(s) at both 5% and 1% levels.

Vector Error Correction Model (VECM): Exports[4]

A vector error correction (VEC) model is a restricted VAR designed for use with non-stationary series that are known to be co-integrated. The VEC has cointegration relations built into the specification so that it restricts the long-run behavior of the endogenous variables to converge to their co-integrating relationships while allowing for short-run adjustment dynamics. The cointegration term is known as the error correction term since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments (pp-545, Eviews user guide). The study employs the following vector error correction model to construct a dynamic particular model for exports since trade balance variable is stationary. In order to test cointegration and use vector error correction models, variables need to be integrated in order one.

$$\Delta lnEX_t = \alpha_0 + \sum_{i=1}^{3} \alpha_i \, \Delta lnEX_{t-i} + \sum_{i=1}^{3} \beta_i \, \Delta lnRER_{t-i} + \sum_{i=1}^{3} \gamma_i \, \Delta lnY_{t-i} + \sum_{i=1}^{3} \delta_i \, \Delta lnY^*{}_{t-i} + \gamma EC_{t-1}$$

4 The cointegration test and VEC for imports also have been estimated which are reported in the appendix.

Given that all variables are in their first difference, this study allows a lag structure of up to three periods (on the basis of the Akaike Information Criteria, and final prediction error criteria). Insignificant lags and variables are eliminated sequentially while significant lags have been reported in the Appendix. The simplified results are given as follows (t-statistics are in parentheses):

$$\Delta lnEX_t = 0.30\Delta lnRER_{t-1} - 0.70\Delta lnIM_{t-1} + 0.47\Delta lnY^{\wedge *}_{t-1} - 1.07EC_{t-1} + 0.03$$
$$(2.02) \qquad (-4.32) \qquad (1.25) \qquad (-6.74) \quad (2.14)$$

The above dynamic estimate suggests that the real exchange rate depreciation has a significant effect on export in the short-run implying that the real exchange rate depreciation will increase exports. The domestic real imports also increase exports as most of the imported goods in Bangladesh are industrial raw materials. The coefficient of output of major trading partners is not significant. The coefficient of ECt-1 is negative and significant, which implies that the model converges. The speed of adjustment is very high -1.07 indicates that if there is any disequilibrium these variables adjust rapidly to get back to the equilibrium.

Diagnostic Test for Exports

Diagnostic test results are given as follows: The R^2 is 0.77 which implies that the estimated model is a good fit model. The F-test result indicates the overall significance of the model. The diagnostic test statistics are performed to check the stability of the error correction model. The autoregressive (AR) test examines up to the 10th order serial correction and cannot reject the null hypothesis that there is no autocorrelation. The autoregressive conditional heteroscedasticity, test cannot reject the null hypothesis that there is no heteroscedasticity. The Jarque Bera test statistics of the normality test implies that the errors are normally distributed.

The Impulse Response Functions (IRFs): Evidence of J-Curve Impact

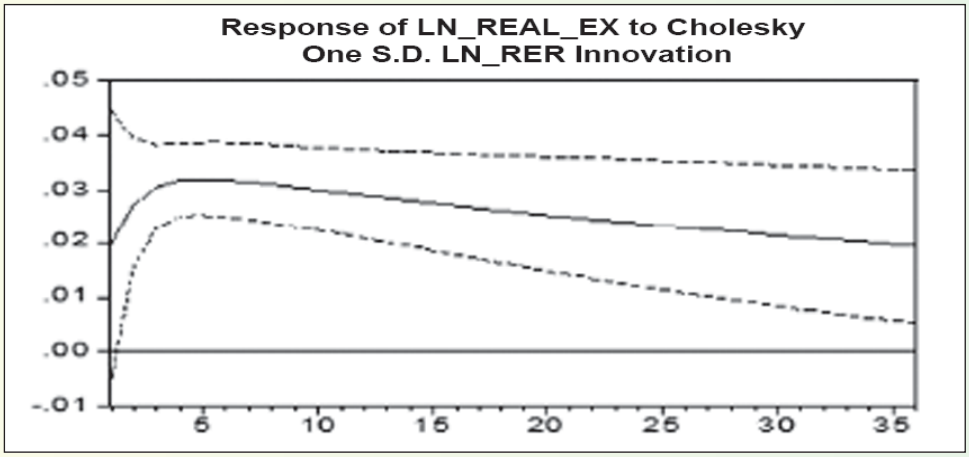
In order to test whether the impact of real exchange rate on the trade balance is, J shaped impulse response functions derived from VAR are used. The IRFs shows the response of a variable due to one standard deviation shock of other variables. The study examines the response of the trade balance, imports, and exports to the real exchange rate (RER) shock. Therefore, in this study the variable RER is placed first followed by the trade balance assuming that the real exchange rate has a contemporaneous impact on the trade balance, while the trade balance has effects on RER through lags. Similarly, RER place before exports and imports.

The study uses monthly data from 2003M6 to 2014M6 to find the responses of exports, imports and trade balance of Bangladesh to real exchange rate movements. Data for monthly exports and imports comes from the economic trends of Bangladesh Bank. Exports and imports are divided with the 12-month average consumer price index to construct real variables. All variables are in local currency unit. The impulse responses (Cholesky

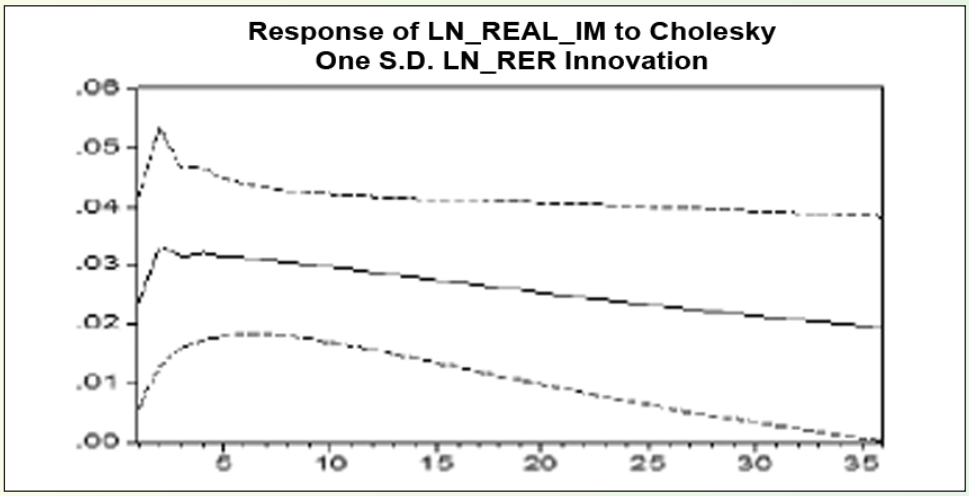
decomposition) of the trade balance, exports and imports are run separately to examine whether the J-curve phenomenon exists. The significance level is shown by standards error around the response functions. The impulse responses are given bellow:

Chart-4: IRFs OF EXPORTS, IMPORTS AND TRADE BALANCE TO REAL EXCHANGE RATE SHOCKS

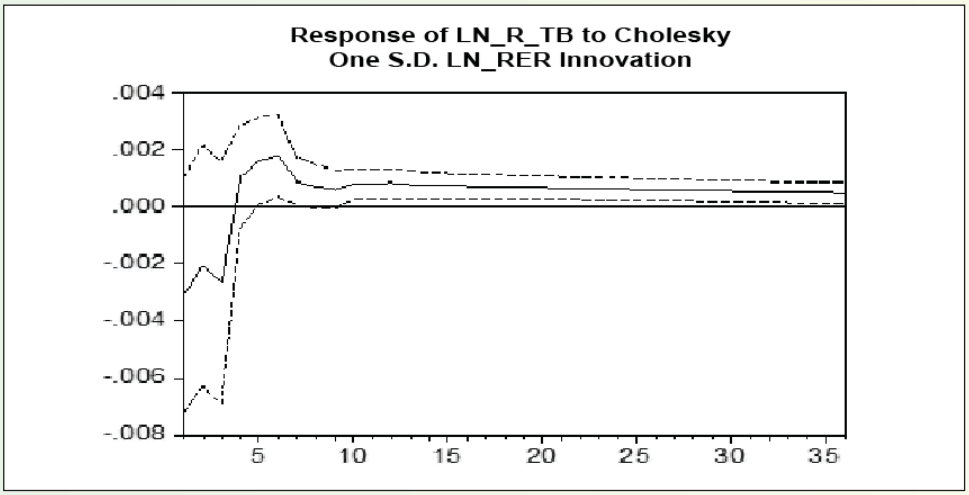
a. Response of Real Exports to Innovations to Real Exchange Rate



b. Response of Real Imports to Innovations to Real Exchange Rate



c. Response of Trade Balance to Innovations to Real Exchange Rate



The impulse response functions (IRFs) of log of real export, log of real imports and log of the real trade balance due to innovations to log of real exchange rate have been shown in Chart-4. The impulse response function of real exports due to one standard deviation shock to real exchange rate, real exports become significant and positive in the first period (month) peaked at period 4th and remain significant thereafter (Chart-4a). Impulse response function (IRF) of real imports due to one standard deviation shock to real exchange rate, also become significant and positive in the same month and peaked at period 6th and remain significant thereafter (Chart-4b).

The impulse response function of real trade balance due to one standard deviation shock to real exchange rate, becomes significant and positive at 5th period then becomes insignificant at 7th month which becomes significant again in period 10th and remain significant and positive thereafter (Chart-4c).

The response of the trade balance due to shock to real exchange rate is reverse L shaped instead of J curve impact though on the effects of exports and imports shows reverse J curve results. The main reason behind the reverse J-curve behavior for Bangladeshi export and imports is because, when exports demand increases following depreciation, the imports demand of intermediate inputs of exporting industries are substantially increased particularly in the Textile and RMG sectors. Therefore, the impact on the trade balance remain constant initially till about 5th period, after that exports increases more than imports that help trade balance to improve due to real exchange rate depreciation.

III.2. Real Effective Exchange Rate (REER)

Bangladesh uses Real Effective Exchange Rate (REER) index to gauge the competitiveness of Bangladesh currency compared with the movement of major trading partners' exchange rate and price level. Accordingly, a REER based exchange rate has been calculated to

examine the trend of local currency against major trading partners. For this reason, it would be worthwhile to examine whether real effective exchange rate has any direct impact on Bangladesh exports, imports, and trade balance.

The data for REER is available in two base periods 2000-01 and 1994-95, therefore to convert REER index into single base, the paper uses the ratio of REER for June, 2013 of two different bases to get the converted data of 2000-01 base for the period from June 2003 to June, 2014. The nominal effective exchange rate has been constructed using following formula and trade weight.

$$NEER^t = \frac{ERI_B^t}{\prod_{i=1}^{8} ERI_i^{tWi}} \times 100$$

Where, ERI_B^t = Exchnage Rate Index of US$ against Taka

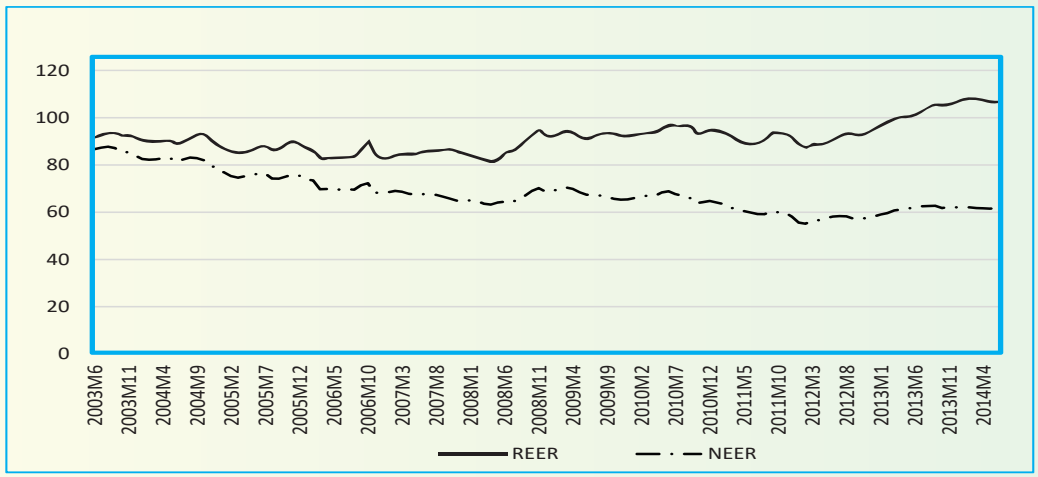
ERI_t^t = Exchange Rate Index of US$ against each partner country currency

w_t^t = Trade weight of Bangladesh with each major trading partner country.

t = time

Moreover, REER is calculated using following formula=NEER*(Domestic Price/Weighted Average Foreign Consumer Price Index)[5]

Chart-5: Trends in NEER and REER



Empirical Results from cointegration test, VEC and impulse response functions

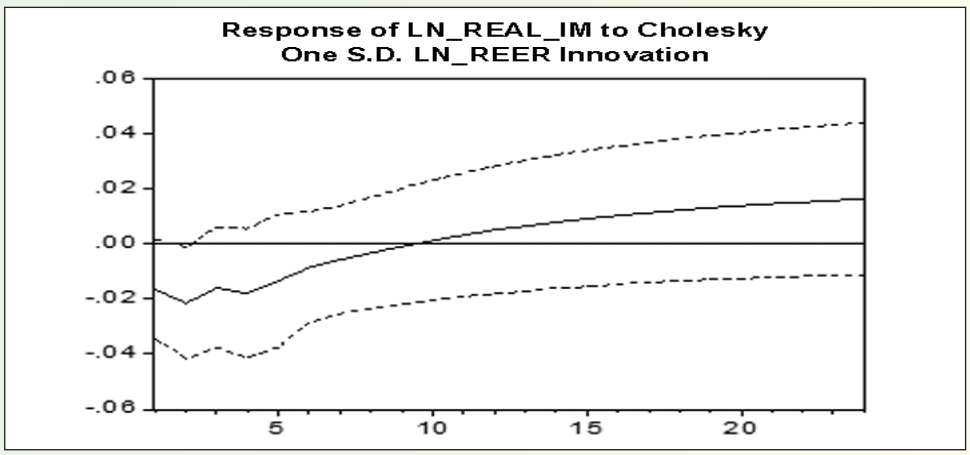
In order examine the impact of REER on trade balance cointegration analysis has been

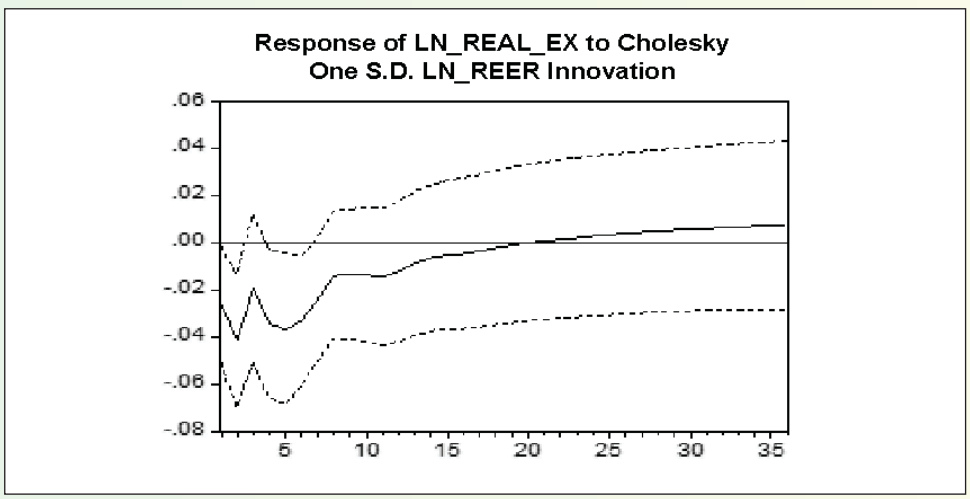
5 WAFCPI= weighted average foreign CPI has been calculated as the summation of trade weight of 8 major trading countries of Bangladesh with log of the price level of respective countries. Unit root test results by ADF and KPSS test confirms the presence of Unit root in the series.

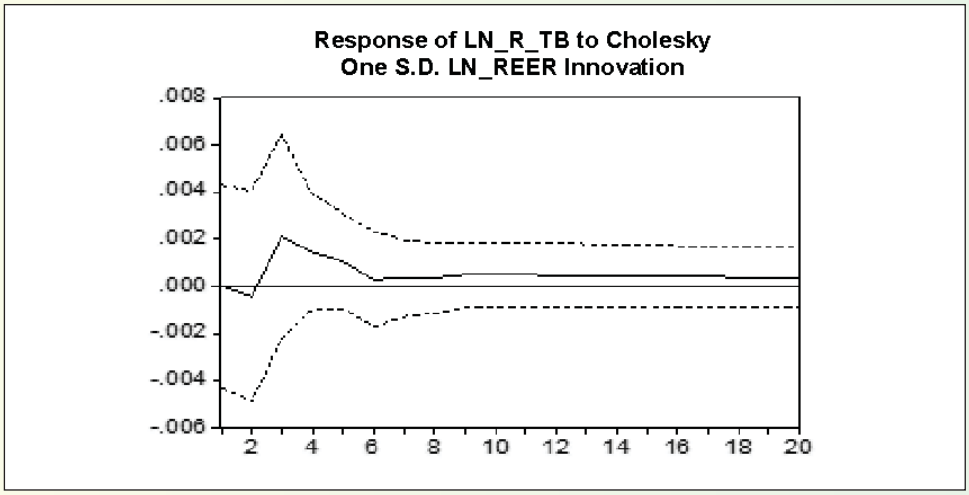
performed using lag 4 suggested by Akaike information criteria (AIC) and final prediction error (FPE). Following Johansen (1987, 88) multivariate approach assuming linear deterministic trend and intercept, this study finds no cointegration among trade balance, real effective exchange rate, domestic income, and foreign income. This is implying that there is no long-run relationship between trade balance with the log of real effective exchange rate index, domestic income, and foreign income.

The vector error correction (VEC) models also show that there is no short run impact of REER on the trade balance in Bangladesh. Finally, impulse response functions derived from Vector Autoregression (VAR) also confirms no J curve effect on the trade balance and imports. However, a small J-curve impact was depicted from response of exports.

Chart-6: IRF of Trade Balance, Imports, and Exports to Real Effective Exchange Rate Shocks







IV. Conclusions and Recommendations

The paper examines the impact of real depreciation of the currency on export, import and trade balance of Bangladesh. The study constructs and applies the real exchange rate and real effective exchange rate variables in monthly frequencies to estimate the models. The estimated results from cointegration and vector error correction models depict that real exchange rate has a significant impact on exports, imports and balance of trade of Bangladesh. The impulse response function suggests that there is reverse L-shaped effect for trade balance while the impact on exports and imports are reversed J curve that is, following a real depreciation, the balance of trade of Bangladesh remains insensitive for 5 months than become significant and improves eventually. This is may be because an increase in export demand from foreign countries following currency depreciation increase competitiveness of domestic goods compared with foreign goods also increase import demand for raw materials which, are used as intermediate goods of export industries in the similar fashion making trade balance insensitive following a depreciation of Bangladesh currency. All these findings imply that depreciation of Bangladesh currency is effective to make the Bangladeshi product competitive in the world market (i.e. growth in exports) in the long run and short run as well. The impact on the trade balance is although insensitive initially become significant after 5th period and remain significant after that.

This study does not find any significant effect of REER either on the trade balance or exports and imports. This is may be because in Bangladesh real effective exchange rate has been calculated for the policy makers to gauge the competitiveness of Bangladeshi goods compared with the major trading countries of Bangladesh. This data is not publicly available. To examine the competitiveness of Bangladeshi products REER based exchange rate is compared with Taka per dollar nominal exchange rate. The difference between two exchange rates gives an idea to the authorities with respect to competitiveness. For this reason, a policy implications of this study is a real exchange rate has highly significant and positive impact on export, negative impact on imports and improves trade deficits in Bangladesh.

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Appendix

Diagnostic Test for Exports

R^2	0.77
F-stat	7.88

Autocorrelation LM Test

VEC Residual Serial Correlation LM

Tests

H0: no serial correlation at lag order h

Lags	LM-Stat	Prob
1	15.86805	0.4622
2	20.76905	0.1876
3	22.76666	0.1201
4	21.07457	0.1757
5	18.77651	0.2804
6	15.56711	0.4836
7	13.06100	0.6683
8	22.12717	0.1391
9	11.24717	0.7940
10	15.26685	0.5052

Probs from chi-square with 16 df.

VEC Residual Normality Tests

Orthogonalization: Cholesky (Lutkepohl)

H0: residuals are multivariate normal

Component	Skewness	Chi-sq	df	Prob.
1	-0.090658	0.143832	1	0.7045
2	0.197744	0.684295	1	0.4081
3	0.327992	1.882633	1	0.1700
4	-0.258417	1.168638	1	0.2797
Joint		3.879398	4	0.4226

VEC Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)

Date: 08/15/14 Time: 03:03

Sample: 2003:06 2014:06

Included observations: 105

Joint test:		
Chi-sq	df	Prob.
740.0384	74	0.4927

Individual components:

Dependent	R-squared	F(74,30)	Prob.	Chi-sq(74)	Prob.
res1*res1	0.602597	0.614732	0.9529	63.27270	0.8086
res2*res2	0.672791	0.833573	0.7396	70.64301	0.5891
res3*res3	0.751636	1.226900	0.2705	78.92182	0.3262
res4*res4	0.786591	1.494254	0.1107	82.59200	0.2312
res2*res1	0.683463	0.875347	0.6844	71.76362	0.5520
res3*res1	0.703158	0.960324	0.5696	73.83163	0.4836
res3*res2	0.630669	0.692271	0.8975	66.22028	0.7284
res4*res1	0.687572	0.892190	0.6616	72.19503	0.5377
res4*res2	0.689503	0.900259	0.6507	72.39777	0.5310
res4*res3	0.733328	1.114832	0.3793	76.99940	0.3829

Co-integrating terms and determinants of Δ LN_R_EXt

The Export Behavior

$ECT(LN\_R\_EX)_{t-1}$	-0.44(-5.39)
$\Delta LN\_IPI\_EX_{t-1}$	-0.25 (-2.35)
$\Delta LN\_IPI\_TP_{t-3}$	2.87 (1.83)
$\Delta LN\_IPI\_BD_{t-1}$	-1.55(-1.86)
$\Delta LN\_IPI\_BD_{t-2}$	-1.90(-2.26)
$\Delta LN\_R\_IM_{t-1}$	-0.76(-3.78)
$\Delta LN\_R\_IM_{t-2}$	-0.43(-2.33)
Constant	0.06(3.31)
R^2	0.57
S.E	0.12
F-Statistics	7.79

Cointegration test for Imports

Unrestricted Cointegration Rank Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.250511	60.13902	47.21	54.46
At most 1	0.133644	28.13065	29.68	35.65
At most 2	0.104136	12.20663	15.41	20.04
At most 3	3.54E-06	0.000393	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level

Trace test indicates 1 cointegrating equation(s) at both 5% and 1% levels

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None *	0.250511	32.00837	27.07	32.24
At most 1	0.133644	15.92401	20.97	25.52
At most 2	0.104136	12.20624	14.07	18.63
At most 3	3.54E-06	0.000393	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level

Max-eigenvalue test indicates 1 cointegrating equation(s) at the 5% level

Max-eigenvalue test indicates no cointegration at the 1% level

Vector Error Correction Model (VECM): Imports

$$\Delta \ln IM_t = 0.85\Delta \ln RER_{t-1} + 1.51\Delta \ln Y_{t-1} + 1.29\Delta \ln Y^*_{t-1} - 0.43EC_{t-1} + 0.01$$

(2.38) (4.49) (4.23) (-2.97) (0.64)

The above dynamic estimate suggests that the real exchange rate depreciation has significant and positive effect on imports in the short-run implying that if the real exchange rate depreciates that will increase imports in the short run. This result is consistent with the results derived from impulse response functions. The VECM results also indicate that domestic real output has significant and positive impacts on imports in the short-run implying that if the domestic real output increase following export demand that will increase imports. The coefficient of output of major trading partners is significant and appeared with the expected positive sign implying that if real output of major trading partner increases that will increase imports in Bangladesh. The coefficient of ECt-1 is negative and significant, which implies that the model converges. The speed of adjustment is high -0.43 implies that these variables will adjust quickly to get back to the equilibrium.

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Revisiting the Marshall-Lerner Condition in the Bangladesh Economy: A Cointegration Approach

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Hossain Md. Alhelal

Abstract

Exchange rates are important macroeconomic policy variables. In formulating exchange rate policies, one of the major concerns of the policy makers is the responsiveness of trade flows to relative price changes. The Marshall - Lerner condition shows that if absolute value of price elasticity of export and import demand is greater than unity, devaluation will improve trade balance. Using the Johansen and Johansen and Juselius Cointegration method we test the Marshall - Lerner condition for Bangladesh for the period 1985-2014. Estimated results show that Marshall - Lerner condition holds for Bangladesh in the long run. Export is current export price inelastic which is consistent with earlier studies. Export is also lag export price inelastic. To get the benefit of currency devaluation, export demand might be made price elastic by increasing the export base, including new products in the export basket, maintaining quality, searching new markets for exports, improving infrastructure facilities for smooth production and supply of exports.

Keywords: Devaluation, elasticity, cointegration, trade deficit.

JEL Classification: F31, F32

1. Introduction

The exchange rate is an important macroeconomic policy variable. Changes in the exchange rate influences export, import and thus trade balance, remittances, foreign exchange reserve and inflation of the economy. In formulating exchange rate policies, one of the major concerns of the policy makers is the responsiveness of trade flows to relative price changes. For small open economies it is basically the sum of export and import elasticity that indicates whether devaluation has favorable effects on trade balance. Economies may face crisis due to wrong or bad choice of exchange rate policies (e.g. Asian crisis in 1997).

1 The authors are Deputy General Manager and Deputy Director, respectively, of the Monetary Policy Department of Bangladesh Bank. Views expressed in this paper are authors own and they do not necessarily reflect the views of Bangladesh Bank. The authors are thankful to Biru Paksha Paul, Md. Akhtaruzzaman, Khawaja A. Mamun, Anupam Das and Aasha Amin for their valuable suggestions. Comments are most welcome to: luthfe.begum@bb.org.bd.

Real exchange rate index is an indicator of the country's trade competitiveness. Depreciation of exchange rate makes the country's product relatively cheaper than the product of other countries and hence the demand for the country's export may increase (Reinhart, 1995) Depreciation increases the prices of goods imported by the country which can reduce the import payment. Since independence up until 1979 Bangladesh followed a fix exchange rate regime. Bangladesh adopted a highly regulated financial, fiscal and industrial policy with inward oriented import substituting trade. During this period exchange rates were overvalued and the country encountered a high trade deficit. Bangladesh shifted from the inward looking regime towards a market-oriented regime. Since the 1980's most trade and industrial policies (under NIP) aimed at higher growth in the export sector.

From the early 1990's, a huge reduction in tariff rates, withdrawal of quantitative restrictions and exchange rate convertibility in the current account created a momentum in the trade sector. As a result, trade openness (export plus import as % of GDP) of the country gradually increased from 13.5% to 16.8 % and 50.5 % in FY1981, FY1991 and FY2011 respectively. Younus et al. (2006) stated that between 1972 and 2002 the Taka was devalued about 130 times to reduce the balance of payments deficit in Bangladesh. In May 2003, Bangladesh introduced the floating exchange rate regime to determine the exchange rate by market forces aiming to accelerate exports, reduce extra pressure on imports thereby improving the trade balance.

It is revealed from the data (Table: 7 and 8; appendix A) that the growth of export is more than double than the growth of import during the period 1980-2015. The composition of total export earnings showed that 69.0 percent of total export earnings came from readymade garments (excluding export by EPZ), followed by 3.0 percent from leather and footwear, 3.0 percent from raw jute and jute goods and remaining 25 percent from others in FY15. Category-wise import payment showed that of the total import payments 44 percent went to raw materials and intermediate goods followed by 14.0 percent for capital machinery, 13 percent for foodgrains and other food and remaining 31 percent for others in FY15.

Empirical evidence from (Figure: 1; appendix B) shows that exchange rate devalued over the period, trade balance as a percent of total trade also declined during the period but the contribution of depreciation on the net export is not clear. Alfred Marshall and Abba Lerner showed that if the absolute value of price elasticity of export and import demand is greater than unity, devaluation will improve trade balance. There is no consensus about the effect of devaluation on trade balance i.e. existence of Marshall -Lerner condition. Different countries showed differing results (Bahmani- Oskooee, 1986). There are few studies (Younus and Chowdhury 2014, Murad 2012, Alam 2010, Aziz.N 2008) on the effect of devaluation of exchange rate on trade balance and existence of Marshall–Lerner condition in the economy of Bangladesh using different variables, varying time period and various methods. The results of these studies are inconclusive as few studies showed that depreciation of Bangladesh currency is effective to make the Bangladeshi product

competitive in the world market in the long run, while others found no causal relationship between currency depreciation and export earnings. The depreciation of real exchange rates, moreover, are not effective in improving the trade balance of Bangladesh in the long run.

Thus the objective of the study is to re-examine the validity of Marshall-Lerner condition in the economy of Bangladesh using annual data from 1985 to 2014 i.e. in the era of a liberalized economy. We organized the research paper as follows: section-2 describes the elasticity approach and Marshall-

Lerner condition, Section-3 reviews the literature, Data and Methodology is shown in section-4, Section-5 investigates empirical results and findings; finally, a conclusion is made in the section-6.

2. The elasticity approach and the Marshall-Lerner condition

Modern literature on devaluation begins with the elasticity approach. The formal development of this approach was in the hand of Alfred Marshall and Abba Lerner. Joan Robinson (1937) later extended it within the Marshallian partial equilibrium framework which is now popularly known as the Marshall-Lerner condition (Metzler, 1949).

According to the elasticity approach, devaluation affects balance of payments in three ways: firstly, the decrease in the amount of imported goods because of the increase in the prices of these goods; secondly increase in export because of the decrease in the prices of exported goods; and thirdly lower revenue from one exported good because of devaluation. Net results of these three impacts depend on export and import elasticity. If the sum of the export and import elasticity is bigger than 1 (one) the impact will be positive. Existing literature has found that the elasticity of exports and imports with respect to the exchange rate is very low in the short run, that is the Marshall-Lerner condition cannot be fulfilled. However, elasticity is high in the long run and the sum of the elasticity may be higher than 1 (one). Thus, devaluation will increase the trade deficit in the short run. The reason is that devaluation makes import more expensive and the value of export cheaper in the short run in terms of foreign currency revenues and has less impact on the increase in export and the decrease in import. In other words, economic entities need a certain time period in order to adapt themselves to new prices. However, the expected impacts of devaluation can be seen after a while and balance of trade will recover.

In recent studies, it is asserted that the impacts of changes in foreign exchange rates on balance of trade cannot be explained with elasticity which is calculated by seeing only the changes in the prices and quantities of goods and so income effect should be added to the model. This study is based on the export and import functions which were used in the 'Long-Run Price Elasticities and the Marshall–Lerner Condition revisited' study of Mohsen Bahmani-Oskooee and Farhang Niroomand in 1998 (Bahmani-Oskooee and Niroomand, 1998: 102). According to this model;

Import demand function:

$$LnM_t = \alpha + \beta Ln\left(\frac{PM}{PD}\right)_t + \gamma\, LnY_t + \varepsilon_t \quad \text{..... (1)}$$

$$\text{Where } \beta < 0, \quad \gamma > 0$$

In this function: M – import, PM – price of import, PD – domestic price level, Y – domestic income, ε_t – error term. Natural logarithms of all variables in the model were taken. The increases in import price levels with respect to domestic price levels decrease import and price elasticity of import is expected to be negative ($\beta < 0$). According to Keynesian Theory, it is expected that increase in domestic income raises import, hence income elasticity is expected to be positive ($\gamma > 0$). However, in literature since the increase in domestic income raises import-substituting production, income elasticity will be negative.

Export demand function:

$$LnM_t = \alpha' + \beta' Ln\left(\frac{PX}{PXW}\right)_t + \gamma'\, LnY_t + \varepsilon'_t \quad \text{..... (2)}$$

$$\text{Where } \beta' < 0, \quad \gamma' > 0$$

In this function: X – export, PX – price of export, PXW – world export price levels, YW – world income level and ε'_t – error term. Natural logarithms of all variables in the model were taken. The increases in export prices with respect to world export price levels create the expectation of a decrease in export. So β' should be smaller than 0 ($\beta' < 0$). When world income level increases it is expected that the export of the country will increase so γ' is expected to be higher than 0 ($\gamma' > 0$).

3. Literature Review

Jamilov's (2012) examination showed that a real devaluation of Manat carried a significant positive effect on the balance of trade in the long run in Azerbaijan's economy and robustness test with prices of exports and imports showed that the trade balance improved in the medium-long run. Caporale et al. (2012) investigation, linking the balance of payments to the real exchange rate and relative income, showed that in Kenya there exists a well-defined cointegrating relationship and that the M-L condition was satisfied in the long run although the convergence process was relatively slow. Joel Hinaunye Eita (2013) examination showed that in Namibia, imports and exports responded significantly to a change in the exchange rate and suggested that the Marshall-Lerner condition did hold. Ritesh Pandey (2013) found that the Marshall Lerner condition was true for the Indian Economy. Hakan TURKAY's (2014) investigation found that the elasticity of exports and imports demand was higher than 1 in Turkey's economy that is, the Marshall-Lerner condition was satisfied. He also found that in the short run there was no statistically significant relationship between the variables but currency adjustments (devaluation) may be effective in reducing current account deficit in the long run. Syeda Shehr Bano et al. (2014) evaluated the impact of currency devaluation on trade balance in Pakistan. Their examination showed that the Marshall-Lerner condition was satisfied for Pakistan's Economy.

Hossain (2000) estimated price and income elasticity of demand for both export and import of Bangladesh for the period 1976 to 1996. He used export price index, import price index, foreign income, home country income as explanatory variables. The estimation showed that export and import demand were price inelastic but income elastic. His estimation showed that though the export and import were not price elastic, the sum of the price elasticity of demand for both export and import was still high enough to satisfy Marshall-Lerner condition both in the long and short run. Before estimation he had claimed that earlier studies were based on historic data that included the 70's data when Bangladesh's export was dominated by few low price elastic primary products. The export trade of Bangladesh was dominated by non-traditional exports after the 80s. As these exports were price elastic, devaluation might have been effective in raising exports earnings from those. But his estimation also failed to show that export demand is price elastic. Nusrat Aziz (2008) using annual data from 1972- 2005 of Bangladesh examined the response of the balance of trade to the real effective exchange rate of Bangladesh using REER, home country income and world real industrial production index (as proxy for trade partner income) as explanatory variables. The results demonstrated an unexpected fall in exports earning and rise in imports cost immediately after devaluation for Bangladesh.

Thus the balance of trade deteriorates immediately after depreciation and then starts improving from the second period and eventually goes to the baseline. The combined results support the Marshall-Lerner condition through the J-curve idea. Rafayet Alam (2010) tested vector autoregressive model using annual data from 1977-2005 to see whether there is any contribution of real exchange rate depreciation of Taka to export earnings of Bangladesh. Findings shows no causality runs from real depreciation of taka to export earning of Bangladesh. S.M. Woahid Murad (2012) estimated trade elasticity using bilateral data between Bangladesh and its major trading partner data covering 1973-2009. 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. Dr. Sayera and Maidul (2014) showed short-run and long-run relationship between trade balance, RER, and domestic income using monthly data for the sample period from June 2003 to June, 2014. Their findings imply that depreciation of Bangladesh currency is effective to make the Bangladeshi product competitive in the world market (i.e. growth in exports) in the long run and short run as well. The impact on the trade balance is although insensitive initially become significant after 5th period and remain significant after that. Unlike earlier studies we used the ratio of export and import price index to estimate price elasticity of export and import demand. Hossain (2000) argued that owing to time series include 70's data price elasticity for export and import became inelastic? We employed annual data from 1985 to 2014 when trade policy started to liberalize and the economy shifted toward export led growth strategy. Exchange rate policy also gradually moved from a fixed to flexible regime. Export earning is dominated by non-traditional goods i.e. readymade garments.

4. Methodology and Data

This study used the same model developed by Bahmani - Oskooee and Niroomand (1998). Bangladesh's export volume (ex), import volume (im), export price index (px), import price index (pm), domestic price level (dm), world export price level (pxw), gross domestic income (y) and world income (yw) are used in order to test the elasticity approach.

The study employed annual data from 1985-2014. We have taken data from 1985 because since then a somewhat market based exchange rate policy was put in place. Since then depreciation/appreciation were made on the basis of the REER index calculated by Bangladesh Bank. Bangladesh's data were collected from Bangladesh Bank's publications and Economic Review published by the Ministry of Finance. World income, world export price index and world GDP deflator are taken from UNDATA website. Sources of the UNDATA are IFS published by IMF. All variables used in the model are in real terms i.e these are deflated by CPI of Bangladesh and world CPI. All the variables are taken in log linear form. Before estimating the model to see the nature of the data we plot the variables (annexure 1). Then we perform unit root test for all the variable entered into export demand and import demand models. We use the Philliph Parron (1988) test because this test is serial correlated and heteroskedasticity adjusted so gives good results for unit root test. Unit root test shows that all the variable have unit root at level but stationary at first difference i.e the variables are cointegrated of order one I(1).

If the variables are I(1), they may have long run relationship. To establish whether there is a long run equilibrium relation among the variables of import and export demand functions we employed Johansen (1988) and Johasen and Juselius (1990) cointegration analysis. The main notation behind the cointegration analysis is that if a linear combination of a set of nonstationary variables is stationary, those variables are said to be cointegrated. Johansen and Joan Juselius technique basically provides two test statistics (λ-max and λ-trace). In order to perform cointegration test we determine lag length through an unrestricted Vector Auto Regression model. All the criteria (AIC, SBC, HQ) shows that export demand function and import demand function has one lag length. From table 1, 2 and 3 both test statistics show that both export demand function and import demand function has one cointegration relation.

5. Empirical Results and Findings

Estimation results of VEC model show that (Table: 4) price elasticity of export is negative as expected and statistically significant. If domestic export price increase more than the world export price then export will decline. Coefficient of export is 0.27 i.e. export is price inelastic which is consistent with earlier studies. Income elasticity of export is positive as expected and statistically significant. Coefficient of income elasticity is 0.80 i.e. export is income inelastic. The sign of the error correction term is negative and significant with a value of 0.17 i.e. any deviation from long run equilibrium will be disappeared in time and long run balance will be regained. There is a time lag between current export and export

price. The settlement of current export is made on the basis of export price at which the export L/C was opened. So, to examine whether the export demand is sensitive to lag export price in the short run, we run a regression of export volume with lag export price. We did not find any significant relation between lag export price and export volume i.e. export demand is not sensitive to lag export price in the short run (Table: 5).

Estimation results of import demand function show that import price elasticity is negative as expected and statistically significant. A rise in import price compared to the domestic price will decline import. Coefficient of import price is 2.01 i.e. import is price elastic. After withdrawal of restrictions on import under trade liberalization and stopping import of food grains due to self- sufficiency in production of food grains, import demand becomes price elastic. Income elasticity of import is negative but insignificant. There is a trend in import demand function whose value is very negligible but statistically significant. The sign of ECM is negative and statistically significant. The value of ECM is 0.10. Any deviation from long run equilibrium will disappear and the long run equilibrium will be regained. The sum of the absolute value of price elasticity of export and import demand is 2.28 (0.27+2.01); which is more than unity i.e. the Marshall-Lerner condition holds in Bangladesh in the long run. Empirical results show that Marshall-Lerner condition does not hold in short run. This finding is consistent with the findings of most of the earlier studies. The estimated results also show that despite price inelastic export demand devaluation improves trade balance in Bangladesh.

Above 80 percent of our total export earnings (including export by EPZ, Annual Report FY14, Bangladesh Bank) come from readymade garments (RMG); which is price insensitive. Demand of RMG does not depend on price rather it depends on timely shipment, maintaining quality, compliance of worker rights etc. (Ahmed 2013, Younus and Yamagata 2012, Mlachila and Yang 2004). Moreover, Bangladesh exports lower end RMG which are price and income inelastic. For these reasons growth rates of our exports of RMG were unaffected during the global recession (15% in FY07, 17% in FY08 and 10% in FY09). Over the period our export increased mainly due to export subsidy, cash incentives, quota and GSP facility. During this time trade balance declined mainly due to economic policies and reform measures undertook towards export led growth strategy (e.g. reducing/withdrawal of credit ceiling on private borrowing and investment, removal of tariff and non- tariff barriers under NIP). Hossain (2000) showed that the share of export earnings by non-traditional items increased from 22 percent in 1980 to 83 percent in 1993 (p-148). He claimed that this follows the fact that with trade liberalization, the composition of export trade usually changes from low price elastic primary products to high price elastic manufactured products (p-158). From the mid eighties i.e. since trade liberalization Bangladesh's RMG (manufacturing products) has been dominating total exports which is price inelastic. Now RMG can be seen as a traditional item in the export basket. We have to include new non-traditional items in the export basket of Bangladeshi products to make it price elastic.

6. Policy Recommendations

Similar to many other developed and developing countries the Marshall-Lerner condition holds in Bangladesh well. This in turn supports the hypothesis that devaluation can improve the trade balance in the long run. To realize the benefit of devaluation, Bangladesh needs to export goods that are price elastic. In order to do that, the export base must be expanded by producing new products including ship building, light engineering, electronics, IT products, processed foods and flowers. In addition, the country should improve the quality and diversity of traditional export items such as jute and jute goods and leather products. It is essential to look for new export markets. Initiatives to develop backward linkage industries for garments sector (e.g. textile, yarn and accessories) should be undertaken. Pragmatic policy formulation and implementation to develop infrastructure (gas, electricity, road, port etc.) to smoothen the production and supply of exports are needed on a priority basis.

Appendix A

Table 1: Unit Root Test

Variables	Level (PP test statistics)		First difference (PP test statistics)		Order of Integration
	With trend	Without trend	With trend	Without trend	
LNEX	1.22 (0.99)	2.04 (0.56)	6.39 (0.00)	6.64 (0.00)	I(1)
LNIM	2.14 (0.99)	3.22 (0.99)	6.50 (0.00)	11.4 (0.00)	I(1)
LNPM_PD	1.30 (0.17)		3.04 (0.04)	3.36 (0.07)	I(1)
LNPX_PXW	0.51 (0.87)	2.34 (0.40)	4.72 (0.00)	4.84 (0.00)	I(1)
LNY	1.36 (0.99)	0.83 (0.95)	4.72 (0.00)	4.98 (0.00)	I(1)
LNYW	1.61 (0.46)	2.28 (0.43)	4.02 (0.00)	4.18 (0.01)	I(1)

Note: Figures in the parenthesis indicate probability. All variables have unit root at level but stationary at first difference

Source: Statistics Department of Bangladesh Bank, UNDATA website and Export Promotion Bureau, Year-1992, 1999, 2015

If the variables are I(1), they may have long run relationship. To establish whether there is a long run equilibrium relation among the variables of import and export demand functions we employed Johansen (1988) and Johansen and Juselius (1990) cointegration analysis. The main notation behind the cointegration analysis is that if a linear combination of a set of nonstationary variables is stationary, those variables are said to be cointegrated. Johansen and Joan Juselius technique basically provides two test statistics (λ-max and λ-trace). In order to perform cointegration test we determine lag length through an unrestricted Vector Auto Regression model. All the criteria (AIC, SBC, HQ) shows that export demand function and import demand function has one lag length.

Table: 2 Co-integration Test for Export

Null Hypothesis	Alternative Hypothesis	Test Statistics	5-percent Critical Value	Prob.	Conclusion
Trace Test					
r = 0	r> 0	32.64	29.8	0.0229	One
r ≤ 1	r> 1	9.69	15.49	0.305	Cointegration
r ≤ 2	r> 3	1.58	3.84	0.2084	Relation
Maximum Eigen value Test					
r = 0	r> 0	22.9	21.13	0.0275	One
r =1	r=2	8.11	14.26	0.3675	Cointegration
r = 2	r=3	1.58	3.84	0.2084	Relation

Source: Statistics Department of Bangladesh Bank, UNDATA website and Export Promotion Bureau. Year-1992, 1999, 2015

Table: 3 Co-integration Test for Import

Null Hypothesis	Alternative Hypothesis	Test Statistics	5-percent Critical Value	Prob.	Conclusion
Trace Test					
r = 0	r> 0	50.96	42.91	0.0065	One
r ≤ 1	r> 1	25.09	25.87	0.0623	Cointegration
r ≤ 2	r> 3	6.13	12.52	0.4441	Relation
Maximum Eigen value Test					
r = 0	r> 0	25.88	25.82	0.0492	One
r =1	r=2	18.96	19.39	0.0576	Cointegration
r = 2	r=3	6.13	12.52	0.4441	Relation

Source: Statistics Department of Bangladesh Bank, UNDATA website and Export Promotion Bureau. Year-1992, 1999, 2015

Table: 4 Cointegration Equation for Export Function

Normalized Co-integration Co-efficient: Export Demand Function		
LEX	LPX_PXW	LYW
1.00	-0.27 (1.75)	0.80 (9.77)
Short-run Dynamics and Speed of Adjustment Co-efficient		
ECM	D(LPX_PXW)	D(LYW)
-0.1704 (-1.80)	-0.21 (-1.18)	0.93 (4.05)

Source: Statistics Department of Bangladesh Bank, UNDATA website and Export Promotion Bureau. Year-1992, 1999, 2015

Table: 5 Cointegration Equation for Import Function

Normalized Co-integration Co-efficient: Import Demand Function			
LIM	LPM_PD	LY	Trend
1.00	-2.01 (3.21)	-1.34 (1.15)	0.08 (-5.75)
Short-run Dynamics and Speed of Adjustment Co-efficient			
ECM	D(LPX_PXW)	D(LYW)	
-0.1018 (-2.57)	-0.0829 (-4.62)	-0.0313 (-1.89)	

Source: Statistics Department of Bangladesh Bank, UNDATA website and Export Promotion Bureau. Year-1992, 1999, 2015

Table: 6(a) Short run effect of export price on export demand

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C DPX_PXW	6.975389	1.929976	3.614236	0.0012
DYW	-0.444383	14.73570	-0.030157	0.9762
	-14.45004	6.019581	-2.400506	0.0235

Source: Statistics Department of Bangladesh Bank, UNDATA website and Export Promotion Bureau

Table: 6(b) Short run effect of lag export price on lag export demand

Variable	Coefficient	Std. Error	t-Statistic	Prob.
	6.911072	2.034991	3.396118	0.0022
C DPX1	3.292217	14.78670	0.222647	0.8255
DYW	-13.86532	6.151655	-2.253918	0.0329

Source: Statistics Department of Bangladesh Bank, UNDATA website and Export Promotion Bureau. Year-1992, 1999, 2015

Table: 7 Composition of Exports of Bangladesh

(Taka in Crore)

Financial Year	Ready-made Garments (all sorts)	Fish & Leather	Raw jute & Jute goods	Garments, Fish, Leather and Jute allied	Total Exports
FY80	1 (0%)	188 (16%)	772 (67%)	961 (83%)	1151
FY85	276 (11%)	457 (18%)	1362 (54%)	2095 (83%)	2521
FY90	1949 (39%)	1091 (22%)	1384 (28%)	4424 (88%)	5004
FY95	7438 (57%)	2197 (17%)	1621 (12%)	11256 (86%)	13130
FY00	15724 (63%)	2573 (10%)	1501 (6%)	19798 (79%)	24923
FY05	33333 (66%)	4184 (8%)	2241 (4%)	39758 (78%)	50835
FY10	67248 (66%)	5639 (6%)	4984 (5%)	77871 (76%)	102148
FY15	156039 (69%)	7078 (3%)	6208 (3%)	169325 (75%)	226522

Source: Statistics Department of Bangladesh Bank and Export Promotion Bureau *Excluding export by EPZ. Year-1990,1999, 2015

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Source: Statistics Department of Bangladesh Bank and Export Promotion Bureau *Excluding export by EPZ. Year-1990,1999, 2015

Table: 8 Composition of Imports of Bangladesh

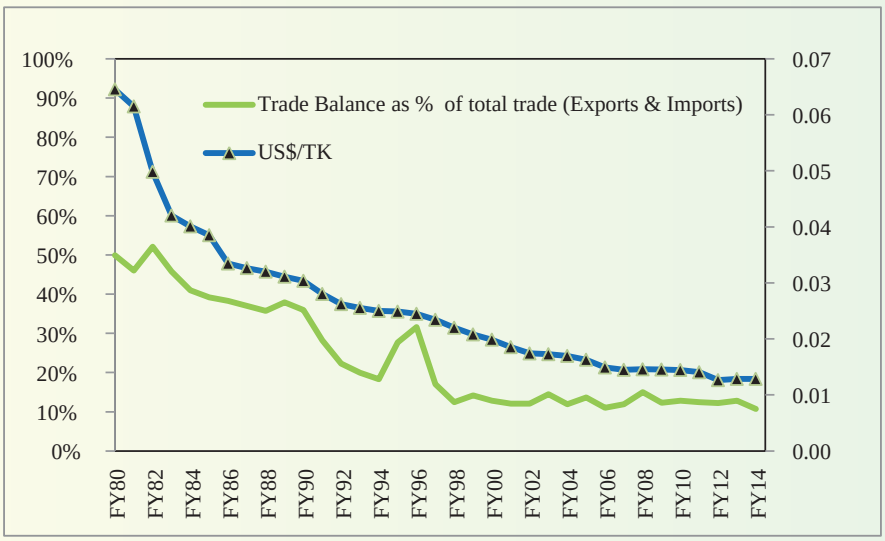
(Taka in Crore)

Financial Year	Foods	POL, Chem, Phar, Ferti	Raw Materials	Capital Machinery, Iron & Steel	Total	Total Imports
FY80	1083 (31%)	945 (27%)	268 (8%)	281 (8%)	2577 (73%)	3546
FY85	1687 (25%)	1295 (19%)	400 (6%)	863 (13%)	4245 (62%)	6874
FY90	2018 (16%)	1793 (14%)	1848 (15%)	1861 (15%)	7520 (60%)	12480
FY95	3513 (15%)	2797 (12%)	5830 (25%)	1624 (7%)	13764 (59%)	23455
FY00	7476 (18%)	5448 (13%)	9277 (22%)	3556 (8%)	25757 (61%)	42131
FY05	7476 (9%)	15321 (19%)	17951 (22%)	11069 (14%)	51817 (64%)	80895
FY10	22359 (14%)	30079 (18%)	38068 (23%)	21084 (13%)	111590 (68%)	164241
FY15	39645 (13%)	55086 (18%)	81407 (26%)	42828 (14%)	226323 (70%)	314209

Source: Statistics Department of Bangladesh Bank and Export Promotion Bureau. Year-1990, 1999, 2015

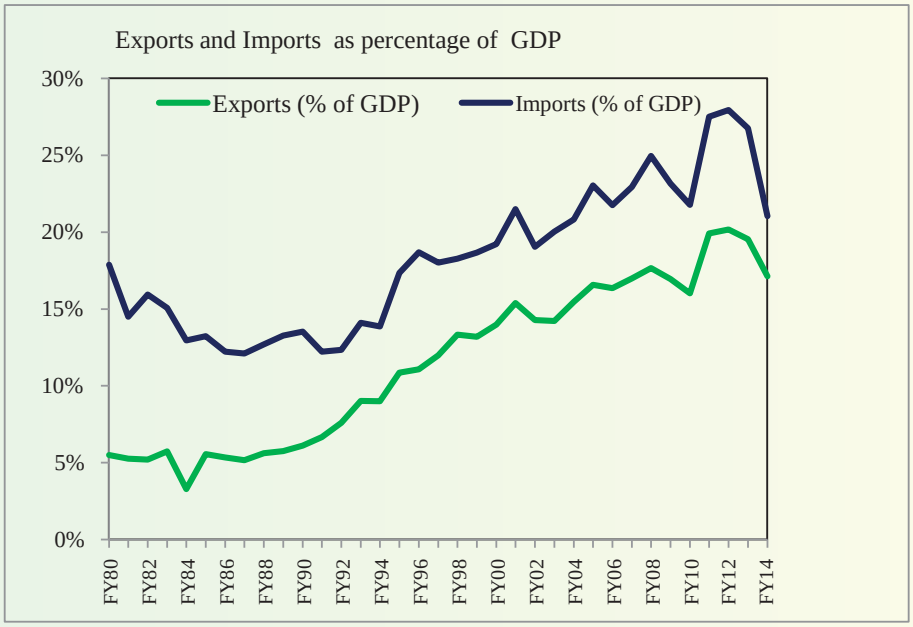
Appendix-B

Figure: 1 Pattern of trade balance and US Dollar per taka



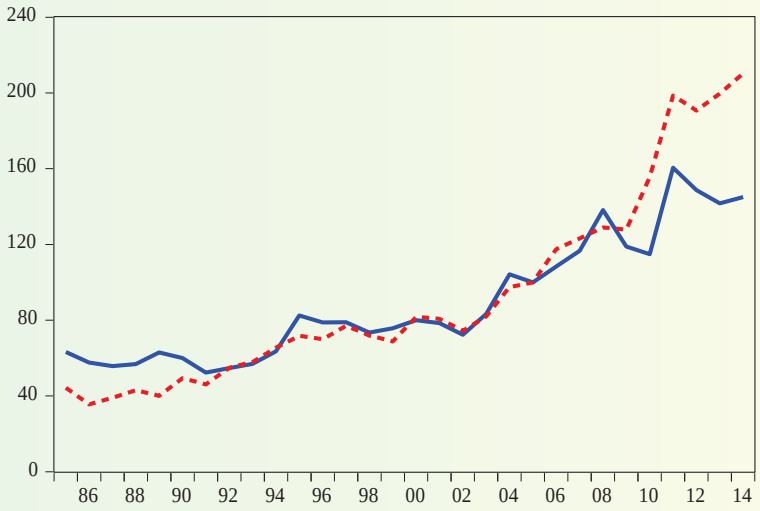
Source: Bangladesh Bank and Export Promotion Bureau Year-1990,1999, 2015

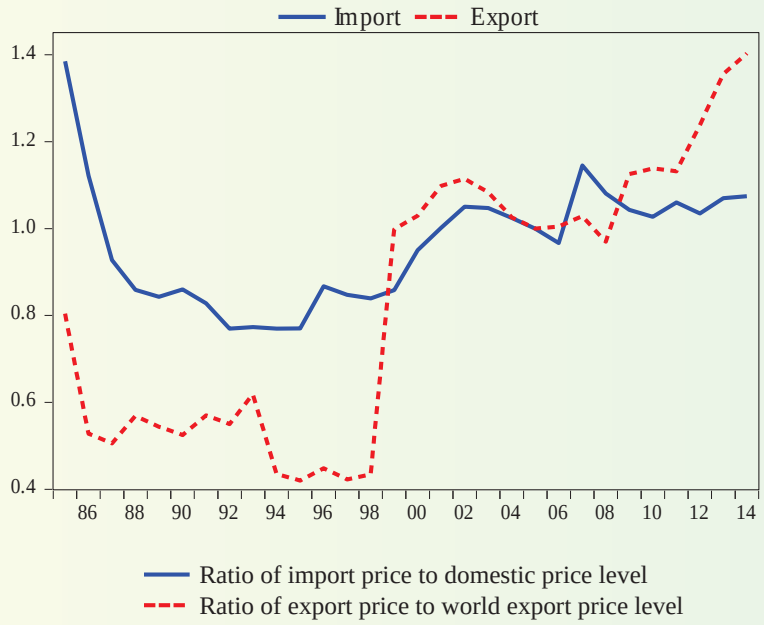
Figure : 2 Patterns of exports and imports as percentages of GDP

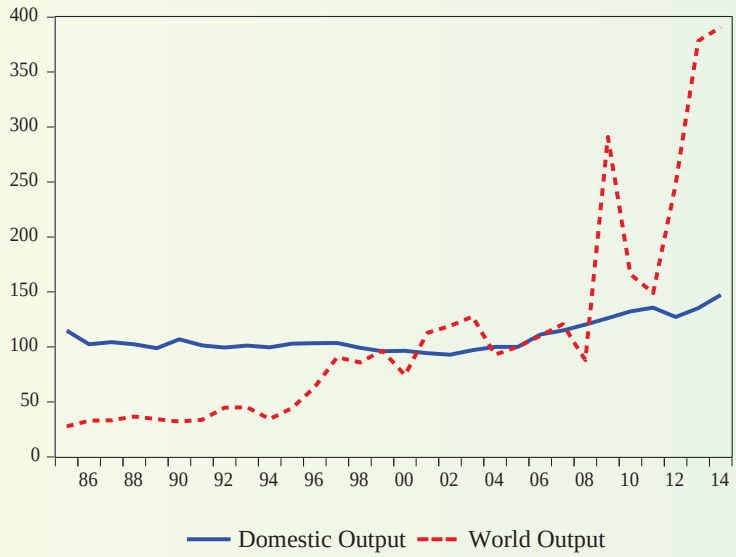


Source: Bangladesh Bank and Export Promotion Bureau Year-1990,1999, 2015

Figure : 3 Plot of Variables used in the Models







Source: Statistics Department of Bangladesh Bank, UNDATA website and Export Promotion Bureau. Year-1992, 1999, 2015

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Profitability Study of Non-bank Financial Institutions A Panel Data Analysis

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Abstract

The importance of nonbank financial institutions (NBFIs) to the economy cannot be overemphasized. Compared to the previous year, the deposit of NBFIs rose by 36% in the year 2013. Analyzing the profitability of non-banking institutions is the central theme of the study: it marks off the model nonbank financial institutions use in Bangladesh. Evoking insight into profitability model helps in pinning down strength and weakness, which in turn ushers to better dealing with distress condition. Thus understanding NBFI profitability model has policy implication. Using panel data the article regresses the profitability on assets, non-interest revenue and equity. The model accounts 90 of variability in profits. The effect of noninterest income is most pronounced among the regressors, which vouches that profitability hinges more upon it for NBFIs and less on interest source. Size puts a negative impact on profits negating the the bigger the better notion, however strong the words supporting it are. The effect of equity is understandably negative on ROE.

Keywords : Business model, profitability, NBFI.

JEL Classification : G23, G32

Introduction

Started in 1981, the nonbanking sector has increased in size in both absolute and relative terms. A private sector nonbank financial institution (NBFI) namely Industrial Promotion and Development Company (IPDC) was the pioneer in the sector in Bangladesh (Gupta and et el, 2013: 17-18, Ahmed and Chowdhury 2007:2). The development of both banks and non-bank financial institutions is necessary for assuring a strong and stable financial system for the country as a whole (Pirtea and et el, 2008:3).

Financial development in a country starts with the development of banking institutions. As the development process proceeds, NBFIs become prominent alongside the banking sector. Both can play significant roles in influencing and mobilizing savings for investment (Goldsmith 1969 in Ahmed and Chowdhury 2007:1).

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That financial development plays an important role in promoting the growth of many countries is nothing new (Cheng and Degryse 2004:3). One strand of research argues that financial development matters for economic growth by observing that financial development is significantly correlated with local growth. First, financial intermediation economizes the costs associated with mobilizing savings, and therefore increases capital accumulation. Second, financial intermediaries evaluate firms, managers and market conditions, and reallocate capital to its best use. Moreover, financial intermediaries monitor firms and exert control to overcome agency problems. Financial intermediation meanwhile diversifies investment risks, which enhances the output and in turn economic growth. In their view, differences in the quantity and quality of services provided by financial institutions partly explain why countries grow at different rates (Shaw 1973, Boyd and Smith 1992).

Quite to the contrary, another strand of research reasons that financial development may react to the expectation of enhanced future economic growth; hence economies with good growth prospects develop institutions to provide funds necessary to support those good prospects. Finance does not cause growth, but reacts to the demand from the real sector (Robinson 1952). Guiso, Sapienza and Zingales (2004) study the effects of differences in local financial development on economic activity in Italy. They find that local financial development enhances the probability that an individual starts a business, increases industrial competition, and in turn spurs firm growth.

Islam and Osman examined the long run relationship between per capita real GDP and the development of NBFIs based on Malaysian market. They showed that NBFIs are a vital component of the financial sector through which financial resource was effectively channelized from the surplus units to the deficit units, and they promote long run sustainable economic growth (Islam and Osman, 2011: 187).

The borrowings, deposits and capital of non-bank financial institutions increased by 27.5 percent, 36.1 percent and 17.7 percent respectively in calendar year 2013 compared with those of the previous year. The trend of increasing capital shows moderately sound financial base of the non-bank financial institutions (Financial Stability Report of Bangladesh Bank, 2013).

The aim of this study is to analyze the profitability of non-banking institutions. Using panel data profitability is regressed on assets, non-interest revenue and equity. It shows what the determinants of profits are in non-bank financial institutions. This study discovers the inner strength of profitability of nonbank financial organizations; also it points out incongruity and instability, which is important from the policy point of view. The analysis evokes the business model NBFIs pursue, and the profitability model has strong bearing on the ability of firms to withstand adverse condition.

Theoretical Underpinning

The current regulatory system fails to reduce the external costs caused by overly risky behavior of non-bank financial institutions ex ante due to toothless regulations or nonexistence of regulation at all, and that ex post the system fails to sufficiently reduce systemic risk caused by the failure of non-bank financial institutions and does a poor job of limiting the moral hazard and uncertainty that it creates (Hashmall, 2010:15).

Vittas opines that creating new marketable securities in the area of leasing, factoring and venture capital, NBFIs create long term financial resources and provide a strong stimulus to the development of capital market (Vittas, 1997:1). Popularity of lease financing is due to tax advantages, timesaving and conservation of cash and funds. Off-balance sheet financing opportunities provided by operating leases are an additional attraction of leasing (Islam 1999).

Profitability of a financial institution basically depends on its operating efficiency, capital structure, fixed charges and income and liquidity position. The common assumption is that growing financial performance will lead to better functions and actions of the organizations. (Farah et al., 2012:12). Analyzing the determinants of profitability in financial sector Mirza and et al has selected size, leverage, liquidity and age as the determinants of the profitability. Moreover, they also incorporated a variable "Net Investment in Lease Finance" which is one of the important variables in determining the profitability of the leasing firms (Mirza and et al., 2012:82).

Retail deposit is more stable in periods of crisis; since they are typically insured by the government, their withdrawals in most circumstances are usually predictable at the aggregate level and mostly linked to depositors' liquidity needs. The stickiness of deposits is also related to high switching costs and the transaction services that retail depositors receive from banks. Deposits, however, are often less flexible in adapting to changes in financing needs, to fund investment opportunities, compared with wholesale markets (Altunbas and et el, 2011:15-16).

A stronger customer deposit base is relatively more effective in reducing distress for the riskier compared to the less risky banks. Similarly a higher proportion of market funding increases the likelihood of distress of the riskiest banks although it has no effect on the less risky institutions (Altunbas and et el, 2011:5-6). Higher levels of loans to total assets should be reflected in a higher profit due to higher risk. In particular, a high ratio of noninterest earning assets to total assets is shown to impact bank profitability negatively (Lindblom, 2010:5).

Theory provides no clear prediction regarding the impact of noninterest income on risk. On the one hand, does a higher share of noninterest income make banks less dependent on interest income and improve risk diversification which should make them more stable. Noninterest income is usually more volatile than interest income, because it is more difficult for borrowers to switch their lending relationship due to information costs. Noninterest income also increases operational leverage, since expanding into noninterest income may

imply a rise in fixed costs. Financial leverage is also higher because regulators require holding less capital against noninterest income activities. Both increase the volatility of noninterest income and make it more risky than interest income (Kohler, 2013:2).

Banks are significantly less risky if they have a more balanced income structure and neither depend heavily on interest or non-interest income. Furthermore the impact of non-interest income on risk significantly depends on the activities used to generate noninterest income with retail-oriented activities being significantly less risky than investment-oriented activities such as those pertaining to capital market activities (Kohler, 2013:1-2).

The financial crisis has demonstrated the need for banks to understand their business models together with the associated risks and to have confidence that performance indicators and executive incentives reinforce desired behaviors. In other words, banks need to understand their business models and have the confidence that these will deliver sustainable value—with appropriate risk mitigations as necessary. They also need to understand the role of performance indicators and executive incentives in driving the right or wrong behaviors—as well as how good governance can make a difference. The financial crisis showed that some banks did not grasp these issues adequately (global banking sector, 2010:7).

Despite the significant build-up of risks that materialized in 2007-09 crisis, the majority of the most commonly used indicators of risk showed a fairly benign picture in the years preceding the crisis. Indeed even the forward-looking measures of risk regularly used by financial institutions, investors, central banks, and regulators to monitor the health of the financial system remained at very low levels. In parallel, existing evidence indicates that there was a convergence in the differences in performance between banks before the crisis broke (as measured by stock market returns). The crisis, however, revealed huge variability across individual banks, as evidenced by the cross-sectional dispersion of risk indicators, which widened significantly during this period. This raises the question of whether the variability in specific bank characteristics, due to their different business models, could have helped in the early identification of hidden risks (Altunbas and et el, 2011:5-6).

Altunbas and et el (2011) find that credit expansion, lower dependence on customer deposits, size and weaker capital in the run up to the crisis accounted for higher ex-post level of distress. Other factors including the amount of market funding and lack of diversification in income sources also contributed to an increase in realized bank risk. Accounting for macroeconomic and institutional factors—including the role of deregulation, economic cycle, competition and asset prices developments—do not change the gist of the results.

Regulators should increase their involvement in and understanding of bank business models and incentives to take on risk. In particular regulators need to consider risk-taking incentives in real time and focus on the potential impact of different business models on risk. The study provides valid reasons for the closer scrutiny of banks experiencing rapid increases in their stock market valuations, to ascertain whether it is driven by improved managerial abilities or by increasing the bank's exposure to hidden risks (Altunbas and et el, 2011:9-10).

Although the academic literature does not provide conclusive evidence that greater size leads to cost and other advantages, there appears to be continual pressure on banks management from shareholders and market analysts to show growth in both revenue and earnings. Bigness is apparently regarded as advantageous (Hanc, 2004:9). In his research Sufian investigated the determinants of bank profitability in a developing economy, case study Malaysian financial sector during the period 2000-2004. The results show that with higher credit risk and higher loan concentration Malaysian banks face lower profitability level. On the other hand, Malaysian banks with higher level of capitalization, higher income from noninterest sources, and higher operational expenses experience higher profitability level (Sufian 2009: 226).

Tarawneh divided the commercial banks in Oman in cohesive categories depending on their financial characteristics revealed by financial ratios. Using simple regression analysis, the effect of asset management, operational efficiency and bank size on the financial performance was determined. The results indicate that banks with higher total capital, deposits, credits or total assets do not always represent a better profitability performance (Tarawneh 2006). Al-Tamimi determined some significant factors influencing performance of the UAE Islamic and conventional banks from 1996-2008. Using regression analysis the researcher concludes that liquidity and concentration were the most significant determinants of national bank performance; on the other hand, number of branches and cost were the most influential factors of Islamic bank performance (Al-Tamimi, 2010:2).

Hossain and Shahiduzzaman (2002) focused on the importance of non-banking sector as a vehicle for the economic development of Bangladesh and identify the underlying problems of the sectors. Ahmed and Chowdhury (2007) found that non-bank financial institutions strengthen the country's financial system and contribute to the economic development of the country through diversified financial services in the market. Using traditional financial indicators like current ratio, debt-equity ratio, return on equity ratio, they analyze the performance of NBFIs and report that in spite of the presence of several constraints, the sector has been performing considerably well in Bangladesh.

In their study Is There Market Discipline for New Zealand Non-Bank Financial Institutions? Hess and Fend see the impact of market discipline through. In the context of non-bank financial institutions they report that the Basel prudential regulation enforces market discipline through more disclosure requirements for if the market participants cannot observe the firm's risk, they are unable to exercise market discipline. Supporting their choice of NBFIs for study of market discipline--more suitable than banking system which due to presence of such moral hazards as 'too big to fail', implicit support or deposit insurance clouds the result--the authors make it apparent that good risk disclosure shift to quality competition and away from pure price competition as market participants cannot reward firms for taking less risk when proper disclosure is absent. Not surprisingly, they find that there indeed appears some play of market discipline as riskier NBFIs offer higher rates. However, what undermines the finding is the hypotheses are tested in OLS framework with no care having been taken regarding OLS assumptions and therefore the procedure is presumably infested with misspecification.

Methodology

Analyzing the profitability of non bank financial institutions is the theme of the article. The paper delineates the business model pursued by non-bank financial institutions in Bangladesh. It uses panel data--an unbalanced panel. The sample consists of 4 companies, chosen conveniently provided their information is available on the Internet. Financial statements of the five years from 2009-2013 are used to collect data. Specifically the balance sheet and the income statement are analyzed. Profitability as proxied by ROE is regressed on equity, gross non-interest income and total assets. ROE is defined as the ratio of profit after tax to total equity. Non-interest income includes, among others, dividend income from investment, agency and advisory fees, arrangement fees, documentation fees, custodial fees, commission and brokerage, underwriting commission, issue management and portfolio management fees etc.

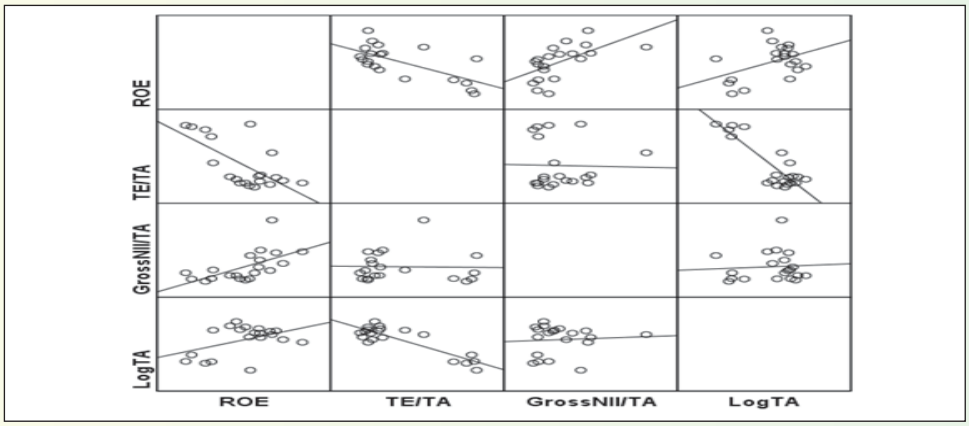


Figure 1 scatterplot matrix

$TE/_{TA}$ =is the total equity adjusted for size.

LogTA=is the log of total asset representing the size.

$GrossNII/_{TA}$=is gross noninterest income modified for size.

The following model is considered:

Profitability=function (size, income, equity)

$$ROE = \beta 0 + \beta 1 * \frac{TE}{TA} + \beta 2 * \log TA + \beta 3 * \frac{GrossNII}{TA}$$

Findings

The regression result shows that the model can explain 88% of variability in the ROE (Table 1). All the regressors are highly significant with absolute t-values well above 2; also indicated by the Prob values. ROE is positively related only with gross non-interest income--which also is the most influential among regressors. The model is correctly specified as

indicated by the Durbin Watson statistic. The model is well fit with a highly significant F statistic. The S.E. of regression also indicates well fit of the model. While the standard deviation of ROE is 10.2%, the standard error of the model is 3.5% (Table 2).

Table 1

Dependent Variable: ROE
Method: Least Squares
Sample: 1 20
Included observations: 20

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GROSSNII_TA	3.412945	0.439943	7.757700	0.0000
LOGTA	-0.164475	0.037204	-4.420950	0.0004
TE_TA	-1.212585	0.152325	-7.960533	0.0000
C	1.006967	0.174744	5.762534	0.0000
R-squared	0.901785	Mean dependent var		0.203520
Adjusted R-squared	0.883369	S.D. dependent var		0.102117
S.E. of regression	0.034874	Akaike info criterion		-3.697286
Sum squared resid	0.019459	Schwarz criterion		-3.498139
Log likelihood	40.97286	Hannan-Quinn criter.		-3.658410
F-statistic	48.96914	Durbin-Watson stat		2.165255
Prob(F-statistic)	0.000000			

TE_TA=is the total equity adjusted for size, LogTA=is the log of total asset representing the size, GROSSNII_TA =is gross noninterest income modified for size.

Table 2

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
ROE	20	.009	.393	.20352	.102117
Prov/TL	19	.0032	.0651	.014713	.0167219
LogTA	20	3.21	4.69	4.1349	.43849
TE/TA	20	.0591	.3470	.157721	.1068866
TL/TA	20	.6443	.9061	.770531	.0837353
TD/TA	20	.1190	.6433	.422252	.1792103
NetII/TA	20	.0266	.1483	.061435	.0353709
GrossNII/TA	20	.0021	.0767	.019894	.0182711
Valid N (listwise)	19				

NB: ROE=return on equity, Prov/TL=loan provision adjusted to total loan, =is the total equity adjusted for size, LogTA=is the log of total asset representing the size, TL/TA=total loan adjusted to size, TD/TA=total deposit adjusted to total assets, NetII/TA=net interest income modified for size, =is gross noninterest income modified for size.

When tested for the interaction among variables, no significant interaction is found (see Table 3).

Table 3

Omitted Variables Test

Equation: UNTITLED

Specification: ROE GROSSNII LOGTA TE_TA C

Omitted Variables: GROSSNII*LOGTA GROSSNII*TE_TA LOGTA*TE_TA

	Value	df	Probability
F-statistic	0.835151	(3, 13)	0.4983
Likelihood ratio	3.524847	3	0.3176

The time series ROE has no unit root at 10% level of significance as indicated by the ADF unit root test. Therefore, the series is stationary (Table 4).

Table 4

Null Hypothesis: ROE has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.794388	0.0778
Test critical values:	1% level	-3.831511	
	5% level	-3.029970	
	10% level	-2.655194	

*MacKinnon (1996) one-sided p-values.

Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 19

The B-G test and the ARCH test indicate there is no serial correlation; and the model neither suffers from heteroscedasticity (Tables 5 & 6).

Table 5

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.336248	Prob. F(2,14)	0.7201
Obs*R-squared	0.916676	Prob. Chi-Square(2)	0.6323

Table 6

Heteroskedasticity Test: ARCH

F-statistic	2.816869	Prob. F(1,17)	0.1116
Obs*R-squared	2.700755	Prob. Chi-Square(1)	0.1003

Table 7 shows that there is no pattern visible in the residuals and the residuals do not change systematically. Residuals cluster near zero indicating hemoscedasticity of variance

across values (Figure 2).

Table 7

obs	Actual	Fitted	Residual	Residual Plot
1	0.17554	0.15174	0.02380	| . | * . |
2	0.15463	0.16047	-0.00583	| . *| . |
3	0.24969	0.20596	0.04373	| . | . * |
4	0.30655	0.28302	0.02353	| . | * . |
5	0.25297	0.28574	-0.03277	| * | . |
6	0.20561	0.18194	0.02367	| . | * . |
7	0.18791	0.20015	-0.01224	| . * | . |
8	0.28686	0.25068	0.03617	| . | .* |
9	0.23543	0.26313	-0.02770	| .* | . |
10	0.21857	0.25261	-0.03404	| * | . |
11	0.09901	0.12765	-0.02865	| .* | . |
12	0.29300	0.30091	-0.00791	| . *| . |
13	0.25548	0.31356	-0.05807	|* . | . |
14	0.32952	0.29998	0.02954	| . | *. |
15	0.39326	0.37537	0.01788	| . | * . |
16	0.02854	0.01365	0.01489	| . | * . |
17	0.00887	0.06441	-0.05554	|* . | . |
18	0.07355	0.06200	0.01155	| . |* . |
19	0.09360	0.10432	-0.01071	| . *| . |
20	0.22182	0.17313	0.04870	| . | . * |

Figure 2

Test of multicollinearity indicates existence of no collinearity as the value falls from zero order to partial and parts (Table 8) and the residuals form a normal curve (Figure 3).

Table 8

Coefficients[a]

Model		Unstandardized Coefficients		Correlations			Collinearity Statistics	
		B	Std. Error	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.044	.173					
	TE/TA	-1.233	.149	-.665	-.905	-.635	.242	4.138
	GrossNII/TA	3.427	.429	.598	.900	.614	.990	1.010
	LogTA	-.173	.037	.429	-.772	-.361	.241	4.155

a. Dependent Variable: ROE, TE_TA=is the total equity adjusted for size, LogTA=is the log of total asset representing the size, GROSSNII_TA =is gross noninterest income modified for size.

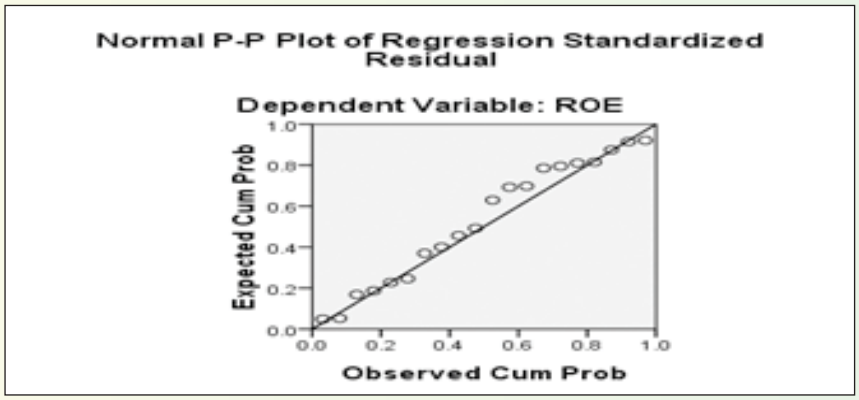


Figure 3

Table 9

Residuals Statistics[a]					
	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	.01143	.37560	.20111	.096935	20
Residual	-.056267	.048107	.002405	.032080	20
Std. Predicted Value	-1.904	1.752	.000	.973	20
Std. Residual	-1.654	1.414	.071	.943	20
a. Dependent Variable: ROE					

Non-linear? A Nuanced Consideration

Do the regressors behave distinctly across the conditional distribution? More precisely, we are interested to know whether income, size and capital exhibit a non-linear relation; that is, they have different impact at different quantiles. Estimating quantile regression reflects a more complete picture of distributional dependence between bank profitability and business model. In other words, it exposes if conditional variables tend to have variant impact at upper and lower deciles compared with the mean as estimated by the OLS.

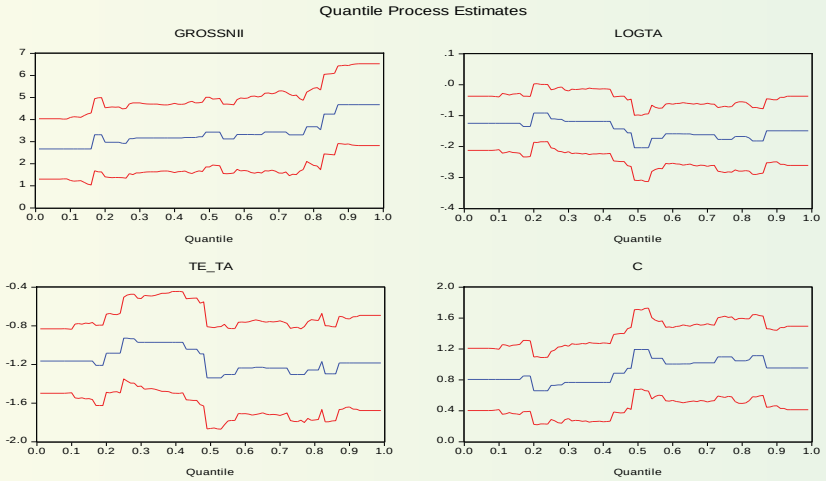
Table 10

Dependent Variable: ROE
Method: Quantile Regression (Median)
Sample: 1 20
Included observations: 20
Ordinary (IID) Standard Errors & Covariance
Sparsity method: Kernel (Epanechnikov) using residuals
Bandwidth method: Hall-Sheather, bw=0.35793
Estimation successfully identifies unique optimal solution

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GROSSNII_TA	3.433241	0.810623	4.235311	0.0006
LOGTA	-0.203762	0.068550	-2.972460	0.0090
TE_TA	-1.338373	0.280668	-4.768529	0.0002
C	1.193231	0.321977	3.705954	0.0019
Pseudo R-squared	0.664626	Mean dependent var		0.203520
Adjusted R-squared	0.601743	S.D. dependent var		0.102117
S.E. of regression	0.036441	Objective		0.264738
Quantile dependent var	0.218574	Restr. objective		0.789382
Sparsity	0.128516	Quasi-LR statistic		32.65862
Prob(Quasi-LR stat)	0.000000			

TE_TA=is the total equity adjusted for size, LogTA=is the log of total asset representing the size, GROSSNII_TA =is gross noninterest income modified for size.

Figure 4 provides a summary illustration of the impact of independent variables for each percentile. The solid lines represent 99 estimates of the quantile regression coefficients ranging from .01 to .99 together with 95% confidence intervals. The figure indicates that the mean is a sufficient statistic to summarize the relationship for every conditional variable viz income, size and capital. The figure also shows that income, size and equity variables have a similar impact, if not same, across their own conditional distributions on bank profitability.



TE_TA=is the total equity adjusted for size, LogTA=is the log of total asset representing the size, GROSSNII_TA =is gross noninterest income modified for size.

Figure 4

The quantile regression estimates for the coefficients of the full model for 10%, 25%, 50%, 75% and 90% quantiles are presented in Table 11. For all the variables the coefficients do not show statistical significance. That is, whether lower or upper quantiles, coefficients are not statistically significant. This suggests that a variable contributes equally across the entire conditional distribution. Variables do not have any distributional effects. Quite reassuringly, the signs of the regression quantile coefficients are coherent with OLS results.

Table 11

Quantile Process Estimates

Equation: EQ01

Specification: ROE GROSSNII_TA LOGTA TE_TA C

Estimated equation quantile tau = 0.5

User-specified process quantiles: .1 .25 .5 .75 .9

Display all coefficients

	Quantile	Coefficient	Std. Error	t-Statistic	Prob.
GROSSNII_TA	0.100	2.669739	0.727120	3.671663	0.0021
	0.250	2.926452	0.795230	3.680006	0.0020
	0.500	3.433241	0.804417	4.267986	0.0006
	0.750	3.305752	0.917577	3.602696	0.0024
	0.900	4.673358	0.904909	5.164451	0.0001
LOGTA	0.100	-0.124780	0.043540	-2.865887	0.0112
	0.250	-0.110302	0.047864	-2.304496	0.0349
	0.500	-0.203762	0.054153	-3.762730	0.0017

	0.750	-0.176831	0.054674	-3.234310	0.0052
	0.900	-0.149109	0.051236	-2.910243	0.0102
TE_TA	0.100	-1.164426	0.167442	-6.954226	0.0000
	0.250	-0.927521	0.215727	-4.299522	0.0006
	0.500	-1.338373	0.267398	-5.005164	0.0001
	0.750	-1.303934	0.249040	-5.235841	0.0001
	0.900	-1.184521	0.232373	-5.097501	0.0001
C	0.100	0.806361	0.199504	4.041818	0.0009
	0.250	0.728600	0.224716	3.242309	0.0051
	0.500	1.193231	0.264427	4.512513	0.0004
	0.750	1.098334	0.267960	4.098878	0.0008
	0.900	0.954399	0.249234	3.829333	0.0015

TE_TA=is the total equity adjusted for size, LogTA=is the log of total asset representing the size, GROSSNII_TA =is gross noninterest income modified for size.

The slope equality test demonstrates that the slope coefficients of regression quantiles are all the same (Table 12). The equality test applied the Wald test where the null hypothesis is that slope coefficients are not different across quantiles.

Table 12

Quantile Slope Equality Test

Equation: EQ01

Specification: ROE GROSSNI_TAI LOGTA TE_TA C

Estimated equation quantile tau = 0.5

User-specified test quantiles: .1 .25 .5 .75 .9

Test statistic compares all coefficients

Test Summary		Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Wald Test		11.76737	12	0.4645
Restriction Detail: b(tau_h) - b(tau_k) = 0				
Quantiles	Variable	Restr. Value	Std. Error	Prob.
0.1, 0.25	GROSSNII_TA	-0.256713	0.637053	0.6870
	LOGTA	-0.014478	0.043203	0.7375
	TE_TA	-0.236905	0.184651	0.1995
0.25, 0.5	GROSSNII_TA	-0.506789	0.875915	0.5629
	LOGTA	0.093460	0.053133	0.0786
	TE_TA	0.410852	0.217129	0.0585
0.5, 0.75	GROSSNII_TA	0.127488	0.822381	0.8768
	LOGTA	-0.026931	0.058604	0.6458
	TE_TA	-0.034439	0.266734	0.8973

0.75, 0.9	GROSSNII_TA	-1.367606	0.756116	0.0705
	LOGTA	-0.027722	0.044246	0.5310
	TE_TA	-0.119413	0.209550	0.5688

TE_TA=is the total equity adjusted for size, LogTA=is the log of total asset representing the size, GROSSNII_TA =is gross noninterest income modified for size.

Concluding Remarks

Size has negative impact on profitability. As the size of an organization increases in terms of assets, its profitability takes a downward turn. On the other hand, ROE rises in pace with non-interest income and its effect is more resounding than either of the other regressors viz size and leverage. Therefore companies are more dependent on noninterest income than interest income for making profits. This suggests that the revenue pie for nonbank financial institutions is monochrome. NBFIs can be better off by diversifying their revenue source, thus in turn becoming stronger in withstanding income cyclicality. Finding an optimum size is what challenges NBFIs as they discover an inverse relation of its to profitability.

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Appendix 1 Comparison between IDLC, DBH, LankaBangla, FAS (amounts in mTk)

	IDLC					DBH					Lankabangla					FAS				
year	2013	2012	2011	2010	2009	2013	2012	2011	2010	2009	2013	2012	2011	2010	2009	2013	2012	2011	2010	2009
NetIncome	811	589	804	805	468	528	404	502	307	233	448	1235	466	403	350	45	9	61	79	124
Equity	4620	3809	3220	2626	1850	2568	2150	1750	1304	1066	4525	4215	1824	1223	890	1577	1015	843	844	559
Loans	38677	30938	25540	21245	19539	25266	24039	21668	18062	13551	19258	13773	11078	9480	8093	3480	2185	1759	1875	1052
Deposits	30287	22998	17638	13001	10359	19539	15751	13307	12630	9845	10875	7676	5309	4814	4456	1251	382	312	516	222
Total Assets	48534	35748	29518	25353	21565	33004	27640	24500	22048	16385	26629	19501	15903	13720	11325	4712	2975	2621	2910	1611
Provision for loan/ investment	145	100	(5)	119	144	122	104	92	139	45	328	191	82	184	166	71	7	90	122	18
Net interest income	2133	1624	1467	1229	942	1295	982	889	763	561	3063	2132	2358	828	786	170	79	`340	166	106
Gross non interest income	1022	822	672	653	439	284	259	269	246	170	407	373	328	174	131	78	64	11	13	30

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Yield Curve of Bangladesh and Burning Economic Issues

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Abstract

Yield curve is the combination of interest rates against different maturity of bills and bonds. Weighted average interest rate of accepted bids is used to derive the yield curve. 91-day government treasury bill rate is the reference rate of the economy. Yield curve may be concave, convex or relatively flat depending on the short term and long term interest rates and amount. Interpolation and extrapolation method is used to derive the yield of a particular maturity due to lack of secondary market in Bangladesh. Summation of all individual auction rates provides shape of the yield curve. Mathematical convention is demonstrated to formulate the price and interest rate of bill and bond. Macroeconomic development is considered to derive the yield curve rates. Amount of liquidity and need of the government and central bank specifically establish the yield rate. It will help to determine the interest rate of the economy impacting the exchange rate, CPI inflation rate and GDP growth. Yield curve rate is used for calculating deposit and lending rates of banks bearing in mind the liquidity position of the economy. It will also help to evaluate the held to maturity (HTM) and held for trade (HFT) securities of the banking and trading book of the banks.

Keywords: Budget systems, debt management and monetary policy.

JEL classification: E52, H61, H63

Introduction

Bangladesh Bank (BB) bill, different maturity of government treasury bills and bonds are the element of yield curve (Chart-1). Weighted average rate of the accepted bid in a particular auction is used to draw the yield curve. Cut-off rate of the bills and coupon rate of the bonds are not applied in deriving yield curve of Bangladesh. Auction of government treasury bills and BB bill is held discount basis. In this case auction winner deposit the discount amount (say Tk. 98) and receive full amount (Tk. 100) at maturity. Here government or BB receives discounted amount. Individual bidder will receive interest according to their individual submitted rate. Lower price of the bid provides higher rate. But the treasury bond winner need to deposit premium amount (over than Tk.100) if the submitted rate is below the coupon rate. In case of devolve if the devolve rate is higher

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than coupon rate then the price of the bond will be lower. In such case the bidder need to pay the discounted amount (lower than Tk. 100) in order to receive the same coupon rate. Thus government will receive the full amount, which has been notified earlier. Higher devolve rate comparing coupon provide the interest rate benefit. In secondary trading corresponding lower rate will provide the interest rate differential gain to the devolve holder. In government treasury bills the cut-off rate is the devolved rate. The devolved rate of bond is different. 10 basis point need to add with the previous auction bond coupon rate to arrive the devolved rate of the current auction. Considering the added 10 basis point immediate past auction all lower rates are considered to make simple mathematical average in arriving devolved rate of a particular auction. The devolved rate of the bonds can be lower or higher comparing the coupon rate. The bid winner in the auction does not further devolved. The unsubscribed amount of the auction is distributed to the Primary Dealers (PD) and non-PD and Bangladesh Bank if necessary.

Banks can utilize the government treasury bills and bonds as collateral to get the assured liquidity support facility (LSF) if the bills and bonds are purchased within 2 months and 15 days back. All other case for instance to get the repo facility the bills and bonds will be treated as outright purchase. The bills and bonds used for yield curve are short and long term to match the asset and liability of banks. The 91-day, 182-day and 364-day Bangladesh government treasury bill are short term instrument. 2-year, 5-year, 10-year, 15-year and 20-year bonds are treated as long term. Government bills and bonds are the debt management tools. Apart from that 30-day BB bill is the short term bill and used as BBs own instrument for open market operation (OMO).

Methods

Quantitative and qualitative analysis has been performed in this paper. Insight of government treasury bills and bonds and BB bill has been discussed lucidly. Operational procedure and financial interactions of the related variable is the essence of this paper.

Organization of the paper

Literature review is articulated in section-I. Economic elements of yield curve are described in section-II. Section-III deals with Basel II capital adequacy requirement of government bonds in brief. Conclusion is represented in Section-IV.

Section-I

Literature review

Literature survey on debt management and OMO is conducted to gain wide-ranging knowledge in the multidimensional perspective. Adepoju and et. al(2008) have reviewed the roles of debt management practices on sustainable economic growth and development with particular emphasis on Nigeria. Information was generated extensively from literature, the Nigeria Central Bank and National Bureau of Statistic reports. The analyses of the data collected with descriptive statistics indicate that, availability of access to external

finance strongly influences the economic development process of any nation. Debt is an important fund needed to support sustainable economic growth. But a huge external debt without servicing in case of Nigeria before year 2000 constituted a major impediment to the revitalization of her shattered economy as well as the alleviation of debilitating poverty. The much needed inflow of foreign resources for investment stimulation, growth and employment were hampered. Without credit cover, Nigerian importers were required to provide 100 percent cash covers for all orders and this therefore placed a competitive disadvantage compared to their counterparts elsewhere. Failure of any owing country to service her debt obligation results in repudiation risk preventing such to obtain new loans since little or no confidence will be placed on the ability to repay. It will also undermine the effort to obtain substantive debt relief over the medium term with a tremendous increase in interest, arrears and other penalties. This will subsequently depress the economy both in the long and short runs. Best arrangement in debt payment must be put in place from time to time in response to changes in the economy and the polity. Debt can only be productive if it is well managed and if the rate of return is higher than the cost of debt servicing.

Hai-Chin Yu et. al (2008) using an effective sample of 3,453 observations selected from the Taiwanese stock exchange attempts to reconcile divergent outcomes from the extant literature on debt structure (public, bank, and non-bank private debt). Sampled firms from this emerging market generally acquire debt from both public and private sources, with a strong preference for bank debt, suggesting, among other things, that bank debt and public debt complement each other rather than acting as substitutes. Pradhan (2009) Caballero (2011), Akhtar (1997), Varadaranjan (2011) and Mike (2002) have worked on debt management and OMOs specially for developing countries and linked to yield curve.

Battellino and Macfarlane (2010) wrote more countries moving away from direct controls toward market-oriented methods implementing monetary policy, interest has increased in the operating procedures for open market operations. Most what has been written on the subject comes from the United States, but is instructive to look at practices in a range of countries. The paper outline procedures used to implement open market operation in Australia, Canada, Germany, New Zealand, the United Kingdom, and the United States! It draws out similarities and differences and notes the inter-relationships between operating procedures and the institutional structure of the financial system in each country.

Section-II

Economic elements of yield curve

Particular and complementary solution of the bills and bonds: Marginal interest rate volatility may create vulnerability in the balance sheet of banks following capital adequacy in Tier 1 and Tier 2 of Basel II. At the same time particular and complementary solution is important to understand the underlying fact of principal and interest rate calculation. Particular solution is related to the principal amount of bills and bonds. While the complementary solution deals with interest rate part depending on the economic fundamentals. The complementary solution is the compound interest of the principal at time t, which starts counting from t=0.

The particular solution is the value of a bill or bond at time t, this starts counting from t=1. In economics we find particular solution (Yp) and complementary solutions (Yc)[2] in arriving total solution of bills and bonds: $Y(t) = y_p + y_c$. In case of particular solution the right hand side is constant, that is $dy/dt + ay = b \rightarrow 0 + ay = b$ therefore $y_p = b/a$. The complementary solution can be $y_c = A.e^{-t2}$ Therefore the total solution can be written as $Y = b/a + A.e^{-t2}$ The bidders of a bond at the beginning deposit the principal amount. Finally the bidder gets back the principal (y_p) amount and interest (y_c). The principal amount is compounded with the e base interest rate. The bidders of the auction calculate the interest rate (coupon or discounted rate) depending on the economic rudiments. Price and interest rate are the two components of bill and bond. In the life time of bill and bond the price changes due to change in market yield. But the coupon based on interest rate will remain same. The price and coupon are related to the essence of mathematical particular and complementary solution respectively. The numerical calculation procedures of bills and bonds are described next.

Calculation procedure of Treasury Bill :

1. Implicit yield (2.02%) = [(100- 99.5000 (offer price)) ×365 × 100] / (99.5000(offer price) × 91) (duration of the bill).
2. Offer price (99.50) =(365×100×100)/((91×2.02)+(365×100))
3. Offer value (99.50) = (99.50 (Offer price)× 100) (Face value) /100
4. Weighted price (99.50) = (199.0 (Cumulative offer value)) × 100/ 200 (Cumulative face value).
5. Corresponding Yield (2.02%) = [(100-99.50 (Weighted Average Price)] × 365×100/ (99.50 × 91-day).

Bond Pricing (yield based multiple price auction)

In order to get bond price we can use the insert function of Microsoft Excel menu selecting Price option (settlement, maturity, rate, yield, redemption, frequency, basis). Incorporating relevant data in the particular field we obtain the Price (15-Feb-12,15-Feb-17,10%,10%,100,2,1). As the rate (10%) and yield is same the price of the bond will be Tk.100. Deviation of yield from rate will generate different price, which may be lower or higher than Tk.100.

2 Complementary solution (y_c) can be elaborated as; $y_c = Ae^{-bt}$. Thus, $dy/dt+2ty=0$ [A=2]$\rightarrow dy/dt = -2ty \rightarrow dy/y = -2tdt \rightarrow \int 1/y.dy = -2\int tdt \rightarrow \ln y = 2.(t^2/2)+c \rightarrow \ln y = t^2+c \rightarrow e^{\ln y} = t^2+c \rightarrow y^{\ln y} = e^{-t2+c} \rightarrow y = e^{-t2}.e^c$ therefore $y_c = Ae^{-t2}$

Here,

Settlement= Security's settlement date: 15-Feb-12 (on which the security is bought or sold:1day added for leap year).

Maturity=Maturity date: 15-Feb-17(the date when security expires).

Rate= Security's annual coupon rate: 10% (cut off yield rate of particular auction).

Yield= Security's annual yield: 10% (quoted by the bidder in a particular auction).

Redemption= 100(face value).

Frequency= 2 (for semi-annual coupon rate).

Basis=1(actual/actual).

Extrapolation of bond yield rate: Due to lack of secondary market the yield for 2.5 year of a 5 year bond using yield curve (Chart-1) rate of related tenure can be premeditated as: 5year yield(9.660%) – ((10 year yield(10.9200%)-5 year yield(9.6600%))/10-5)×2.5 (period passed:2+0.5) (26weeks/52weeks).9.6600–(((10.9200-9.6600)/5) ×2.5) = 9.0300%

Interpolation of bond yield rate: Yield for 18 year of a 20 year bond with 2 year remaining maturity. We need to calculate 3 year (5(class interval of 5,10,15,20 year bond)-2) bond yield and add with 15 year bond to dig up the 18 year bond yield (18=15+3).15year yield(11.4200%) + ((20 year yield(11.9645%)-15 year yield(11.4200%))/20-15)×period remaining(3 year). 11.4200+(((11.9645-11.4200)/5) ×3) = 11.7467%. Yield curve is shown in (Chart-1).

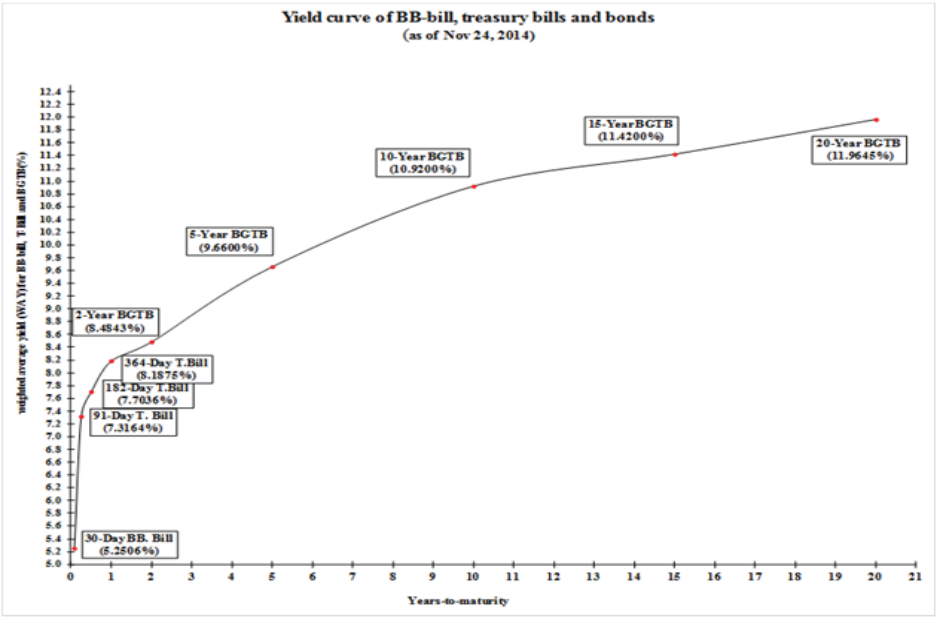

Chart-1

Dirty price and clean price of bond: On the basis of coupon rate 10% and 9.50% current yield with certain time holdings the dirty price of bond is Tk. 101.95. After 60 days of holdings if the bond is sold the buyer of the bond need to pay 60 days accrued interest of Tk. 1.64 and the clean price of the bond will be Tk.100.31. A corporate bond has a coupon rate of 7.2% and pays 4 times a year, on the 15th of January, April, July, and October. It uses the 30/360 US day count convention. A trade for 1,000 par value of the bond settles on January 25. The prior coupon date was January 15. The accrued interest reflects ten days' interest, or Tk.2.00 (7.2% of 1,000 * (10 days/360 days)).

The full value of the bond is set by the market at Tk.985.50. The following calculation illustrates the values of related terms. The market convention for bond price assigns a dirty price of Tk.98.55 to the trade, not 0.9855. This is sometimes referred to as the price for 100 par value.

Bond Pricing Example :

Term	Value
Full Market Value	Tk 1,000
Dirty Price	Tk.985.50
Accrued interest	98.55
Flat market value	Tk.983.50
Clean price	98.35

The following table illustrates the effective interest rate method of amortizing Tk.4100 (premium) on a bond payable. After gradual amortizing of Tk.4100 during 6-month time interval the bond reached its face value at Tk.100,000(Table-1).

Table 1. Amortization of Bond

A	B	C	D	E	F	G
Date	Interest Payment Stated 4.5% x Face	Interest Expense Mkt 4% x Previous BV in G	Amortization Of Bond Premium C minus B	Balance In Bond Premium Account	Balance In Bonds Payable Account	Book Value of the Bonds F plus E
	Credit Cash	Debit Interest Expense	Debit Bond Premium			
Jan 1, 2010				4,100	100,000	104,100
Jun 30, 2010	4,500	4,164	(336)	3,764	100,000	103,764
Dec 31, 2010	4,500	4,151	(349)	3,415	100,000	103,415
Jun 30, 2011	4,500	4,137	(363)	3,052	100,000	103,052
Dec 31, 2011	4,500	4,122	(378)	2,674	100,000	102,674
Jun 30, 2012	4,500	4,107	(393)	2,281	100,000	102,281
Dec 31, 2012	4,500	4,091	(409)	1,872	100,000	101,872
Jun 30, 2013	4,500	4,075	(425)	1,447	100,000	101,447
Dec 31, 2013	4,500	4,058	(442)	1,005	100,000	101,005
Jun 30, 2014	4,500	4,040	(460)	545	100,000	100,545
Dec 31, 2014	4,500	3,955	(545)	0	100,000	Tk.100,000
Total	45,000	40,900	(4,100)			

For mark to market and amortized cost system company can use extrapolation and interpolation method to get bond yield. Certain amount of government outstanding blocked debt taken through overdraft from BB can also be amortized following 10 years schedule improving the balance sheet of BB.

Section-III

Basel II capital adequacy requirement of government bonds

According to Basel II risk weighted asset of Tk. 100 value 5-year government treasury bond with 2-month remaining maturity for instance is Tk. 2 (100×0.20%×10) using standardized approach. To arrive this number 0.20% risk factor for 2-month remaining maturity is multiplied by conversion factor 10 (capital asset ratio) with base amount. Bank is needed to keep 10% of risk weighted asset i,e. Tk 0.20 in Tier 1 for minimum capital requirement. DMBs HFT securities need to calculate in the trading book and HTM need to report in banking book. Calculation of HFT treasury bills and bonds is needed to incorporate in the trading book rather banking book to address general market risk. The specific risk of treasury bills and bonds is zero. Pillar 1 of Basel II deals with minimum capital asset requirement of risk weighted asset of Tier 1 and Tier 2. Pillar 2 deals with supervisory issues addressing related risk for adequate capital asset requirement. Pillar 3 of Basel II reflects disclosure issues of banks and financial institutions.

Stress testing of government securities: Rise in interest rate at 1% level will decrease the price of bills and bonds used as base. Fall in risk weighted asset of bills and bonds due to lower base surfacing from market will lead to maintain lower capital in the DMBs balance sheet. Lower capital in the balance sheet will condense the capital asset ratio (CAR). Further rise in interest rate at 2% or 3% level eventually may lower the CAR below 10. All these depend on market rate of HFT government securities. It may be mentioned that CAR below 10 according to Basel II will expose the bank as vulnerable.

Duration of bond: Government bond with a yield to maturity of 8.00%, a par value of Tk.100, a coupon rate of 10%, and a cash-flow frequency of 2 time(s) per year will have a duration of 4.10 years. Duration measures how long, in years, it takes for the price of a bond to be repaid by its internal cash flows. DMBs need to consider it cautiously, as bonds with higher durations reflect more risk and have higher price volatility than bonds with lower durations.

Duration GAP (DGAP) impact the market value of equity and overall position of the bank. DGAP crop up combining weighted average duration of assets and liabilities of which investment of government securities are integrated. Formulation of DGAP:

DGAP=DA-(MVL/MVA)×DL [DA=Duration of asset; DL= Duration of liability; MVL= Market value of liability and MVA= Market value of asset].

DGAP = 3.07-(10000 /11000)×1.62 =1.60. Longer DGAP causes larger change in the market value of DMBs equity. 1% rise in interest rate will reduce the market value of equity equivalent to Tk. 161.47 crore impacting balance sheet of banks as follows:

$\Delta MVE(-DGAP)\times(\Delta i/(1+y))\times TA$

$=-1.60\times(0.01/(1+0.09))\times 11000 = -161.47$ crore

Section-IV

Conclusion

Bangladesh Bank meticulously determines the cut-off rate of bills and bonds considering the excess reserves of the banks and liquidity need of the government. Effective yield curve rate specially the 91-day government treasury bill rate contributes in arriving call money, deposit and lending rates of the banks. The book values of the banks are affected with the yield of the bills and bonds following Basel II norms. Due to lack of secondary market Interpolation and extrapolation of yield curve provide the rate for valuation of bills and bonds. The HFT and HTM securities are also evaluated depending on the yield curve. Appreciation of Taka rate lowers the exchange rate. Higher interest rate also contribute to lower the inflation rate considering monetization and pass through. Solidity of the yield curve rates impact in determining the GDP growth of the country.

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Price Transmission Dynamics in the Rice Market of Bangladesh

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Abstract

The principal objective of this paper is to investigate the price transmission mechanism of commodity 'rice' between Bangladesh and her major import destination country, India due to its importance in ensuring food security in Bangladesh. So, an in-depth study about the degree of market integration and price transmission mechanism in the domestic rice market is essential for the policy makers, rice producers and other rice value chain role players since it affects their decisions which in turn influence their profitability and determine the overall supply in the rice market of Bangladesh. To address the mentioned issue, this study engages both Johansen & Juselius (1990) cointegration technique and innovation accounting approach to critically examine the price transmission process of rice price from Indian market to Bangladeshi market covering the time period from July, 1998 to May, 2015. This paper finds that the price shock in Indian rice market induces price change in the Bangladeshi rice market both in short run and long run. The findings strongly suggest to consider the impact of external forces in stabilizing the domestic rice price of Bangladesh along with the role of existing internal factors.

Keywords: Rice market, price transmission, agriculture in international trade, economic integration, time-series models.

JEL classification: C32, F15, F42, O13, Q17

Introduction

Rice in Bangladesh represents important roles in domestic consumption, international demand, and GDP contribution from production. Rice prices in Bangladesh are not only determined by market system but also by government intervention through implementation

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of rice price policy. Generally, analysis of price transmission measures the effect of prices in one market on prices in another market. Price transmission from global to domestic market gives us an opportunity to comprehend the degree of the economic integration into the market process. This transmission is more observable in case of considering the diffusion of price in a developing country from the country it imports most.

A competitive pricing behavior concept delineates the idea of price transmission. The classical notion of the law of one price and various price determination models hypothesize that the price transmission is resulted in equilibrium price of a commodity sold on competitive foreign and domestic markets varying only by transportation cost, when converted to domestic currency. But the ideal state of one price notion described by the classical school of thought may deviate as we see in the reality due the distortion of commodity market through different intervening tools. The time necessary to transmit the price from exporting country to importing country differs depending on various factors between the two trading countries.

Price transmission mechanism is very important to achieve efficient outcome on which economic welfare depends. Various policies related trade and other issues, illegal trade, transaction cost arising from poor transportation facility e.t.c. can play role to reduce price information to economic agents and accrues inefficient outcome by product.

A very common argument among economists and policymakers is that market relaxation augments economic growth whereas intervention policies restrain it (Onafowara and Owoye, 1998). Agricultural trade needs to be integrated into the international market for ensuring realization of gains from liberalization by producers and consumers. Farmers cannot specialize according to the long-term competitive advantage unless they receive the correct price signals. Consequently, realization of potential gains from trade will be hampered (Ravallion, 1986). Many developing countries have taken various market oriented initiatives to make their agricultural sector liberalized in recent years so that their farmers can reap the maximum opportunity of market liberalization. Bangladesh is not different from those countries. Rice market of Bangladesh is very important for the inhabitants of the country. This market experienced mentionable liberalization during late 1980s and early 1990s.

Market liberalization cannot avoid the market integration in present period. So market integration can be considered as mandatory for bringing market liberalization in developing countries. “Without spatial integration of markets, price signals will not be transmitted from urban food deficit to rural food surplus areas, prices will be more volatile, agricultural producers will fail to specialize according to long term comparative advantage and gains from trade will not be realized” (Baulch, 1997).

The role of market liberalization in enhancing integration of spatial market is a fundamental idea preoccupying many researchers (Silumbu for Malawi, 1991; Goletti and Babu for Malawi, 1994; Barrett for developing countries, 1996, 2001; Hossain and Verbeke for Bangladesh, 2010; Dercon for Ethiopia, 1995). Spatial market integration is very influencing

on the smoothness of price transmission. Looking into the market integration can be a passive approach to examine the market efficiency (Hopcraft, 1987). The spatial and inter-temporal market integrations of maize market in Malawi was tested by Silumbu (1991) using monthly whole sale price where slight increment of urban market integration was found even under partial liberalization. Ghafoor and Aslam (2012) explored spatial market integration among major rice markets in Pakistan and price transmission from two international rice markets viz. USA and Thailand using Johansen's Co-integration approach and Error Correction Mechanism for the period January 2000 to December 2009. The analysis showed integration and price transmission in rice markets of Pakistan which implies that it is easier to disseminate policy impact through the rice marketing chain in Pakistan.

Huda (2014) analyzed the effect of global commodity market factors and domestic exchange rate development on domestic food price from Bangladesh perspective. Author used bi-variants co-integration approach for the analysis of shock transmission and eventually an error correction model was developed. The study found that only 46 per cent of the total world shock pass-through in domestic economy. Baltzer (2013) analyzed the evidence on price transmission from international maize, rice and wheat markets to domestic markets in fourteen developing countries for the global food crisis taken place in 2007-08. Author found great variation in the price transmission pattern: almost no price pass-through in China and India, close relationship between international and domestic prices in Brazil and South Africa, substantial domestic price overshooting in Ethiopia and Nigeria. The study concluded that price stabilization policies, public policy failure, incomplete market integration, and coinciding domestic shocks could explain much of this variation.

Hossain and Verbeke (2010) investigate the nature and extent of market integration from the divisional perspective using weekly market price data for the period 2004-2006. A co-integration analysis is carried out by Dorosh and Rashid (2012) between the monthly import parity prices of below-poverty-line rice and national average wholesale prices of coarse rice in Bangladesh covering the period July 1997 to March 2011. The analysis concludes with the long run relationship between the monthly import parity prices of below-poverty-line rice and national average wholesale prices of coarse rice in Bangladesh.

Akhter (2016) analyzed spatial market integration between an adjacent rice surplus market (India) and deficit markets (Bangladesh and Nepal) through Applying the maximum-likelihood method of co-integration over January 1999 to May 2013 sample period. The main focus is on the government policies of these three rice-producing countries which have been imposed to reduce domestic price volatilities in rice markets during the recent 'global food crisis' in 2007–2008. The co-integration tests found that domestic rice prices of India, Bangladesh and Nepal are integrated both in short-run and long-run periods despite the imposition of export restriction policies by India. The reason that prices are transmitted so effectively is most likely to be the widespread informal cross-border trade through the porous borders among India, Bangladesh and Nepal.

However, our study differs from Hossain and Verbeke (2010) and Akhter (2016) by

extending to cross border rice price transmission with wider sample period and from Dorosh and Rashid (2012) by extending the co-integration analysis between rice price of India and Bangladesh to the examination of long run relationship behavior in response to price shocks through impulse response. Thus, this paper concentrates on the techniques of time series analysis to investigate the price transmission of rice between Bangladesh and her major import destination, India.

The remaining of this paper is organized as follows. Section 2 describes recent development of rice trade in Bangladesh and India. Section 3 conducts the data and model specification. Section 4 provides estimation of price transmission dynamics in rice market of Bangladesh. The last section, Section 5, provides the conclusion along with policy prescription.

Brief overview of the rice markets in Bangladesh and India

Rice is the staple food of about 155.8 million people of Bangladesh. It provides nearly 48% of rural employment, about two-third of total calorie supply and about one-half of the total protein intake of an average person in the country. Rice sector contributes one-half of the agricultural GDP and one-sixth of the national income in Bangladesh. Almost all of the 13 million farm families of the country grow rice. Rice is grown on about 10.5 million hectares which has remained almost stable over the past three decades. About 75% of the total cropped area and over 80% of the total irrigated area is planted to rice. Thus, rice plays a vital role in the livelihood of the people of Bangladesh.

Total rice production in Bangladesh was about 9.61 million metric tons in the year 1971 when the country's population was only about 70.88 millions. However, the country has produced about 34.71 million metric tons to feed her 155.8 million people in FY15. This indicates that the growth of rice production was much faster than the growth of population. This increased rice production has been possible largely due to the adoption of modern rice varieties on around 66% of the rice land which contributes to about 73% of the country's total rice production.

Rice is the most important cereal food crop of India, which occupies about 24 percent of gross cropped area of the country. It contributes 42 per cent of total food grain production and 45 per cent of total cereal production of the country. Rice production in India has increased during last 60 years by about 3.5 times from 22.71 million metric tons during the first 5-yr plan period to 77.77 million metric tons during the tenth plan period. The average productivity of rice in India, at present, is 2.2 tons/hector, which is far below the global average of 2.7 tons/hector.

India is the largest rice exporting country in the world. Being the neighboring country of Bangladesh, India is a suitable destination of rice import for Bangladesh. Variety of transportation facility and low transportation cost are the main factors playing important role behind high rice trade relationship between the countries. As a result, the lion's share of Bangladesh's rice import comes from India. The Figure 1 (annex) shows the share of India in the total rice import of Bangladesh from the period of 2001-2015. Calendar year is

considered for the period 2001-2011 when fiscal year is considered for the period of 2012-2015 due to the rigidity on data availability. In 2001, about 50 percent of imported rice of Bangladesh came from India. In the period of 2002 to 2008, on average, about 88 percent of rice import was done from India by Bangladesh. The rice import of Bangladesh from India dropped significantly in the period 2009 to 2011 due to the Indian restriction on rice export. Following 2011, India again became important destination of rice for Bangladesh. In the fiscal year 2015, about 99 percent of Bangladesh's imported rice came from India. So there is huge scope of Indian rice price transmission into Bangladeshi rice price. The Figure 2 (annex) portrays the dynamics of Indian rice price and Bangladeshi rice price for the period of 1998-2015 on monthly basis. The overall movement of two rice prices adumbrates a conspicuous co-movement of the prices. Though the prices were away from each other in few years of the stated period, the movement of each Bangladeshi rice price followed the trajectory of Indian rice price. In rest of the years, the rice price of Bangladesh not only followed the movement of the Indian rice price but also moved very closely. The plotted relationship between Indian rice price and Bangladeshi rice price indicates close relationship between the prices.

Moreover, the domestic demand for rice in Bangladesh consists of the domestic production and import only as Bangladesh export very little amount of rice sporadically. The data from Food Production Monitoring Unit shows that rice import of Bangladesh varied from about 0.03 million metric ton to 1.56 million metric ton during FY10 to FY15. So the physical amount of the imported rice looks large enough to have the ability to affect the rice price in Bangladesh. The lion's share of the imported rice in Bangladesh comes from India and consequently Indian rice price is likely to affect the rice price in Bangladesh. In addition, India is the leading rice exporting country of the world, so rice price in India affects the world rice price. As a result, price of imported rice by Bangladesh from the countries other India is also likely to be guided by the Indian rice price. Lastly, geographical position of Bangladesh compare to India makes the whole Bangladesh economy sensitive to Indian economy and rice market of Bangladesh is not free of that fact either. Especially informal trade in the border area facilitates to transmit the Indian product price into Bangladesh (Akhter, 2016). Under the stated circumstances, we can easily expect that Indian rice price can affect Bangladeshi rice price which we are testing empirically in our paper.

The data and model specification

The monthly average of wholesale price of Bangladeshi and Indian rice was collected from Food and Agricultural Organization (FAO). The data period covers July 1998 to May 2015 and the price series are measured in dollar/kg. To avoid the seasonality problem, price series have been seasonally adjusted.

Generally time series data are characterized with unit root processes. To get the order of integration of price series, the individual price series are tested whether they are integrated in level or difference forms. The Augmented Dickey-Fuller (ADF) test is frequently used in this regard (Dickey and Fuller, 1979, 1981). In 1988, Phillips and Perron (PP) proposed

a modification of the Dickey-Fuller (DF) test and have developed a comprehensive theory of unit roots. A t-statistic on the unit-root coefficient has been introduced by PP in a DF regression, adjusted for autocorrelation and heteroskedasticity. Monte Carlo simulation shows that the power of the various DF tests can be very low (Enders, 2010). Maddala and Kim (1998) comment that the DF test does not have serious size distortions, but it is less powerful than the PP test. According to Choi and Chung (1995) PP test appears to be more powerful than the ADF test in case of low frequency data. Therefore, we adopt the PP methodology to test unit roots in the price series. If the price series are found to be stationary at same order of integration subsequently testing them for cointegration will be followed as per the Johansen approach, due to Johansen (1988), and Johansen and Juselius (1990). If the series are really cointegrated, the number of the cointegrating relation must be less than two in case of two variables (price series). If both the trace and maximum eigenvalue tests recommend the presence of one cointegrating relationship, the long-term relationship exists between the price series. Then estimating them in a vector error correction model (VECM) will be required.

The model is:

$$X_t = \beta_o + \beta_1 X_{t-1} + \ldots\ldots + \beta_p X_{t-p} + \nu_t \qquad (1)$$

Where p = lag length; X_t = the (n×1) vector of endogenous variables; β's are matrices of unknown parameters; and ν_t is an independently and identically distributed n- dimensional vector with zero mean and variance matrix ∑t. The VAR model in equation (1) written in error correction form is;

$$\Delta Xt = \Upsilon_o + \sum_{p-1}^{j=1} \gamma_j \Delta X_{t-1} + \pi X_{t-p} + \nu_t \qquad (2)$$

Where $\Upsilon_o = \beta_o$;

$\Upsilon_j = -(I - \sum_{p-1}^{j=1} \beta_j)$; j=1,2.....,p-1

$\pi = -(I - \sum_{i=1}^{p} \beta_i)$

and ΔX_{t-j} is an (n×1) vector of X_{t-j} in first differences, and π as well as Υ_j (j = 1, 2,……, k) are n by n matrices of parameters and Vt is an n-vector of residuals which are assumed to be normally distributed with mean zero and have a contemporaneous covariance matrix ∑t. The long-run information in Xt is summarized by the long-run impact matrix Υ. π (Defined by r) is the rank of the matrix of the VECM that determines the number of independent co-integrating vectors. If the matrix π has a rank, r, greater than 0, then co-integration exists. If the rank of π is 0, then the variables have no long relationship and the model translates into a standard VAR model in differences.

Estimation

Table 1 (annex) represents the results of the Phillips-Perron (1988) unit root tests for Bangladeshi and Indian rice prices. Both the price series exhibit unit roots at their level form but they become stationary at their first difference. So the order of the integration is I (1) that results allow to proceed for cointegration tests for checking the long run equilibrium relationship.

The main task in this step is to determine the rank of π, for this reason cointegration is tested using Johansen›s maximum likelihood procedure using two test statistics, namely the trace test (λtrace) and maximum eigenvalue (λmax). Before going to perform the cointegration test, it is prerequisite to determine optimal lag length for the model. In practice, the SBC will select a more parsimonious model than will either the AIC or t-tests. However, researcher has to ensure that residual act as white noise processes (Enders, 2010). To ensure the robustness of model, we take optimal lag 12 by the iterative process. The trace test (λtrace) and maximum eigenvalue (λmax) results are represented in Table 2 (annex). The test results indicate that Bangladeshi and Indian rice prices were cointegrated with one cointegrating vector and this cointegrating rank gives the number of stationary linear combinations of the price series. This result is consistent with the identification of one linear combination of prices (as it is a bi-variate case) that delineates stability over the time periods. Thus the rice markets in Bangladesh and India during the sample periods are linked together and that therefore, the long run equilibrium exists.

It is not only sufficient to know that markets are integrated but also essential to know the extent to which markets are integrated. This obliges distinction between the short and long-run dynamics of price changes deriving from one market to another. For this reason, we estimate vector error correction model (VECM) to see the dynamic adjustments of price series between markets.

The normalized cointegrating coefficients can be used to see the long-run cointegration of price series. The Johansen (1988) cointegration test has been used to estimate the cointegrating coefficients. The result is as follows:

BDRP = 0.092 + 0.708 INDRP

Where, BDRP indicates Bangladesh rice wholesale price and INDRP is India rice wholesale price. The estimated coefficient shows that the Indian rice price has positive impact on the Bangladeshi rice price and the coefficient is statistically significant at the 1 percent level.

In the short-run dynamics, the error correction term (Table 3) on the regression with first difference Bangladesh rice price is significant at the 1 percent level, addressing the adjustment behaviour of Bangladesh rice price market if by any means the long-run equilibrium relationship is stunned. The estimated error correction term of BDRP is - 0.1235 which means that almost 8 months need to bring the system into the steady state once it is disturbed. However, the INDRP coefficient is positive but not statistically significant, suggesting that in short-run Indian rice price is weakly exogenous in the relationship of the

model. Hence, though there is a long-run relationship prevail between BDRP and INDRP, it is only BDRP adjusts to bring the disequilibrium into equilibrium once the system is shocked.

Based on the estimated result of VECM, We derived impulse response functions (IRFs). To derive the impulse response functions, we used generalized impulse response analysis as it does not require orthogonalization of shocks and is invariant to the ordering of variables in the VAR. Figure 3 (annex) shows the impulse response of Bangladesh rice price. The response of Bangladesh rice price due to one standard deviation innovation in Indian rice price appears to be positive and very strong.

Conclusion and Policy Prescription

This study engages both Johansen and Juselius (1990) cointegration technique and innovation accounting approach to critically examine the price transmission process of rice price from Indian market to Bangladeshi market covering the time period from July, 1998 to May, 2015. It finds a long-run and short-run relationship between the rice price of Bangladesh and India (the result is consistent with Akhter, 2016). With the advent of Globalization, commodity price of giant exporters is going to influence the importing country's price of same commodity. Hence, Bangladesh corrects the disequilibrium in price justifying the norm of Indian leadership in rice market. Here both countries' prices affect each other. Own price shock also affect themselves. But the rice price shock of India is more sustainable to both herself and Bangladesh comparing with the rice price shock in Bangladesh. So this outcome of the study ensures that shock originating from outside of Bangladesh can affect the rice price of Bangladesh besides the domestic factors like input price, fuel price, natural calamities etc. From this token, the upshot of the study suggests that global market conditions need to be continually monitored. In addition to this, our internal policy formulation needs to be in a way where the economic condition of the trading partners is considered. Devising such type of policy needs to be continued till the reduction of domestic price sensitivity of rice to the rice price of international trading partners.

Annex

Table1. Results of Unit Root Tests

Variables	In levels		In first difference		
	Model A	Model B	Model A	Model B	Order of Integration
Bangladesh Rice Price	-1.965 (0.30)	-2.813 (0.19)	-11.613 (0.00)	-11.591 (0.00)	I(1)
India Rice Price	-0.795 (0.82)	-1.805 (0.70)	-12.516 (0.00)	-12.486 (0.00)	I(1)

Note: Model A includes intercept, and Model B includes both intercept and trend. The null hypothesis states that the variable has a unit root. P-values are shown in the parentheses following each adjusted t-statistic.

Table 2. Johansen-Juselius cointegration Tests

λ_{trace} test				λ_{max} test			
Null	Alternative	λ_{trace}	Prob	Null	Alternative	λ_{max}	Prob
r=0*	r>0	16.54005	0.0347	r = 0*	r = 1	15.59399	0.0306
r ≤ 1	r > 1	0.946057	0.3307	r = 1	r = 2	0.946057	0.3306

Note: The λtrace and λmax are calculated as per Johansen (1988) and Johansen and Juselius (1990). P-values are calculated as per MacKinnon et al. (1999). r stands for the rank of the matrix, which denotes the number of the conintegrating equation between the variables. Trace and Max-eigenvalue tests indicate 1 cointegration equation at 0.05 level.* Denotes rejection of the hypothesis at the 0.05 level.

Table 3. Estimation result of VECM

Regressors	D(BDRP)	D(INDRP)
ecm (t-1)	-0.123523*** (0.03607)	0.029700 (0.03098)
D(BDRP(-1))	0.172972 (0.07307)	0.030972 (0.06277)
D(BDRP(-2))	-0.020886 (0.07345)	0.043805 (0.06309)
D(BDRP(-3))	0.248916 (0.07346)	-0.026576 (0.06310)
D(BDRP(-4))	0.057093 (0.07575)	0.058706 (0.06507)
D(BDRP(-5))	0.239188 (0.7517)	-0.026573 (0.06457)
D(BDRP(-6))	-0.047218 (0.07758)	-0.056305 (0.06664)
D(BDRP(-7))	0.138554 (0.07690)	-0.057320 (0.06606)
D(BDRP(-8))	-0.056235 (0.7743)	-0.051907 (0.06652)
D(BDRP(-9))	0.148326 (0.07734)	-0.118654 (0.06643)

D(BDRP(-10))	0.103718 (0.07786)	-0.015559 (0.06688)
D(BDRP(-11))	0.037501 (0.07791)	0.045315 (0.06692)
D(BDRP(-12))	-0.152415 (0.07631)	0.015781 (0.06655)
D(INDRP(-1))	0.224367 (0.09219)	0.098343 (0.07919)
D(INDRP(-2))	0.017349 (0.09253)	-0.174886 (0.07948)
D(INDRP(-3))	0.102711 (0.09404)	0.047504 (0.08078)
D(INDRP(-4))	-0.037759 (0.09401)	0.078921 (0.08076)
D(INDRP(-5))	-0.039688 (0.09471)	0.142014 (0.08135)
D(INDRP(-6))	0.039357 (0.09581)	0.107220 (0.08230)
D(INDRP(-7))	0.004499 (0.09572)	0.011220 (0.08222)
D(INDRP(-8))	0.024952 (0.09542)	0.013051 (0.08196)
D(INDRP(-9))	0.068542 (0.09546)	-0.056782 (0.08200)
D(INDRP(-10))	-0.012433 (0.09588)	0.029232 (0.08236)
D(INDRP(-11))	-0.035161 (0.09353)	-0.088078 (0.08035)
D(INDRP(-12))	-0.196712 (0.09411)	0.008475 (0.08084)
C	-0.000194 (0.00093)	0.00595 (0.00080)
R^2	0.34	0.13

Cointegrating equation: ect (t) = DBRP(-1) - 0.708*** INDRP(-1) - 0.092
(0.07702)

Note:*** refer that coefficients are significant at the 1 percent level.

Values in parentheses against each coefficient indicate standard errors.

“D” stands for first-order difference operator.

“ect” stands for error correction term and “ecm” is error correction model.

Figure 1: Share of India in the total rice import of Bangladesh (2001- 2011 and FY2012-FY2015)

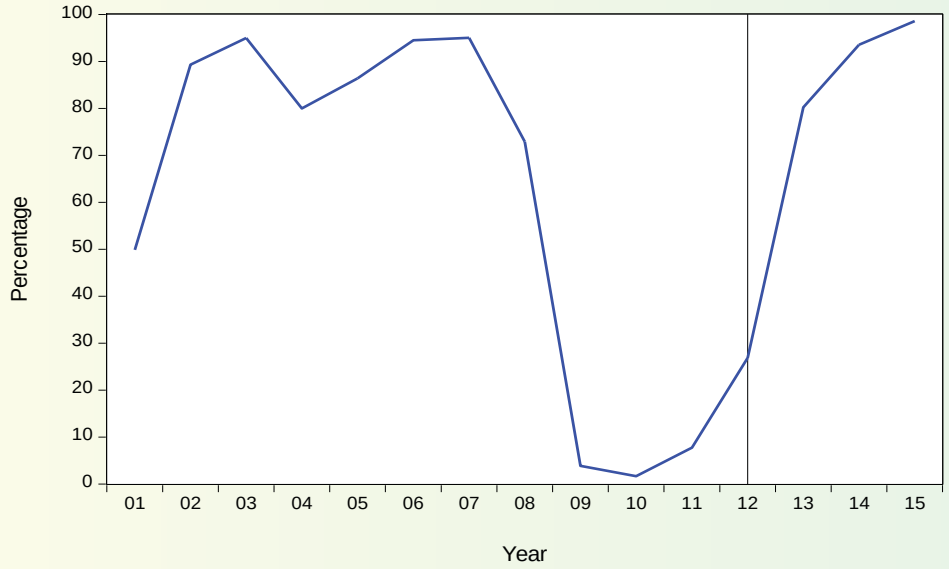


Figure 2: Bangladeshi rice price and Indian rice price: overtime movement

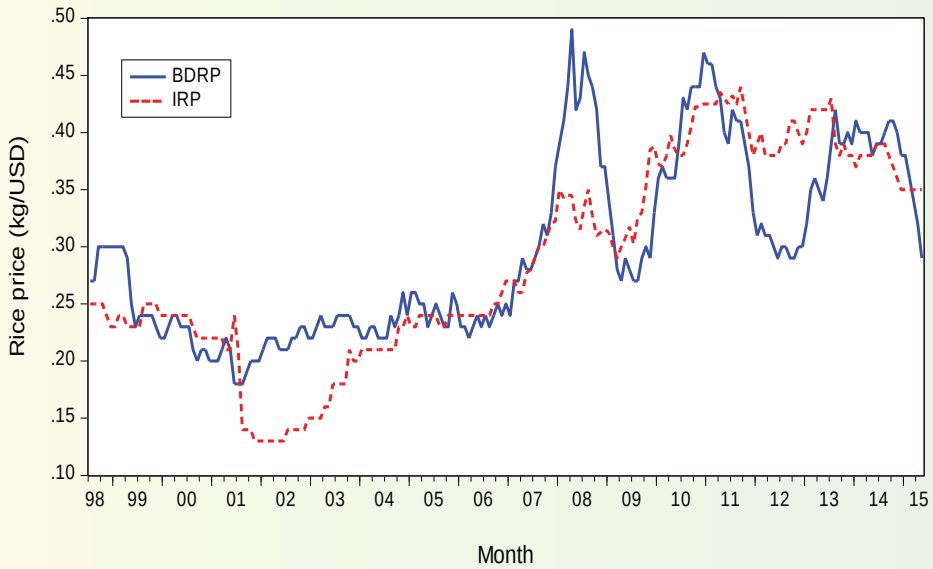
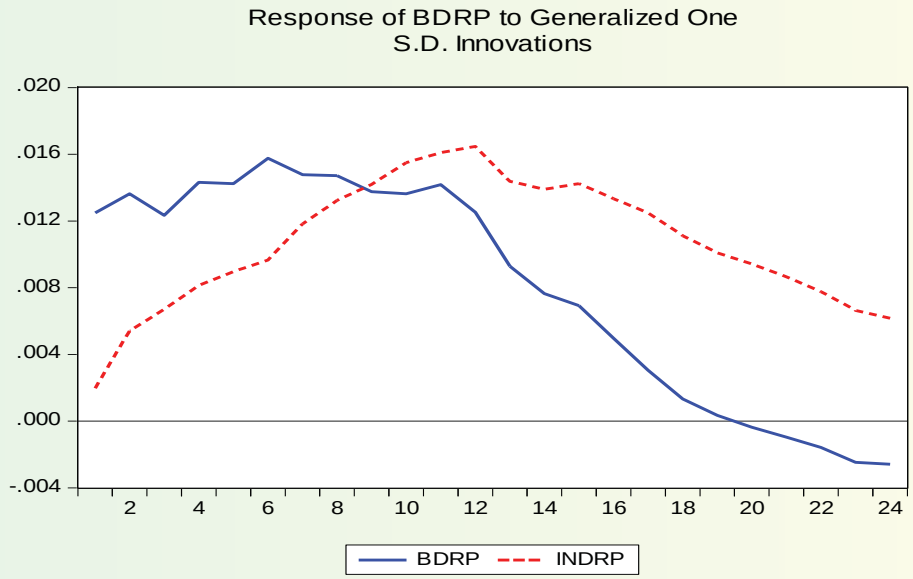


Figure. 3: Generalized Impulse response of Bangladesh rice wholesale price



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Green Banking Practices in Bangladesh: An Ingenious Action for Sustainable Development

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Abstract

The main objective of this paper is to examine the green banking practice in Bangladesh and suggest ways to increase sustainable development through green banking activities. Since the banking sector is the dominant supplier of credit to various sectors of the economy, especially industrial and the agricultural sectors, sound innovative green banking practices may promote environmentally sustainable and socially responsible investment. The study finds that although most banks have adopted green banking policy and continued to show improvements, private commercial banks and foreign commercial banks performed better than state-owned commercial banks. The study also noticed that projects on effluent treatment plants, solar energy plant, bio-fertilizer plant, Hybrid Hofiman Kiln are neglected despite their crucial role in environmental protection.

Keywords: Green banking, developing countries, sustainable development.

JEL Calssification : G28, O13, Q01, Q53, Q54

Introduction

An increasing number of global banks around the world are going green by launching environmental friendly initiatives and providing innovative green products. US congressman Chris Van introduced a "Green Bank Act" in 2009 with the aim of establishing a green bank under the ownership of the US government in order to offer financial support to effort to increase efficient energy usage, reduce carbon emissions and environmental pollution resulting from energy creation. Bank Technology News has recently awarded Citigroup, the US banking giant, top honors in its first ranking of America's Greenest banks. Citigroup updated computer hardware across the 1000+ Citibank branches in North America, reducing energy costs by 15% a year, while improving the speed with which it services customers. The Financial Times of London announced the Sustainable Banking Awards last year and the winner was the UK's Cooperative Bank.

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Public concern about the state's natural environment has been growing significantly in the last few years, mostly due to apparently unusual weather patterns, rising greenhouse gases, declining air quality etc. Among all other concerns, banks hold a unique position in an economic system, can affect production and businesses through their financing activities.

In developing countries, the green banking practices are at an early stage. As an emerging economy, Bangladesh is looking for a change in banking strategy to conform to the global green banking strategy. With this aim, the central bank of Bangladesh introduced a guideline of green banking in 2011. Millat et al; (2012) reported that banks in Bangladesh have enthusiastically responded to Bangladesh Bank's Guidelines towards green banking. Similarly, Ullah, M. M. (2010) pointed out that state owned commercial banks and social development banks' initiatives compare poorly to private commercial banks and foreign commercial banks. On the other hand, very recently BRAC Bank Ltd of Bangladesh became the regional winner for 'Asian Emerging Markets Sustainable Bank of the Year'. It represents the popularity of green banking practices in Bangladesh.

Objectives

The main objective of this paper is to examine the present situation of green banking performances of Bangladeshi banks. The following sub-objectives are set to expand the primary objective.

a. To examine the specific areas of green banking initiatives taken by Bangladesh Bank;
b. To examine the policy and implementation strategy of BB compared to the issued guidelines;
c. To examine the nature of green financing performance of different types of commercial banks;
d. To examine the performance of online and mobile banking and growth of green banking;
e. To examine the major in-house green activities of banks;

Literature Review

British Institute of Management (BIM) (1992) urged in favor of greening and launched a major report which produced basic tips on greening the workplace.

Rutherford (1994) stated that Banks need to monitor post transaction for the ideal environmental risk management program during the project implementation and operation.

Schmidhciny, Federico and Zorraquin (1996) described that commercial banking has been emphasized on investment banking rather environmental risks but it would play a larger role in their investment decision in the near future.

Jeucken and Bouma (1999) mentioned that investment which take into account of environmental side-effects usually have lower rate of return.

Sahoo and Nayak (2008) explored the importance of green banking and highlighted important lessons for sustainable banking and development in India.

Ginvosky (2009) focused on the efforts of community banks in the U.S. to leverage sustainability, or green banking.

Rahman (2010) focused on green banking. Environmentally responsible financing are beginning to make profound impact on environmental practices in the real economic factor.

Rahman and Zareen (2014) mentioned that for successful green banking an isolated effort by banking community may not bring much. All stakeholders need to be proactive and change mindset for sustainable development.

Ullah (2010) marked green banking as a component of global initiatives to save the environment and climate. He concluded the study pointing out that state owned commercial banks and social development banks are less concerned with this issue.

Khan (2012) stated that green banking initiatives by all banks are a moral obligation to save the people. He also urged that lenders should consider 'Go green' and 'Think green' themes.

Millat (2012) reported that Banks in Bangladesh have enthusiastically responded to Bangladesh Bank's guidance about green banking, with steps in environmentally responsible financing that are beginning to make profound impact on environmental practices in the real economy.

Methodology

This article is mainly based on secondary data collected from several reliable sources. The sources of secondary data are annual reports of Bangladesh Bank and various Commercial Banks, and related articles. In addition, the data is also collected from companies' corporate profiles, daily newspapers, different journals & articles, banks' websites and the Bangladesh Bank's websites. The data are analyzed in aspect of practices and problems of green banking. The findings of the study are as reliable as the authentic sources of data. The major limitation of the study is that no primary data is involved in the study.

1. Green banking activities of Bangladesh bank and practice thereof

Though be late, Bangladesh is now aware that global warming is an issue that calls for a global response. The rapid change in climate will be too great to allow many eco-systems to suitably adapt, since the change have direct impact on biodiversity, agriculture, forestry, dry land, water resources and human health. Due to unusual weather pattern, rising greenhouse gas, declining air quality etc. society demands that business also take responsibility in safeguarding the planet. Green finance as a part of Green Banking makes great contribution to the transition to resource-efficient and low carbon industries i.e. green industry and green economy in general. Green banking is a component of the global initiative by a group of stakeholders to save environment. The state of environment in Bangladesh is rapidly deteriorating. The key areas of environmental degradation cover

air pollution, water pollution and scarcity, encroachment of rivers, improper disposal of industrial medical and house-hold waste, deforestation, and loss of open space and loss of biodiversity. In addition, Bangladesh is one of the most climate change vulnerable countries. In line with global development and response to the environmental degradation, financial sector in Bangladesh should play important roles as one of the key stake holders.

In response to the above, urgent measures are required by stakeholders for sustainable development and thereby save the planet. Banks hold a unique position in an economic system that can affect production, business and other economic activities through their financing activities and thus may contribute to pollute environment. Moreover, energy and water efficiency and waste reduction are of high concern for many big banks. Green banks or environmentally responsible banks do not only improve their own standards but also affect socially responsible behavior of other business.

Table-1: Summary of BB's green banking activities

Particulars	Practice
Policy formulation & implementation	41 out of 47 banks have formulated Green banking policy.
Green Banking Unit formation	45 out of 47 banks have established Green Banking Unit
Budget allocation and utilization -Budget for green finance -Budget for climate change risk fund -Budget for marketing and capacity building for green banking	Annual Budget allocation for 2012 was Tk. 14444.90 million -Tk.11349.24 million -Tk. 1704.40 million -Tk.231. 25 million
Bangladesh Bank's Green banking initiatives	BB's refinance line renewable energy. Table-2
Online Banking	Table-4 & Table-5
In-house Environment Management	Table-6

2. Guidelines for Green Banking in Bangladesh

The Bangladesh Bank outlines a three-stage roadmap for green banking. In the first phase, the guideline suggests that all banks to develop green banking policies and establish separate green banking cells and incorporate environmental risk management strategies by June 30, 2011. The banks are also advised to introduce green initiatives and create climate risk funds to finance flood, cyclone and drought prone areas at regular interest rates without charging an additional risk premium. Promoting eco-friendly products, supporting training and events for raising awareness for environmental risk management were also suggested to include in the regular activities of the bank by December 31, 2011.

In the second phase, the report suggested banks implement specific policies by December 31, 2012 for different environmental sensitive sectors such as agriculture, poultry, dairy, tannery, fisheries, textiles, renewable energy, pulp and paper, chemicals, plastic industry, hospital, brick manufacturing and ship breaking etc. During this period, all banks will also set up green branches to use maximum natural light, renewable energy, energy saving light bulbs and other equipment. In addition, they will have to determine a set of achievable targets and strategies and disclose these in their annual reports and websites.

In the final stage, banks will focus on fine tuning of their green activities and look for more innovative products and services to expand eco-friendly business and strategies. Commercial banks had to adopt a comprehensive green banking policy by December 31, 2013 as part of the central bank's efforts to make banking practices more responsible to social and environmental causes. The central bank will name the top ten banks for their overall performances in green banking and take into account to give it permission to open new branches. The banks will have to inform the BB of their initiatives on a quarterly basis within 15 days after the end of a quarter.

3. Green Banking Approaches and Objectives

The term green banking generally refers to banking practice that foster environmentally responsible financing practice and environmentally sustainable internal process minimizing GHG emissions.

Green Banking has two approach, these are:

- ✓ Green Banking focuses on green transformation of internal operations of all banks.
- ✓ All Banks should adopt environmental risk of project before making financing decision and in particular supporting and fostering growth of up-coming green initiatives and projects.

4. Bangladesh Bank's refinance line for renewable energy

a. The current bank rate is 5% and commercial banks add maximum 4% to charge from investors or NGO. It means the interest rate will be not more than 10%. But the actual practice is not as directed by the central bank. In some cases, it is more than 13%.

b. A comparative figures of two quarters are presented below:

Table-2: BB's refinance line for renewable energy

Name of projects	December, 2011 (million)	April 2012 (million)	% change in investment
Solar irrigation pumping station	18.87	18.87	Nil
Solar home system	59.37	59.86	0.83%
Biogas	132.21	132.41	0.15%
ETP	20.78	26.96	29.74%
HHK	20.00	20.00	nil
Solar PV module assembling plant	nil	248.8	-

Table-2 shows that in the second quarter ETP and Solar PV module assembling plant refinancing schemes have increased significantly. Other projects didn't grow significantly. It may be because of the lack of publicity, lack of motivation or the weakness of managerial decision making.

5. Green finance of different types of commercial banks

There are four types of commercial banks in Bangladesh and these are: state owned commercial banks (SCB), private commercial banks (PCB), foreign commercial banks (FCB), and social development banks (SCB). A comparative study of two quarters Up to March, 2012 and up to June, 2012 are presented below:

Table-3: Comparative figures of different commercial banks' green finance

Green projects	SCB (m)	PCB (m)	FCB (m)	SDB (m)
ETP	77.68	3134.80	705.97	1.00
Projects having ETP	5758.74	122694.64	19726.55	0.00
Bio-gas plant	28.31	219.76	0.00	0.00
Solar renewable energy plant	229.77	756.02	0.00	0.00
Bio-fertilizer plant	0.00	4.50	0.00	0.00
Hybrid Hoffman Kiln (HHK)	112.40	795.17	0.00	0.00
Others	5249.70	5.20	220.00	42.80
Up to June 2012				
ETP	77.68	3164.31	705.97	17.05
Projects having ETP	5758.74	162941.69	39130.45	564.26

Bio-gas plant	32.54	285.26	0.00	7.00
Solar renewable energy plant	231.25	998.34	38.00	141.15
Bio-fertilizer plant	0.00	4.90	0.00	0.00
Hybrid Hoffman Kiln (HHK)	114.27	1279.46	0.00	30.23
Others	5251.68	722.23	220.00	54.83
change in quarter June 2012				
ETP	0.00	29.51	0.00	16.05
Projects having ETP	0.00	40247.05	19903.90	564.26
Bio-gas plant	4.23	65.50	0.00	7.00
Solar renewable energy plant	1.48	242.32	38.00	141.15
Bio-fertilizer plant	0.00	0.40	0.00	0.00
Hybrid Hoffman Kiln (HHK)	1.87	484.29	0.00	30.23
Others	1.98	717.03	0.00	0.00

Table-3 shows a significant change in June 2012 in projects having ETP in all types of banks except SCBs. Similarly, it happened for solar renewable energy projects. The overall performances of SCBs are very poor while it is satisfactory for PCBs. On the other hand, Bio-fertilizer plant projects completely failed to attract investors.

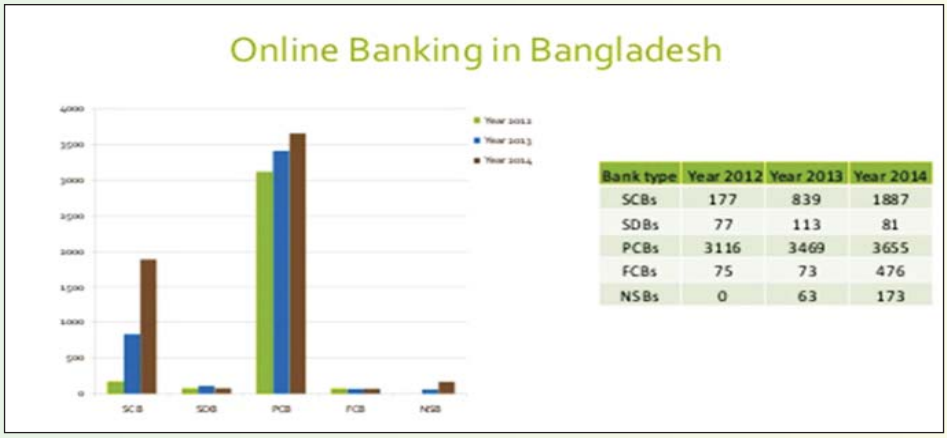
6. Online Banking/Mobile or SMS banking

This kind of banking system reduces the paper works which ultimately environment friendly. It reduces wastes and increases productivity and satisfaction of customers. Table-4 shows that FCBs provide 100% online banking facilities followed by PCBs (91.5%). But the figure is disappointing for SCBs (5.49%) and SDBs (3.46%).

Table-4: Online Banking

Types of Banks	Total number of Branches	Number of branches with online banking facilities	% of branches with online banking facility
SCBs	3442	189	5.49%
PCBs	3188	2917	91.5%
FCBs	74	74	100%
SDBs	1415	49	3.46%
Total	7998	3042	38.03%

Chart -1



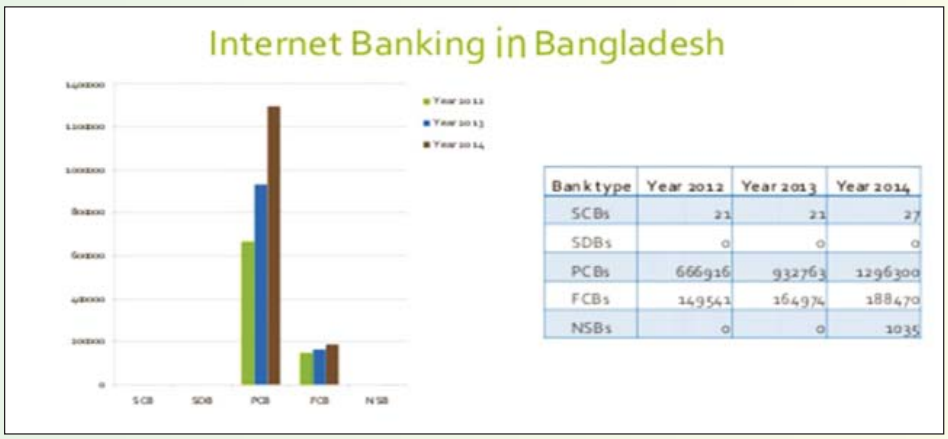
Bank type	Year 2012	Year 2013	Year 2014
SCBs	177	839	1887
SDBs	77	113	81
PCBs	3116	3469	3655
FCBs	75	73	476
NSBs	0	63	173

Table-5: Internet & Mobile/SMS banking

Types of Banks	% of accounts facilitated with Internet banking	% of accounts facilitated with Mobile/ SMS banking
SCBs	0.00%	0.06%
PCBs	1.39%	1.37%
FCBs	52.61%	43.23%
SDBs	0.00%	0.00%

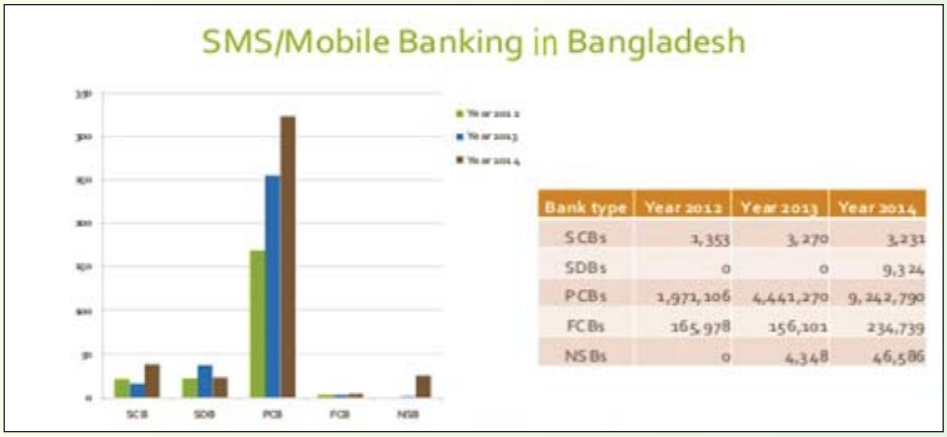
Table-5 states that only FCBs are concerned with internet and mobile or SMS banking. The other group of banks' internet and mobile banking facilities are very poor.

Chart -2



Bank type	Year 2012	Year 2013	Year 2014
SCBs	21	21	27
SDBs	0	0	0
PCBs	666916	932763	1296300
FCBs	149541	164974	188470
NSBs	0	0	1035

Chart -3

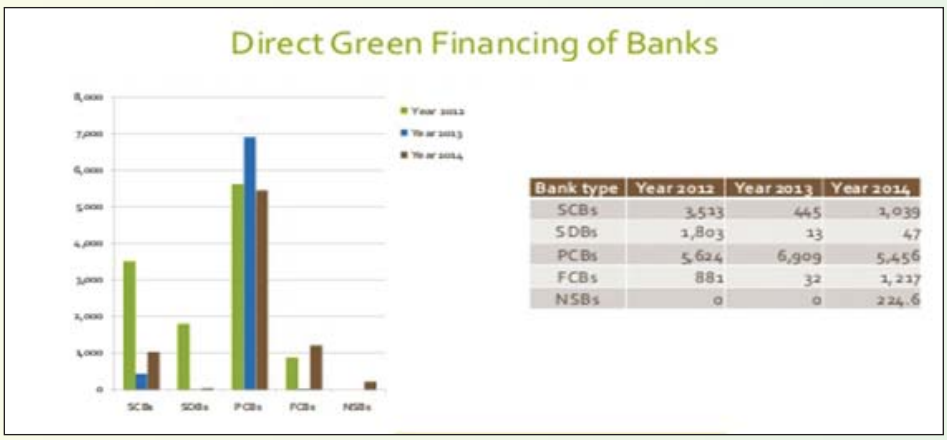


Bank type	Year 2012	Year 2013	Year 2014
SCBs	1,353	3,270	3,231
SDBs	0	0	9,324
PCBs	1,971,106	4,441,270	9,242,790
FCBs	165,978	156,101	234,739
NSBs	0	4,348	46,586

7. Banks' In-house Green activities (Direct and Indirect)

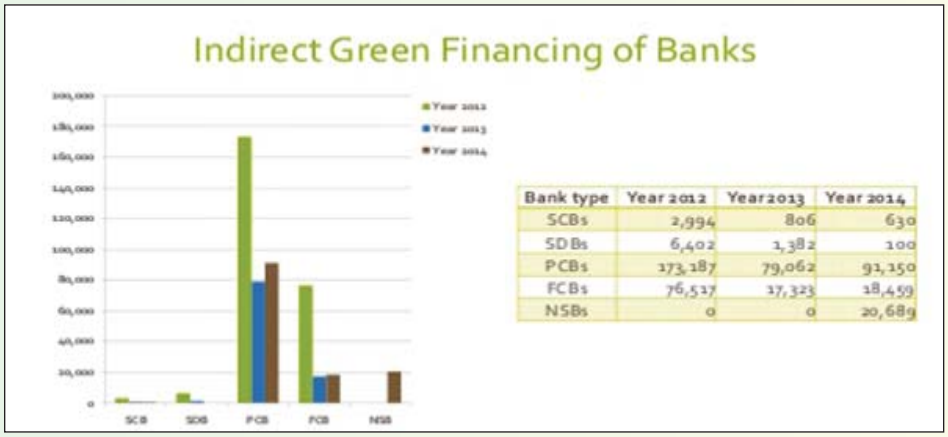
In order to save the environment, banks maintained in-house green activities. Major performances regarding this issue are presented in Table-6.

Chart -4



Bank type	Year 2012	Year 2013	Year 2014
SCBs	3,513	445	1,039
SDBs	1,803	13	47
PCBs	5,624	6,909	5,456
FCBs	881	32	1,217
NSBs	0	0	224.6

Chart -5



Bank type	Year 2012	Year 2013	Year 2014
SCBs	2,994	806	630
SDBs	6,402	1,382	100
PCBs	173,187	79,062	91,150
FCBs	76,537	17,323	18,459
NSBs	0	0	20,689

Table-6: Banks' In-house green activities

01.	Common use of table stationeries instead of individual use.
02.	Use of paper on both sides for internal consumption.
03.	Introduction of e-statement for customers instead of paper statements.
04.	Using more daylight instead of electric lights and proper ventilation in lieu of using air conditioning.
05.	Using energy saving lights.
06.	Use of eco font for printing light impression on both sides of the paper.
07.	Video/audio conferences in lieu of physical travel.
08.	Conversion of Bank's vehicles into CNG and use of energy efficient electronic equipment.
09.	Efficient use of printer cartridges, photocopy toner, office stationery etc.
10.	Sharing electronic files, voice mail, and e-mail instead of paper memos.

8. Average Growth in Green Banking

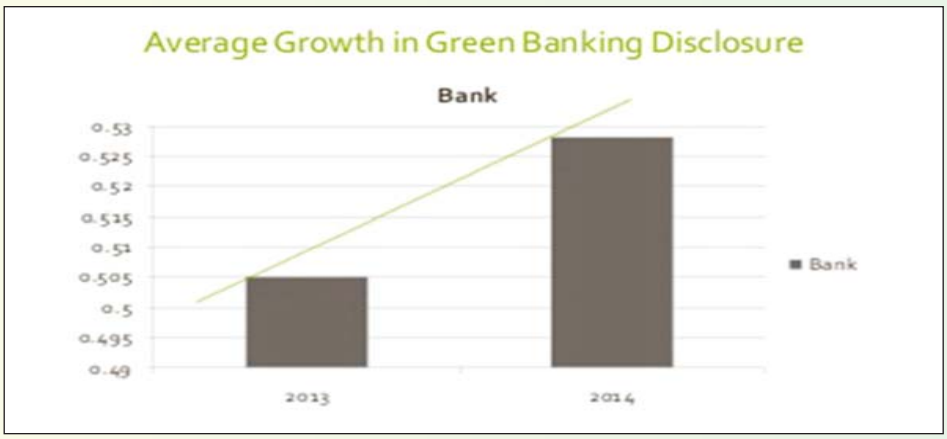
Bangladesh Bank's Green Banking Initiatives are in two aspects.

- √ Bangladesh Bank's in-house green activities and
- √ Bangladesh Bank's green activities other than in-house.

Bangladesh Bank's In-house Green Activities With a move towards encouraging Green Banking in Bangladesh, Bangladesh Bank installed an 8 kilowatt solar power system on its rooftop in March 2012-07-12. Environmentally harmful incineration of non re-issuable damaged bank notes is being phased out, resorting instead to shredding. Steps for measuring the carbon footprint of Bangladesh Bank's internal processes and operations are also underway; eventually to set time bound targets for carbon neutrality/ emission reduction. Under the networking program, all the departments of Bangladesh Bank Head

Office and its nine branch offices have already been brought under a computer network (LAN/WAN),connecting almost 3,100 PCs. Banks have been brought under the purview of E-Commerce with a view to providing the Customers with online-banking facilities covering payments of utility bills, money transfer, and transactions in local currency through internet. Bangladesh Bank has taken the lead position in encouraging and implementing IT based technologies in the overall banking sector. The implementation of the Bangladesh Automated Cheque Processing System (BACPS), Bangladesh Electronic Fund Transfer Network (BEFTN), Enterprise Resources Planning (ERP), Credit Information Bureau online facilities, and Mobile Banking Service are worth mentioning. Establishment of a National Payment Switch (NPS) is also a major driving force for the whole payment system.

Chart -6



The Bangladesh Automated Clearing House (BACH) has simplified the remittance channel and payment system and, therefore, brings dynamism in business activities. The cheque clearing time has been reduced to one day for countrywide payment. In other cases, it is a matter of a couple of hours only. The Enterprise Data Warehouse (EDW) creates an electronic data bank which will provide all information and statistics of monetary, trade and fiscal areas of the national economy, where all the concerned people of Bangladesh Bank will have access to use it for further policy analysis. Bangladesh Bank with its network package is now activated on a web based e-tendering system, which covers announcement of tender, distribution of schedules, bidding etc., to ensure simplicity and transparency of the tendering process. Online salary and other necessary advice, personnel file updated information, office orders, notification about on-line balance statements for all members employee of Bangladesh Bank, an electronic pass for visitors and many more such conveniences are instantly available.

Conclusions

Bangladesh is an overpopulated developing nation. After the liberation war of 1971, it has tried to reform its economic condition by establishing industries and creating opportunities for investors. For the greater interest of the people of Bangladesh, government overlooked some major issues in setting a new industry especially environmental pollution. But now it is a common issue all over the world. In an open economy, every company has now become a competitor. In this connection, the Bangladesh government introduced environment conservation act in 1995 and commenced green banking strategy in January 2011. This paper investigates the present green banking practices in Bangladesh after issuance of guidelines for green banking. Results showed that the majority of banks (41 out of 47 banks) formulated green banking policy and forty five banks established a Green Banking Unit. Allocation of budgets by the central bank for 2012 for green finance and climate change risk fund are insignificant compared to the number of banks. In addition to that no significant investment was made in renewable energy line except ETP and Solar PV module assembling plant in the first quarter of 2012. The green banking practices of PCBs and FCBs are remarkable while the performances of SCBs and SDBs are unsatisfactory which is similar to Ullah, M. M. (2010). Moreover, it showed that projects having ETP are growing significantly for PCBs, FCBs and SDBs during the second quarter of 2012. Projects of only ETP, Solar energy plant, Bio-fertilizer plant, HHK etc. are neglected by almost all types of banks. The prime reason may be insufficient incentives for those projects. The interest rate is almost the same for these projects where there is no direct return for the investors. In order to get the maximum output from green banking policies, the central bank should reform the strategy. Interest free financing incentives should be declared for pollution controlling or pollution preventive projects of existing industries.

Further research can be carried out to establish the size of the company which absorbs the environmental fund allocated by different types of banks and also to establish the additional financing costs and operational costs of the projects.

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An Empirical Testing of Wagner's Law in South Asia: A Panel Unit Root and Cointegration Analysis

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Ataur Rahaman

Abstract

The study strives to assess short-run and long-run relationship between government expenditure and GDP per capita in South Asian region using panel data over the period 2001-2014. To investigate this relationship Wagner's hypothesis has been estimated which support the existence of long-run relationship between economic growth and growth of public expenditure. The methodology includes both Pedroni's and Kao's residual based cointegration tests which confirmed that the variables used in the model are cointegrated. Granger causality test exhibits that there is causation from government final consumption expenditure to GDP per capita. Error-correction model has been also used to check short-run dynamics. The study found both short- and long-term relationship between government expenditure and GDP per capita. Hence the study confirms the validity of Wagner's Law.

Keywords: Wagner's law, GDP, panel unit root, cointegration, error correction model (ECM).

JEL Classification: C32, E62

1. Introduction

Continuous expansion of Gross Domestic Product (GDP) and increasing size of public expenditure explains the recent development of world economies. All countries of the world, regardless of its size, small or big, have witnessed rising government outlays over the last sixty years. For this reason, the relationship between GDP and government expenditure is regarded as one of the most discussed research focus in the discourse of economic development. There are two views, Keyenes and Wagner, on relationship between economic growth and government expenditure (Suleiman, 2010). The government expenditure is an exogenous factor in economic growth in Keynesian hypothesis. On the other hand, the observation of Wagner reveals that higher public expenditure is a consequential product

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of rising GDP, Wagner (1883). A number of studies have been conducted to examine the Wagner's Law empirically and found puzzling results for different country perspectives.

A German economist, Adolph Wagner put forward a law of increasing public expenditure in 1893 known as Wagner's hypothesis (WH) or Wagner's Law. Perhaps he was very first economist to offer a direct economic account of the rising public expenditures. It has been claimed by Musgrave and Musgrave (1984) that Wagner's anticipation regarding the trends to be materialised fifty to hundred years later as development of modern industrial society would give upheaval to rising political pressure for social progress and a continuous increase in public sector.

Most often, government expenditure aimed at reducing poverty (Fan, Hazell and Thorat, 2000). However, if public expenditure fails to promote economic growth, it will not generate enough income to mobilise resources to finance government expenditure (Bataineh, 2012). For this reason, around different parts of the world, Wagner's law has been a subject of extensive pragmatic investigation. However, there is no visible attempt made to analyse the long run relationship between government expenditure and GDP by using panel data in case of South Asia.

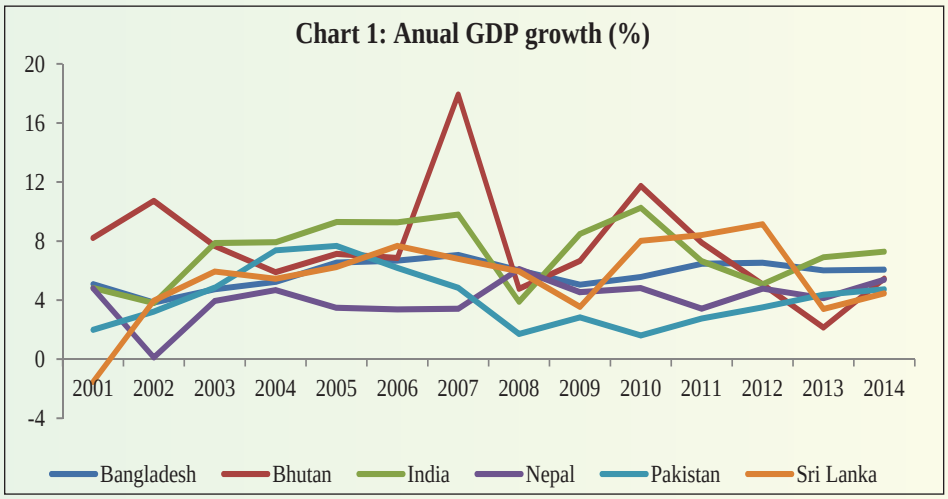
The increasing public expenditure may not translate into better economic performance for many countries (Nurudeen and Usman, 2010). It is of great research significance to understand whether last decade reasonable economic growth has contributed to rising government expenditure in South Asia. Therefore, understanding of these two major macroeconomic variables will be fundamental importance for the policy makers of this region. This study aims at empirically assessing the short- and long-run relationship government final consumption expenditure and GDP per capita of South Asian countries for period covering 2001-2014. The study also aims to give some policy recommendations based on the results found.

The paper is structured as follows. Section 3 outlays a review of related literatures on this issue. Section 4 discusses on the source of data and methodology applied. Section 5 specifies the hypothesised model of Wagner's Law to examine the validity of Wagner's law. Section 6 reports the analysis of results using empirical data. Section 7 concludes the discussion and provides direction on future research.

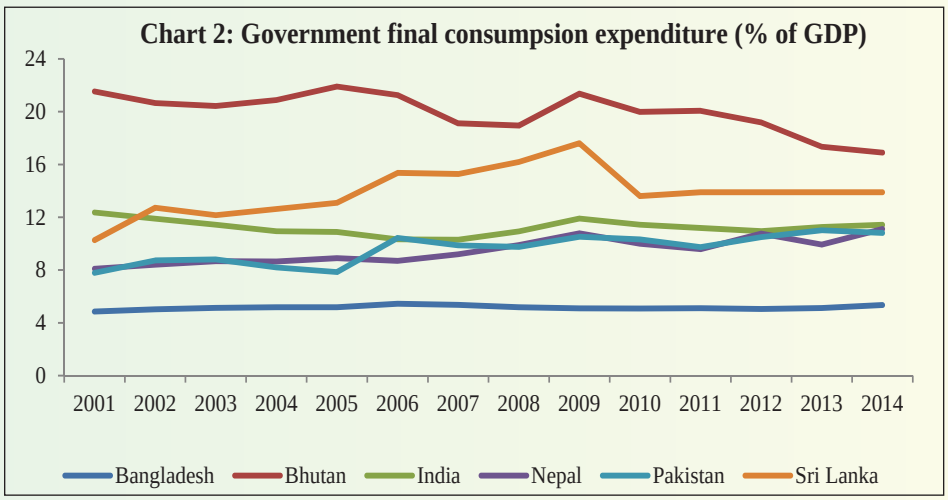
2. Cross country scenario: Some Stylized Facts

The main objective of the study is to assess short- and long-run relationship between government final consumption expenditure and GDP per capita of South Asian countries and hence the testing the validity of Wagner's law. The relationship between government final consumption expenditure and GDP growth depends on the countries historical trend, geographical location, social indicators, environment, population and the structure of the economy etc. The country with higher growth may have higher expenditure and vice versa. In this paper panel data series is used and the result may not be appropriate for a specific country.

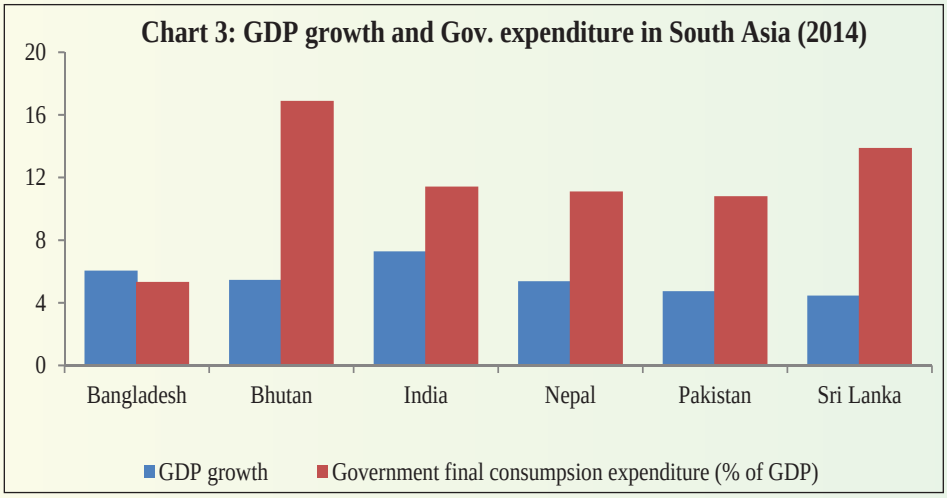
The above chart depicts that south Asian countries' economy is growing in a similar pattern. The recent trend of GDP growth of the countries' is upward and within a range of 4 to 7. India has the highest GDP growth (7.9 percent) recorded in 2014 and Bangladesh is on second position (Chart 1).



It is observed that in Bhutan, government final consumption expenditure as percentage of GDP is higher than any other countries in South Asia region. On the other hand, this amount is the lowest in case of Bangladesh. However the of government final consumption expenditure as percentage of GDP is downward in case of Bhutan and constant in case of Bangladesh. On contrary, India and Pakistan have rising trend (Chart 2).



The above bar graph shows that in 2014, government final consumption expenditure as percentage of GDP is higher than GDP growth in all the countries except Bangladesh. In Bhutan and sri lanka this difference between expenditure and growth is higher (chart 3).



3. Review of Related Literature

Wagner proposed the notion that there is a long-run tendency for government activities to grow with total economic activity in the late 19th century (Wagner, 1883; 1912). As stated by Wagner the share of its public expenditure in total expenditure increases as the real income per capita of a country increases. Three reasons can justify this type of claim: (1) the cultural and welfare services, (2) the regulatory and administrative functions of the states, and (3) the state participation to mobilise resources large-scale projects for technological needs.

Based on the arguments build by this law it also indicates a direction of causality from national income to public sector expenditure. Under this law, public expenditure is considered as endogenous to the growth of national income. On the contrary, pubic spending is considered as an exogenous policy instrument in national income accounting under the Keynesian view. A large number of studies empirically validated the law both in developing and developed countries using time series as well as cross-sectional data sets. There are at least seven versions of the Wagner's law. Magazzino (2010) represented the seven versions of the Law.

Table 1: Seven versions of Wagner's law

No	Version	Equation
1	Peacock- Wiseman (1961)	$\ln GE = a + b \ln GDP + u_t$
2	Gupta (1967)	$\ln(GE/P) = a + b \ln(GDP/P) + u_t$
3	Goffman (1968)	$\ln GE = a + b \ln(GDP/P) + u_t$
4	Pryor (1969)	$\ln GCE = a + b \ln GDP + u_t$
5	Musgrave (1969)	$\ln(NGE/ NGDP) = a + b \ln(GDP/P) + u_t$

6	Mann (1980)	$\ln(NGE/ NGDP) = a + b \ln GDP + u_t$
7	Murthy (1994)	$\ln(E/GDP) = a + b \ln(GDP/P) + c \ln(BDef/GDP)$

Source: Magazzino (2010)

Note: G*E* stands for government expenditure, *GDP* stands for gross domestic product, *GCE* stands for government consumption expenditure, *NGE* for nominal government expenditure, *NGDP* for nominal GDP, *P* for Population, E for expenditure and *BDef* for Budget Deficit.

On the different types of the econometric methodology applied, the empirical works on Wagner's Law can be divided in to two groups (Sideris, 2007). Firstly, early studies which are performed until the mid-1990s, assume stationary data series and apply simple OLS regressions to test alternative versions of the law (Ram, 1987; Courakis et al., 1993). Secondly, cointegration-based studies, which are performed from the mid-1990s and on, test for cointegration between government expenditure and national income (and occasionally population). Early studies of this group use the Engle and Granger (1987) methodology. However, more recent works apply the Johansen (1988) technique. Most of the recent studies also perform Granger causality tests to indicate the direction of causality between the variables (Henrekson, 1993; Murthy, 1994; Ahsan et al., 1996; Biswal et al., 1999; Kolluri et al., 2000; Islam, 2001; Al-Faris, 2002; Burney, 2002; Wahab, 2004). However, the empirical studies have yielded mixed and sometimes contradictory results. Some of these conflicting findings have been attributed to the various econometric methodologies used, and to the application of this law on different economies during alternative time periods (Bohl, 1996).

Using data of British Economy over the period of 1870-1913, Oxley (1994) found evidence congruent with Wagner's hypothesis. Long-run validity of Wagner's hypothesis applied to People's Republic of China for 1952-1992 has been reported by Cotsmoitis et al. (1996). Using both the Granger and Holmes and Hutton statistical procedures to test the income-expenditure hypothesis for three African countries (Ghana, Kenya and South Africa), for the period of 1957 to 1990, Ansari et al. (1997) found that there is no long-run relationship between government expenditure and national income. However, only Ghana shows evidence of government expenditure being caused by national income in short-run which supports Wagner's hypothesis.

The traditional Wagner's hypothesis in the case of Greece using disaggregated data of public expenditure has been tested by Clethsos and Kollias (1997). They reported that Wagner's Law is only valid in the expenditure related to military incidentals.

Karagianni et al. (2002) employs six alternative functional forms of Wagner's law using data for EU-15 countries covering the period 1949-1998 and found no long-term relationship between government spending and income, with few exceptions in sub-cases in Finland, Italy and the Netherlands. The experience of five economies, namely- USA, UK, France, Germany and Italy covering the period of 1870-1900 has been analysed by Florio and Colautti (2005). They found evidence in support of Wagner's Law. Halicioglu (2005) found that Wagner's Law does not hold in the case of adopted traditional form for

Turkey as there is no cointegration and no causality in line with the proposed implications of the law. However, he finds a long-run relationship between the share of government in GDP and real per capita income growth, which is in line with the law. Using an error-correction model, Akitoby et al. (2006) examined the short- and long-run behaviour of government spending with respect to output for 51 developing countries. The study finds evidence that government spending and total output tends to rise over time in developing countries which is congruent with Wagner's hypothesis.

There are also a number of studies conducted at country level for South Asian countries. Based on bivariate as well as trivariate framework, Kalam and Aziz (2009) empirically investigated Wagner's Law, using Bangladesh data from 1976 to 2007. The study finds evidence in favour of the law for Bangladesh, both for short- and long-run. They reported that there is a long-run conintegration relationship among real government expenditure, real GDP and the size of population where government expenditure is positively associated with the real GDP, per capita GDP and population size. Verma and Arora's (2010) study endeavors to inspect the validity of Wagner's Law in India over the period FY 1951 to FY 2008. It found evidence in favour of Wagner's Law in all six versions of the law proposed by different economists which indicates there is a long-run relationship between economic growth and growth of public expenditure. Afzal and Abbas (2010) apply time series econometric techniques to reinvestigate the validity of Wagner's Law in Pakistan covering the data for period of 1960-2007. They found no evidence of long-run relationship between government expenditure and national income. They also not found any direction of causality between these two variables. Kesavarajah (2012) examines the empirical validity of Wagner's law in the Sri Lankan economy using time series annual data over the period from 1960 to 2010. Based on six versions of Wagner's Law, the study finds the existence of short-run relationships between public expenditure and economic growth. However, in long-run, the study finds no strong evidence to support the Wagner's hypothesis. Rana (2014) empirically analyses the association between economic growth and government expenditure from the perspective of Bangladesh covering the period 1973 to 2012. The study reports that there is a significant long run relationship between government expenditure and gross domestic product for Bangladesh which validates the Wagner's hypothesis.

Lahirushan and et. al (2015) identify the impact of government expenditure on economic growth in Asian Countries using econometrical techniques of cointegration, panel fixed effects model and granger causality in the context of panel data of Asian countries; Singapore, Malaysia, Thailand, South Korea, Japan, China, Sri Lanka, India and Bhutan from 1970 to 2013. The paper found a momentous positive impact of government expenditure on gross domestic production and a long-run relationship between government expenditure and growth in Asian countries.

In this paper, it has been strived to examine the empirical validity of Wagner's Law in South Asia region for the period of 2001-2014. It is another attempt from the existing

literature that applies panel data estimation method for South Asia region. In other words, previously no other study focused on testing the validity of Wagner's law for South Asia as a whole using panel data. This study will apply advanced econometric techniques like panel unit-root and cointegration analysis. Moreover, it will also encompass sophisticated econometric tools like Granger causality test to detect the causal flow between the variables and error-correction mechanism to fine tune the findings using empirical data. Hopefully, this research will provide new insights and will add value to existing empirical evidence regarding the phenomenon of Wagner's Law.

4. Data and Methodology

Panel data of respective variables are ranged from 2001 to 2014. Data on GDP per Captia (GDPC) are collected from UNCTAD database website. Here, Government Final Consumption Expenditure is regarded as government or public expenditure. Data on Government Final Consumption Expenditure to GDP ratio (GFCE) and Budget Deficit to GDP ratio (BDEF) have been collected from World Development Indicators (WDI). Here, Afghanistan and Maldives are excluded from the analysis as data on respective variables for these two countries are not reported regularly. Therefore, 6 South Asian countries (Bangladesh, Bhutan, India, Nepal, Pakistan and Sri Lanka) have been considered as cross-sectional units for the study. So, total number of observation is 84.

The empirical analysis in this study is carried out using five tests to check the stationarity of the series namely- Levin, Lin and Chu (2002), Breitung (2000), Hadri (1999), and Im, Pesaran an Shin (2003), Augmented Dicky-Fuller (1979) and Phillips-Perron (1988) tests. To examine whether the dependent variable is cointegrated with the explanatory variables Johansen-Juselius test for cointegration using two procedures Pedroni and Kao Residual Cointegration tests have been applied. Granger Causality test has been reported to examine whether there is causality among variables. Finally, short run dynamics i.e. error-correction model is estimated once equilibrium relationship among the variables is determined.

5. Specification of the Model

To examine the long-run equilibrium relationship between the government final consumption (GFCE) and GDP per capita (GDPPC) and budget deficit to GDP ratio (BDEF) of South-Asia region, the following simple model has been specified:

$$(lnGFCE_t) = \beta_1 + \beta_2(lnGPDPC_t) + \beta 3(lnBDEF_t) + U_t \quad \ldots\ldots..(1)$$

Where, $lnGFCE_t$ = Logarithm of Government Final Consumption Expenditure to GDP ratio in period t; $lnGPDPC_t$ = Logarithm of GDP per capita in period t, $lnBDEF_t$ = Logarithm of Budget Deficit to GDP ratio in period t, U_t =Stochastic error term.

6. Analysis of Results

6.1. Testing for Integration

To check the integration i.e. stationarity properties of data the presence of unit root is to be tested. This study sorts out the matter by applying several panel-based unit root

tests namely, Levin, Lin and Chu (2002), Breitung (2000), Im, Pesaran and Shin (2003), Augmented Dicky-Fuller (1979), and Phillips-Perron (1988) that are similar to tests carried out on a single series. Interestingly, these investigators have shown that panel unit root tests has more strength than unit root tests applied to individual series because the information in the time series is enhanced by that contained in the cross-section data. Moreover, in contrast to individual unit root tests which have complicated limiting dispersals, panel unit root tests lead to statistics with a normal distribution in the limit (see Baltagi, 2001).

Except IPS test, all of the aforementioned tests assume that there is an identical unit root process across the relevant cross-sections (referred to in the literature as pooling the residuals along the within-dimension). The LLC and Breitung tests employ a null hypothesis of a unit root using the following basic Augmented Dickey Fuller (ADF) specification:

$$\Delta y_{it}=\alpha y_{it-1}+\sum\beta_{ij}\Delta y_{it}+X_{it}\delta+\upsilon_{it} \quad \ldots\ldots\ldots\ldots\ldots(2)$$

Where y_{it} refers to the pooled variable, X_{it} represents exogenous variables in the model such as country fixed effects and individual time trends, and ν_{it} refers to the error terms which are assumed to be mutually independent disturbances. As indicated above, it is also assumed that $\alpha=\rho-1$ is identical across the six cross-sections, but the lag order for the difference terms across the six sectors is allowed to vary. On the contrary, the less restrictive IPS test (and other widely used tests such as the ADF Fisher Chi-square) estimates a separate ADF regression for each of the six cross sections to allow for individual unit root processes; *i.e.,* ρ_i may vary across cross sections (referred to in the literature as pooling the residuals along the between-dimension).

At first, panel unit root tests on the relevant variables given in equation (1) above at level, have been implemented. However, all the tests statistics found that the null hypothesis of unit root cannot be rejected for all the three variables. This is a clear indication of non-stationarity problem for all the variables at level. Therefore, the tests for unit root need to be conducted for all the three variables at first differenced from.

Table 2 reports panel unit root test of the variables involved at first differenced from. It is evidential from Table 2 that for two variables GFCE and BDEF, the null hypothesis of unit root can be rejected for all three models based on the test statistics reported under five testing procedures. For GDPPC, all the tests procedures have rejected the null hypothesis unit root with trend. In a nutshell, the hypothesis of non-stationarity can be rejected in most of the cases for all three variables once they are first differenced.

Table 2: Panel Unit Root test of the Variables

Variables	LLC		Breitung		IPS		ADF		PP	
	Statistic	Prob.	Statistic	Prob.	Statistic	Prob.	Statistic	Prob.	Statistic	Prob.
At Level										
lnGFCE	-3.26*	0.00	-0.63	0.26	-1.21	0.11	16.98	0.15	20.48	0.06
lnGDPPC	-4.96*	0.00	2.09	0.98	-1.93*	0.03	18.80*	0.04	20.59*	0.02
lnBDEF	-2.23*	0.01	-1.84*	0.03	-0.75	0.23	13.07	0.22	16.48	0.08
At first differenced										
lnGFCE	-6.63*	0.00	-2.28*	0.01	-3.30*	0.00	32.10*	0.00	58.24*	0.00
lnGDPPC	-3.00*	0.00	-2.30*	0.01	-2.12*	0.02	18.45*	0.01	26.55*	0.00
lnBDEF	-9.55*	0.00	-3.19*	0.00	-6.28*	0.00	51.12*	0.00	90.31*	0.00

Source: Author's estimation based on WDI (2015) and UNCTAD (2015) data and using econometric software (E-views).

Note: LLC=Levin, Lin, Chu (2002), IPS=Im, Pesaran, Shin (2003), ADF=Augmented Dickey-Fuller (1979), PP=Phillips-Perron (1988). The other statistics are described in detail in Breitung (2000). The statistics are asymptotically distributed as standard normal with a left hand side rejection area. A * indicates the rejection of the null hypothesis of non-stationarity (LLC, Breitung, IPS, ADF and PP) at least on the 5per cent level of significance.

Now, it is therefore necessary to turn to panel cointegration techniques in order to determine whether a long-run equilibrium relationship exists among the non-stationary variables in level form.

6.2. Panel Cointegration Analysis

To determine whether a cointegrating relationship exits, the recently developed methodology proposed by Pedroni (1999) is employed. Basically, it employs four panel statistics, four weighted panel statistics and three group panel statistics to test the null hypothesis of no cointegration against the alternative hypothesis of cointegration. In the case of panel statistics, the first-order autoregressive term is assumed to be the same across all the cross sections, while in the case of group panel statistics the parameter is allowed to vary over the cross sections. If the null is rejected in the panel case, then the variables of equation (1) are cointegrated for all the sectors. On the other hand, if the null is rejected in the group panel case, then cointegration among the relevant variables exists for at least one of the sectors. Similar type of procedure is followed in Kao's residual cointegration test.

Table 3: Panel Cointegration Tests

Procedure 1	Pedroni Residual Cointegration Test					
	Panel Statistics				Group Statistics	
	Statistic	Prob.	Weighted Statistic	Prob.	Statistic	Prob.
PP statistic	-2.27*	0.01	-4.12*	0.00	-3.67*	0.00
ADF statistic	-2.45*	0.01	-3.21*	0.00	-3.40*	0.00
Procedure 2	Kao Residual Cointegration Test					
	Statistics	Prob.	Residual Variance		HAC Variance	
	-1.99	0.02*	0.939284		0.666941	

Source: Author's estimation based on WDI (2015) and UNCTAD (2015) data and using econometric software (E-views). Note: The Kao statistics are described in detail in Kao and McCoskey (1998).A * indicates the rejection of the null hypothesis of no cointegration (Pedroni) or cointegration (Kao and McCoskey) at least on the 5 per cent level of significance.

As it is evidential from the findings reported in Table 3 that PP statistic and ADF statistic is found out to be statistically significant at 5 per cent level of significance. For group statistics, in a similar fashion, PP statistic and ADF statistic is found out to be statistically significant at 5 per cent level of significance. Therefore, out of four statistics used in Pedroni's residual cointegration test, all statistics are found out to be statistically significant. Test statistics value for Kao's residual based cointegration test also found out to be significant at 5 per cent level. Thus, using the test statistics value from both procedures, it can be argued that the variables used in the model are cointegrated.

6.3. Tests for Granger Causality

These empirical results analyze the relationship between government expenditure and GDP growth in order to investigate the validity of either the Wagnerian approach or the Keynesian stance or both concerning the direction of causality. Therefore, this study applies the Granger causality test in a context of panel data in order to determine the direction of causality between government expenditure and economic growth in a panel of Asian countries.

The null hypothesis in each case is that the variable under consideration does not "Granger cause" the other variable. The results are as follows:

Table 4 : Granger Causality Tests Results

Dependent variable	Direction of causality	F value	Probability	No. of lags	Decision
lnGFCE lnGDPPC	lnGDPPC→ lnGFCE	1.38	0.29	2	Do not Reject
	lnGFCE→ lnGDPPC	3.20	0.03		Reject
lnGFCE lnBDEF	lnBDEF → lnGFCE	1.02	0.46	2	Do not Reject
	lnGFCE → lnBDEF	0.67	0.71		Do not Reject

Source: Author's estimation based on WDI (2015) and UNCTAD (2015) data and using econometric software (E-views). Note: * denotes significant at 5 percent level.

The test results represent in Table 4 reveals that "Granger cause" goes from government final expenditure to GDP growth only, since the null hypothesis (lnGFCE does not Granger cause lnGDPPC) can be rejected at 5 percent level of significance (Table 4). The relationship between government final expenditure and GDP growth is unidirectional and validate Wagner's law.

On the contrary, there exists no "Granger cause" from lnGDPPC to lnGFCE which ignores the Keynesian stance. Similarly, there is no "Granger cause" from lnBDEF to lnGFCE, and from lnGFCE to lnBDEF at 5 percent level of significant.

6.4. Short-run Dynamics: Error Correction Model (ECM)

As it has been supported by the above tests of cointegration that there exists cointegrating relationship between lnGFCE and other variables, the next task will be the estimation of short-run dynamics models for correction. This is because though there is a long run relationship between the variables as in cointegration tests, however, in short run they may drift apart i.e. there may be disequilibrium. Therefore, the error term has been treated as the equilibrium error, which is to tie the short run behavior of the variables.

Results show that the estimated error correction term of the variable lnGDPPC is 26 per cent which is the short run equilibrium error. If there any short run shocks lead the system in disequilibrium then it requires more than 3 years to reach in the long equilibrium (Table-5).

Table 5: Error-Correction Model

Error Correction	D(lnGFCE)	D(lnGDPPC)	D(lnBDEF)
Cointegrating Equation	0.053681* (2.20854)	-0.264877 (-1.37531)	0.143036* (3.43223)
D(lnGFCE(-1))	-0.285124* (-2.14261)	4.713170 (0.93603)	-0.220980 (-0.96851)
D(lnGFCE(-2))	-0.205380 (-1.59637)	-2.865375 (-0.58860)	-0.290362 (-1.31630)
D(lnGDPPC(-1))	-0.000243 (-0.06325]	0.336827* (2.32009)	0.002657 (0.40389)
D(lnGDPPC(-2))	0.006101 (1.43790]	0.099549 (0.62006)	0.014463* (1.98809)
D(lnBDEF(-1))	0.062991 (0.83534]	-0.906075 (-0.31755)	-0.334403* (-2.58641)
D(lnBDEF(-2))	0.031991 (0.47523]	-2.642514 (-1.03743)	-0.010280 (-0.08907)
C	-0.192084 (-0.77085)	26.93802* (2.85700)	-0.616668 (-1.44335)
R-squared	0.149003	0.351245	0.423897
Adj. R-squared	0.046297	0.272947	0.354367
F-statistic	1.450770	4.486005	6.096627

Source: Author's estimation based on WDI (2015) and UNCTAD (2015) data and using econometric software (E-views). Note: Figure in parentheses denotes t-statistics. * denotes significant at 5 per cent level.

7. Conclusion

Throughout the paper, it has been strived to examine the relationship between GDP per capita or budget deficit to GDP ratio and government final consumption expenditure using time series data of South Asian countries over the period of 2001 to 2014. This empirical investigation has found out the long-run relationship among these variables within the cointegration and error-correction framework. Two procedures of conducting Johansen-Juselius test for cointegration for panel data provides results indicating cointegrating relationship among these variables. Granger causality test has been applied to explore out the causality between the dependent and independent variables. There is an indication of unidirectional causality between government final consumption expenditure and and GDP growth. The error-correction term in most of the cases are found significant.

All this findings mentioned above provides a clear indication that there is exists both short- and long-term relationship between government expenditure and per capita GDP. In turn, it's a clear indication of validation of Wagner's law in South Asia, i.e. rise in GDP per capita is associated with high growth rate in government final consumption expenditure. However, this study is not free from limitations. This study uses data from 2001 onwards due to unavailability of data. Future research initiative may overcome this situation by using national level data for all eight South Asian countries. But a caution should be followed

in this regard as the data sources will not be uniform. Researches should find some sort of technique to unify and standardise data collected from national sources.

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