Income Terms of Trade and Trade Balance: The Long Run Evidence from Bangladesh

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Abstract

The paper implements the Autoregressive Distributed Lag (ARDL) approach to cointegration to test the Harberger-Laursen-Metzler (HLM) effect in the context of Bangladesh. The HLM effect predicts that a rise in terms of trade from an exogenous shock to a small open economy will lead to an improvement in that country's trade balance. Our findings confirm a long run relationship. The Granger causality test reports unidirectional causality from income terms of trade to trade balance. Results are consistent with the theoretical predictions.

Keywords: Income terms of trade, cointegration, ARDL
JEL Classification codes: F11, F32, F40

1. Introduction

Despite the presence of a sizeable literature examining the relationship between terms of trade and trade balance, evidence so far remains inconclusive. The idea that an exogenous shock to terms of trade in a small open economy can lead to an improvement in the country's trade balance is known as the HLM effect, named with the first initials of its authors, Harberger (1950); Laursen and Metzler (1950). The model is based on Keynesian approach. The logic is intuitively appealing: an improvement in a country's terms of trade increases income. Given marginal propensity to consume less than unity, savings also rise and so does investment. Based on the results of a sizeable literature, professional agree that the effect can go either way. The HLM effect has been scrutinized within deterministic intertemporal models by Sachs (1981), Obstfeld (1982), and Svensson and Razin (1983), inter alia. Backus (1993) and Mendoza recast the effect within a dynamic general-equilibrium models. Otto (2003) examined the effect for a number of developing and small OECD economies[1]. He found that a positive shock to the terms of trade improves trade balance initially; but suffers later as the shocks become persistent. Dibooglu (2000) pointed out that positive shock to terms of trade is important in short run but may not sustain in long run once other factors tend to offset the initial effect. Hoque (1995) found long run relationship among current account deficit, terms of trade, domestic income, and foreign income within a fixed exchange rate regime, but not one for a flexible regime e.g., Australia. Kouassi et al. (1998) investigated the relationship between terms of trade and current account deficits using VECM. For Cote'

[1] Otto finds two important results. First, a strong support for an HLM effect is present. Second, his findings implied by the structural vector autoregression model is consistent with those reported by Mendoza (1995) based on simulation of a specific dynamic stochastic equilibrium model for a small open economy.

Ivory they found a long-run relationship, but they point out that the current account deficit cannot be explained by terms of trade alone. A strong unidirectional causality runs from the former to the latter. The dynamic simulations indicate that a significant portion of fluctuations in terms of trade is explained by current account deficits.

The relationship between terms of trade and trade balance can be masked by the measure used which might produce misleading results, and make it difficult to formulate trade policy. For small open developing economies in a globalized world, understanding the relation between terms of trade and balance of trade is very important. The absence of such a study on Bangladesh is the primary motivation for the undertaking the present research. The objective of the paper is to investigate short-and-long runs link between trade balance and income terms of trade in Bangladesh by implementing the autoregressive distributed lag (ARDL) approach to cointegration. The paper contributes in two distinct ways: (a) covers an understudied area in the context of Bangladesh; and (b) provides further evidence on a topic (HLM) that still remains inconclusive. The ARDL approach is appropriate due to the small sample size. The findings can offer useful guidance to policymakers in Bangladesh.

Much of the literature exploring the direct relationship between trade balance and terms of trade focuses on the correlation between the two variables. Only a few studies have examined the long run relationship between them. Haynes and Stone (1982) found positive relationship between U.S. terms of trade and trade balance. Warner and Kreinin (1983), Gylfason and Risager (1984), Bahmani-Oskooee (1986) and Marquez (1990)

found that a deterioration in terms of trade improves trade balance. Bahmani-Oskooee and Jonardhanan (1995) examined 24-countries but found no long-run relationship between the series. Wong (2006) found long run relationship between trade balance and commodity terms of trade, but not between income terms of trade and trade balance for Malaysia. Zortuk (2008) examined the long run relationship between terms of trade (income terms of trade and commodity terms of trade) and trade balance for Turkey using Johansen cointegration and VECM Granger causality approaches. They confirmed a long run relationship between income terms of trade and trade balance; but no causality between the series. Bouakez and Kano (2008) used the present-value representation of current account which includes the HLM effect. The paper draws from Bergin and Sheffrin (2000)'s usual consumption-smoothing motive and the effects of future changes in interest rate and exchange rate by including the PVM. The method allows study of intertemporal substitution, and income and wealth effects associated with a change in world real interest rate, and its instantaneous effect on net foreign interest payments.

Hamori, (2008) investigated the relationship between terms of trade and trade balance using data from 19 African nations using the Pedroni (2004) panel cointegration method. They confirmed long run relation between the series. The results tended to validate the ML condition as income terms of trade have positive effect on trade balance. Wong (2009a) tested the HLM effect using the data from Korea, Hong Kong and Singapore. He found that an increase in terms of trade leads a decline in trade balance. A feedback hypothesis was found between income terms of trade and trade balance in Hong Kong and Singapore. Also, the trade balance Granger causes income terms of trade in Korea.

For Asian countries, Wong (2009b) examined the relationship between terms of trade and trade balance, but found that the effect of the former on the later varies across counties. They found that domestic demand, foreign income, terms of trade and oil prices appear to be major determinants of trade balance in short run as well as in long run.

Except Wong (2006)[2] most studies ignore the long run relationship between the above noted series; and use commodity terms of trade[3] which is a form of barter terms of trade. Appleyard and Field (2001) approximated the income terms of trade[4] by the ratio of exports value to import price. They claim that income terms of trade is a better measure of terms of trade compared to commodity terms of trade because the former can rise faster relative to the latter. Commodity terms of trade focuses on the relation between export price and import price; while income terms of trade quantifies the trend of export-based capacity of a country to imports of goods. The high value of commodity terms of trade implies that price of exports is high relative to import price. However, the direction of causality between commodity terms of trade and income terms of trade may not imply the same thing. An increase in the price of exports relative to import could lead to higher commodity terms of trade but income terms of trade could worsen if offset by a decline in quantity of exports.

The rest of the paper is structured as follows. Section 2 provides a historical background of the trade balance in Bangladesh; followed by methodology in section 3. Section 4 reports empirical results, and section 5 draws conclusion based on the findings.

[2] Wong 2009a and 2009b also explores long run relationship, in addition to the HLM effect.
[3] It is defined as export price divided by import price.
[4] It is defined as export price multiplied by export volume and divided by import price.

2. Balance of Trade in Historical Retrospect

Bangladesh is a small developing country of with a population of 148.7 million (2010; World Bank) in the Indian sub-continent. The nation is heavily dependent on imports including food, capital machinery and oil; and has been facing persistent balance of payment deficit since its inception. Import and export play a major role in economic growth. Bangladesh was born out of the civil war in 1971 adopted a highly regulated economic system where financial, fiscal, commercial and industrial policies favored an inward-oriented trade policy. The policy of overvalued exchange rate regime proved very ineffective. In response to the rising tide of globalization, Bangladesh, like many others chose market oriented liberal economic policy. Since 1980's most of the trade and industrial policies were aimed at achieving higher export growth. Trade liberalization was initiated in the 1980's, but the policy did not gain momentum until the early 1990's, when tariff, non-tariff, and other quantitative restrictions were eased. Although still in red, trend in trade balance began to improve over time. The ratio of exports to imports and the trade gap declined during the last five years with some volatile years (Nusrat, 2008). A chronic trade deficit forced the nation to address the malady in the terms of trade. Regrettably, no serious academic study was undertaken in this area.

3. Data and Methodology

3.1 Sources of Data

Trade balance (TB_t) is defined as the ratio of real exports to real imports (value of exports/price of exports)/ (value of imports/price of imports) i.e. $(X_t / Px_t)/(M_t / Pm_t)$[5]. The value of exports and imports as well as the prices has been obtained from World

[5] See Wong, (2006)

Development Indicators (WDI-CD-ROM, 2011). Data on unit value of exports and imports has collected from International Financial Statistics (IFS-CD-ROM, 2011). Income terms of trade (TT_t) are defined as (X_t / Pm_t). All data is annual covers 1985 to 2011.

3.2 Methodology

3.2.1 Ng-Perron Unit Root Test

To test for non-stationarity we use Ng-Perron (2001) test statistics wherein GLS is applied to de-trend the series D_t^d. The critical values of the tests are based on those of Philip-Perron (1988) Z_α and Z_t statistics, Bhargava (1986) R_1 statistics, and Elliot, Rotherberg and Stock (1996). The following annotations are used:

$$k = \sum_{t=2}^{T} (D_{t-1}^d)^2 / T^2 \qquad (2)$$

The de-trended GLS tailored statistics is given by:

$$MZ_a^d = (T^{-1}(D_T^d)^2 - f_\circ)/(2k)$$

$$MZ_t^d = MZ_a \times MSB$$

$$MSB^d = (k / f_\circ)^{1/2}$$

$$MP_T^d = \begin{cases} (\bar{c}^2 k - \bar{c} T^{-1}(D_T^d)^2 / f_\circ, and \\ (\bar{c}^2 k + (1 - \bar{c}) T^{-1}(D_T^d)^2 / f_\circ \cdots \end{cases} \qquad (3)$$

3.2.2 ARDL Approach to Cointegration

Of the several methods used to explore along run relationship among macroeconomic series, the ARDL approach (Pesaran et al. 2001) is better suited in small samples. Also, the procedure applies irrespective of whether the underlying regressors are purely I(0), or I(1) or mutually cointegrated. The statistic is the familiar Wald or F-

statistic in a generalized Dickey-Fuller type regression, used to test the significance of lagged variables under consideration in the conditional unrestricted equilibrium error correction model (ECM) (Pesaran et al. 2001). In this paper, a long-run relationship between TB_t and TT_t is investigated in the form of the unrestricted error correction model (UECM) as follows:

$$\ln TB_t = \alpha_1 + \alpha_2 T + \sum_{i=1}^{m} \alpha_3 \Delta \ln TB_{t-i} + \sum_{i=0}^{m} \alpha_4 \Delta \ln TB_{t-i} + \alpha_{TB} \ln TB_{t-1} + \alpha_{TT} \ln TT_{t-1} + \mu_i \qquad (9)$$

$$\ln TT_t = \beta_1 + \beta_2 T + \sum_{i=1}^{m} \beta_3 \Delta \ln TT_{t-i} + \sum_{i=0}^{m} \beta_4 \Delta \ln TT_{t-i} + \beta_{TB} \ln TB_{t-1} + \beta_{TT} \ln TT_{t-1} + \mu_i \qquad (10)$$

where, $\ln TB_t$ and $\ln TT_t$ refer to the natural log of trade balance, TB_t and terms of trade, TT_t, T is a time trend, and η and μ are random error terms. The first part of the equations with α_3, α_4 and β_3, β_4 represents the short-run dynamics; and the second part α_{TB}, α_{TT} and β_{TB}, β_{TT} refer to the long-run phenomenon. The null hypothesis in equation (9) $\alpha_3 = \alpha_4 = 0$ implies no long-run relationship and conversely. Likewise, for ($\beta_3 = \beta_4 = 0$) in equation (10) .

In testing the null hypothesis of no cointegration under the ARDL approach we test the critical bounds. The calculated F-statistic is compared with the critical bounds from Pesaran et al. (2001); or from Narayan (2005) for small samples. In the present study we use the latter. If the F statistic exceeds the upper critical bound (UCB), the null hypothesis of no cointegration is rejected regardless of orders of integration of the regressors. If the computed F is lower than the LCB, the null hypothesis is sustained; and if F lies between the two bounds, the result is inconclusive. When the order of integration of the variables is known and all the variables are I(1), the decision is made based on the

UCB. Similarly, if all the variables are I(0), then the decision is made based on the LCB. For model selection, lag length is chosen based on Schwartz-Bayesian Criteria (SBC) and Hannan-Quinn (HQ) information criterion is used.

The Granger causality tests are conducted within the VECM. In terms of the Granger representation theorem, if the I(1) series are cointegrated then there must be Granger causality at least in one direction. Engle-Granger (1987) cautioned that if the Granger causality test is conducted in first difference within the vector autoregression (VAR) method, it can be misleading in the presence of cointegration. So, they suggest the inclusion of the lagged error-correction term to capture the long-run relationship. The augmented Granger causality test is formulated in a bi-variate p^{th} order vector error-correction model (VECM) as follows:

$$\begin{bmatrix} \Delta \ln TB_t \\ \Delta \ln TT_t \end{bmatrix} = \begin{bmatrix} k_1 \\ k_2 \end{bmatrix} + \sum_{i=1}^{p} \begin{bmatrix} d_{11}(L) & d_{12}(L) \\ d_{21}(L) & d_{22}(L) \end{bmatrix} \times \begin{bmatrix} \Delta \ln TB_{t-i} \\ \Delta \ln TT_{t-i} \end{bmatrix} + \begin{bmatrix} \gamma_1 ECT_{t-1} \\ \gamma_1 ECT_{t-1} \end{bmatrix} + \begin{bmatrix} C_1 \\ C_2 \end{bmatrix} + \begin{bmatrix} \eta_1 \\ \eta_2 \end{bmatrix} \quad (12)$$

where, Δ is a difference operator, ECT represents the error-correction term derived from long-run cointegrating relationship, C (i = 1, 2) is a constant and η (i = 1, 2) are serially uncorrelated random error terms with zero mean. The long-run causality is established if the t-statistic of the lagged ECT term is significant; while a significant joint F-statistic or Wald test suggests a short-run causality.

4 Findings

Table-1 reports the descriptive statistics and correlation matrix. Both the series are positively correlated and are highly significant for Bangladesh.

Table-1 Correlation Matrix and Descriptive Statistics

Series	Mean	Median	Maximum	Minimum	Jarque-Bera	Probability	$\ln TT_t$	$\ln TB_t$
$\ln TT_t$	21.1750	21.0937	21.9525	20.2811	1.5673	0.4567	1.0000	0.9227
$\ln TB_t$	-0.3086	-0.2274	0.1263	-0.7707	2.0498	0.3588	0.9227	1.0000

Although the ARDL approach works regardless of the series is *I (0)* or *I(1),* a formal test helps to insure that none is I(2) or beyond in which case the computed F-statistics of Pesaran et al. (2001) becomes invalid (Ouattara, 2004). The Ng-Perron (2001) unit root test results, reported in Table-2, show that both series are *I*(1).

Table-2 Unit Root Estimation

Ng-Perron Test at Level				
Variables	**MZa**	**MZt**	**MSB**	**MPT**
$\ln TT_t$	-4.1327	-1.2566	0.3040	20.1477
$\ln TB_t$	-5.0644	-1.4814	0.2925	17.4583
Ng-Perron Test at 1st Difference				
$\ln TT_t$	-21.7837**	-3.2994	0.1514	4.1882
$\ln TB_t$	-17.9086**	-2.9923	0.1670	5.08861
Note: ** shows the significance level at 5 percent.				

For purpose of ARDL, the total number of regressions estimated from equations-(9-10) is $(1+1)^2 = 4$. The critical bounds generated by Narayan (2005) are better suited for small samples. Our computed F-statistic is 8.396 (Table-3) which exceeds the UCB (8.265) from Narayan (2005) at the 5% level of significance. This confirms cointegration between the series over the period 1985-2011.

Table-3 ARDL Estimation for Cointegration

Dependent Variable		ARDL Bounds F-statistics
Lag Order 1	$\ln TB_t$ $\ln TT_t$	**8.396**** **1.276**
Critical Values	Narayan (2005)	
	Lower Bound	Upper Bound
1%	10.605	11.650
5%	7.360	8.265
10%	6.010	6.780
Diagnostic Test		
Test	F-statistic (Prob. values)	F-statistic (Prob. values)
χ^2_{NORMAL}	0.8208 (0.6633)	1.2573 (0.5333)
χ^2_{SERIAL}	0.0127 (0.9116)	2.2906 (0.1405)
χ^2_{ARCH}	0.0225 (0.8821)	0.7792 (0.3898)
χ^2_{HETERO}	1.7925 (0.2051)	0.5701 (0.8790)
χ^2_{RESET}	0.0363 (0.8514)	2.5616 (0.1153)
Note: ** shows significance at 5 % level of significance.		

The Income-terms of trade positively impacts balance of trade in Bangladesh. A 1 percent improvement in income terms of trade leads to 0.48 percent improvement in trade balance on average and is highly significant.

$$\ln TB_t = -10.5722 + 0.4847 \ln TT_t$$

(-12.0773) (11.7280)

R-Squared = 0.8514 D.W = 2.0842

$\ln TT_t$ explains 85 percent of variation in $\ln TB_t$ in terms of linear relation ($R^2 = 0.8514$). These findings contrast with those of Obsfeld (1982) who found negative impact of terms of trade on trade balance. Otto (2003) found that terms of trade shock improves trade balance initially but dissipates thereafter once shocks become stubborn.

The Granger causality test shows unidirectional causality runs from income terms of trade to trade balance in the long run. Thus, an improvement in income terms of trade in Bangladesh will lead to the improvement in the trade balance, and not the other way around. The estimated ECM_{t-1} term is negative and significant at the 5 percent level.

Table-6: VECM Granger Causality Analysis

Variables	Type of Causality				
	Short Run		Long Run	Joint Significance of Long-and-short Runs	
	$\sum \Delta \ln TB_{t-1}$	$\sum \Delta \ln TT_{t-1}$	ECT_{t-1}	$\sum \Delta \ln TB_{t-1}, ECT_{t-1}$	$\sum \Delta \ln TT_{t-1}, ECT_{t-1}$
$\Delta \ln TB_t$	…	2.7424*** [0.0913]	-0.5037** [-2.3433]	…	4.4948** [0.0160]
$\Delta \ln TT_t$	0.1559 [0.8567]	…	…	…	…
Note: The asterisks *** and *** denote the significance at 5 and 10 per cent levels.					

The speed of adjustment from the short to the long run is -0.5037, implying that the deviation is corrected by 50% each year. In the short run, income terms of trade

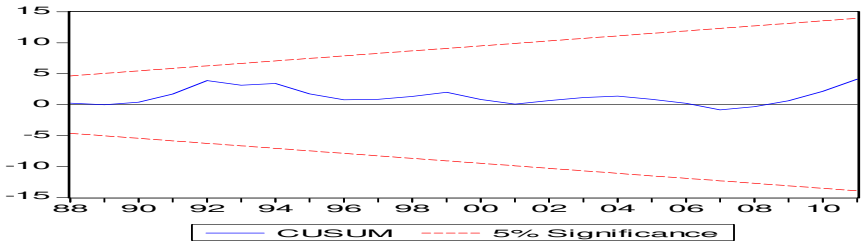
Granger causes trade balance. The joint causality analysis validates both short and long run causality. The findings are consistent with Wong (2009a) who also report that income terms of trade Granger causes trade balance in Korea and Singapore. Also unidirectional causality is found runs from trade balance to income terms of trade in Hong Kong.

4.1 Sensitivity Analysis

The model passes sensitivity against serial correlation, non-normality of errors, and autoregressive conditional heteroscedisticity. Ramsey Reset test shows that model is well specified. Cumulative sum (CUSUM) and cumulative sum of squares (CUSUMsq) tests on the recursive residuals are employed for stability of ARDL model. The tests show that the parameters lie within the 95% confidence bands, and thus are stable.

Figure 1

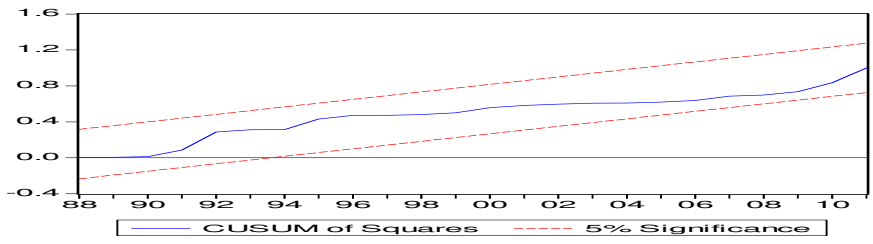
Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5% significance level.

Figure 2

Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5% significance level.

5. Conclusion and Policy Implications

This paper applies ARDL bounds testing approach to test the HLM effect which captures the relationship between income terms of trade and trade balance in Bangladesh. Annual data from 1980 to 2011 is used. Ng-Perron test confirms that the series are I(1). Using ARDL, and VECM model we find long run relation. Evidence supports unidirectional causality from income terms of trade to trade balance. Based on the findings it appears that Bangladesh should put emphasis on investment to boost domestic output to improve trade balance. Some studies indicate that real devaluations improve trade balance (Nusrat, 2008; for Bangladesh; Shahbaz, 2009 for Pakistan; and Wahid and Shahbaz, 2009 for the Philippines). Although Bangladesh operates under freely floating exchange rate system, the nation might be in better position to avoid a major shock -- domestic or international so long as it follows a policy of well-managed floating exchange rate. Bangladesh can learn useful lessons from the experiences of its relatively stronger neighbors such as, India, Sri Lanka, and perhaps Pakistan.

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