Working Paper

Understanding the impact of exchange rate adjustment on the Trade balance of selected Caribbean Countries

Shelly-Ann Wilson & Esmond Mclean[1]

July 2014

Abstract

This study investigates an adjustment process in the bilateral trade balances of five countries within the Caribbean, with their largest trading partner, namely the United States. Unlike previous studies, this study controls for oil prices which play a vital role in the countries' trade balances. A panel econometric technique was utilized using annual data over the period 1980-2012. Analysis of the autoregressive distributed lag (ARDL) approach reveals only limited adjustments in the trade balance to exchange rate changes both in the short- and in the long-run with some countries satisfying the Marshall-Lerner condition in the short-run. The bounds testing and error correction modeling suggests that the variables have long-run relationships with relatively slow adjustments after short-run deviations. The paper also considers the underlining policy issues of the usefulness of exchange rate as a tool for trade balance improvements.

JEL Classification: F31, F32, F41

Keywords: Trade Balance, exchange rate

[1] The views expressed are those of the authors and do not necessarily reflect those of The Bank of Jamaica.

Table of Contents

1.0 Introduction

Recent economic crises have underscored the need for a greater understanding of movements in the current account, its sustainability and its impact on economic growth. Developing countries have in recent times sought to find an appropriate policy response that would mitigate the impact of negative shocks to the current account, whilst maintaining stability within the wider economy.

The intertemporal approach suggests that current account deficits are the outcome of savings and investments decisions by all agents in the economy (Sachs 1981). With regards to the trade balance however, conventional wisdom suggests that an appreciation (depreciation) in the exchange rate will result in imports becoming cheaper (more expensive) relatively to exports which would have become more (less) expensive. The resultant effect of an appreciation (depreciation) would be higher imports and elevated levels of exports. Additionally, sources of current account deficits have been a focal point for policy makers and persons in academia particularly because changes in the current account are directly related to the behaviour of a country's exchange rate. Against this background, the current account is therefore a vital indicator of the net wealth of a country that forms part of the basis for policy adjustment. To this point there has been a debate in the literature that for some developing countries with relatively low levels of savings, some level of deficits in the current account may be unavoidable to facilitate growth.[2]

Devaluation to boost export competitiveness is a standard policy prescription which has worked in the past for countries such as China, Japan, Germany and Venezuela which have a vibrant export trade and have benefitted from these exchange rate adjustments.[3] However for countries such as the Caribbean who are heavily reliant on imports such that nearly half of all imports are needed as intermediate manufactured inputs and raw materials, may not profit from devaluation. Additionally, one has to consider the productive capacities of these small developing states that may not be able to meet the additional international demand for exports.

[2] See Blanchard & Milesi-Ferretti (2011)

[3] Since price is not the only factor that determines competitiveness devaluation may not yield the desirable results for Caribbean territories.

The aim of this paper is to evaluate the policy implications that an exchange rate adjustment may have on the current account of these Caribbean economies. Since, improvements in the real and financial sectors are vital for the sustainability of economic growth, current account and exchange rate concerns remain a fundamental issue as growth in income is usually associated with growth in imports which is determined by the exchange rate. As a result, much public debate has been geared towards the role of the exchange rate in determining a country's trade performance.

The paper is organized as follows: Section 2 presents the literature review while section 3 outlines the stylized facts on the selected economies. Section 4 gives a brief description of the data and the estimation technique employed. Section 5 presents the findings of the model, while the policy implications of the results and the conclusion are outlined in section 6.

2.0 Literature Review

Theories have claimed that there are merits to depreciating a country's currency. Among those are the Elasticity Approach which states that devaluation can improve the balance of trade if the total of the price elasticities of domestic and foreign demand for imports is greater than one (Nasir, Chowdhury & Mridha, 2009). When a county devalues its currency, it improves the Balance of Payments under ideal conditions known as the Marshall-Lerner condition. Devaluation causes the price of imports to rise relative to exports which, in theory, will increase the global competitiveness of domestic products (Kandil and Mirazaie, 2005). However for increased demand to occur, exports must be elastic. Some theories posit that devaluation may result in a J-curve effect, that is, an initial worsening in the short-run followed by an improvement (Kulkarni and Clarke, 2009). Review of the literature would indicate inconclusive evidence concerning the impact of depreciation on trade balance, both in the short- run and in the long-run. Rose and Yellen (1989), used disaggregated bilateral trade data the US and UK, the US and Japan, and similarly for the rest of the G-7 countries while Rose (1991) used aggregate real trade data for five OECD countries. Both papers employed Engle and Granger (1987) cointegration techniques but found no evidence of the M-L condition. Bahmani-Oskooee and Ratha (2004) also found that the short-run adjustment process of the trade balance to exchange rate depreciation is typically not significant. On the other hand, J-curve effects were identified in

developed countries in studies such as Marwah and Klein (1996) and Shrivani and Wilbrate (1997) who identified significant short- as well as long-run responses of trade balances to depreciation. It should be noted that studies such as Bahmani-Oskooee and Brooks (1999) and Bahmani-Oskooee and Tatchawan (2001) identified some type of adjustment in the trade balance following currency depreciation using modern approaches like the auto-regressive distributive lag (ARDL) models.

Several empirical studies have utilized theoretical framework to examine the determinants of current accounts and trade balance. Some have only focused on advanced and emerging market countries while others have incorporated less developed and developing countries.
For example, Debelle and Farquee (1996) used cross-sectional data and panel data from advanced economies to ascertain the factors that affect current account balances. They found that in the cross-sectional approach, stages of development and demographics have a significant impact on current account positions while in the panel approach, deterioration in a country's fiscal position is associated with a weakening of the current account. Boyd, Caporale and Smith (2001) measured the effects of real exchange rate on the BOP using structural cointegrating Vector Autoregressive Distributed lag (VARDL) models. They used quarterly data for eight OECD countries with variables: domestic and foreign output, the balance of trade data and the real exchange rate. The overall results show that the ML condition holds in the long-run with some degree of J-curve effects in the short-run for France and Germany. Additionally, they found that for countries such as Canada, Italy, Japan, Netherlands, UK and the USA.[4] Likewise, Lee and Chin (2006) found that there exists a positive relationship between the Real Effective Exchange Rate (REER) and current account balances of most of the G7 countries and concluded that the relationship between the REER and the current account can differ based on the source of shocks to each variable.

Oyinlola, Adeniyi and Omisakin (2010), in using ADRL models for import demand and export supply, found that the sum of the estimated price elasticitiess of imports and exports in Nigeria exceeds unity indicating that the ML condition holds. On the other hand, Gangal and Agarwal

[4] This is known as an L-effect, the opposite of the J-curve effect, where there is an initial improvement in the trade balance after a depreciation followed by a long-run worsening.

(2013) found no evidence of significant relationship between the REER and the CAB of India. They conclude that only through increased productivity can a REER adjustment cause a significant change in the current account position. Other research such as Bahmani-Oskooee and Kara (2008) used data from 12 developing countries of Columbia, Greece, Hong Kong, Hungry, Israel, Korea, Pakistan, Philippines, Poland, Singapore, South Africa and Turkey to test the responsiveness of trade flows to changes in the exchange rate. Here they found a negative significant exchange rate for Columbia, Pakistan, the Philippines, Poland and Turkey which suggests that for these countries, currency depreciation is expected to stimulate their exports. Additionally, the authors found that response times of trade flows to changes in the prices and nominal exchange rate depreciation is country specific with no general pattern.

In another study, using data for 44 developing countries, Calderon, et al (2002) adopted a reduced form approach to modeling current account balances. They estimated two region models, one that focused on country-specific factors such as domestic output growth and private and public savings while the other captured cross-country effects which include terms of trade and the REER. Results show that an increase in domestic growth rate leads to an increase in the deficit for countries with low growth rates and a 10% depreciation of the REER lead to an improvement in the current account balance. Furthermore they also found a negative relationship between the CAD and both inflation uncertainty and public savings.

Although extensive literature exists on exchange rate impact on trade flows and CABs, there is limited research on this phenomenon in Caribbean economies. Brown and Williams (2007) studied the determinants of CADs in Jamaica using imports, tourist arrivals and remittances and estimated demand functions for those variables. They modelled the current account using the Real Effective Exchange Rate (REER) both in its composite form and as a disaggregation of relative prices and employed a Vector Error Correction Model (VECM) which traces the long run income and relative price elasticities for each variable. Results of the study indicate that increases in foreign income positively influences tourist arrivals in Jamaica and that increases in raw material imports is positively related to increases in domestic income. Both can have significant impact on the current account deficit with the former causing a decrease in the deficit and the latter causing a deterioration. Henry and Longmore (2003) also examined the

relationship between Jamaica's REER and the current account, particularly the trade account and tourism services. The results suggest that in the short-run there was no significant relationship between the REER and the three major categories of imports – consumer goods, raw material and capital goods. Furthermore, they found that altering the REER to reflect industry prices did not result in significant changes to the volume of Jamaica's main exports namely alumina, bauxite, sugar and banana. Their analysis showed that in the long-run the trade balance and by extension the current account will not improve given a depreciation of the currency as posited by the Marshall-Lerner condition.

3.0 Data

The paper utilized a balanced panel of 160 annual observations from five developing countries over the period 1980-2012. The sample of countries represents small developing islands in the Caribbean region. The selection was based on similarity in the levels of openness as well as similar trade patterns. Those countries included Jamaica, Guyana, Barbados, Dominican Republic and Trinidad and Tobago. The data was obtained from several sources including the World Bank, the IMF, World Trade Organization as well as the various central banks. A description of each variable and their sources as well as graphs depicting the relationship between the REER and the trade balance can be found in Table 1 and Figures 1 in the appendix.

Goldstein and Khan (1985) indicated that the use of real exchange rates may yield insignificant estimates due to feedback effect generated from depreciation to domestic price, as a result both the nominal and real measures of exchange rates will be employed in the empirical investigation. The nominal bilateral exchange rates are the principal/official rate and are measured as domestic currency per US dollar. The real exchange rates are constructed as the product of bilateral nominal rates and the US CPI divided by the domestic CPI.

Trade denotes the value of merchandise goods measured in US$B. The measure of domestic and foreign income is the Gross National Income quoted in US$. Lastly, the West Texas Intermediate variable is used as a proxy of world oil prices and it represents the end of period dollars per barrel of oil measured in US$. As normal, the variables were transformed into log-linear form with 2005 as the base year. A dummy is included for the periods 2007-2009 to account for

structural breaks caused by the world recession. It takes on a value of 1 for the period 2007-2009 and 0 otherwise.

4.0 Stylized Facts

4.1 Jamaica

Jamaica over the last couple of years has experienced persistent current account deficits (CAD) averaging around 10% of Gross Domestic Product (GDP) since 2005. This has been largely attributed to fiscal imbalances and low external competitiveness. In Jamaica, CAD is reflected through deficits in the trade balance and income accounts which are partially offset by surpluses in the services and transfer balance. The large negative trade balance which accounts for the largest portion of the current account deficit is generally attributed to weak export growth and a high import bill with the main import product being oil. At the fourth quarter of last year Jamaica's import bill amounted to US$ 1428.3 million while only US$ 366.5 million worth of goods were exported from the country which meant a negative trade balance at the beginning of the year. Oil importation accounts for the largest share of imports with a recorded figure of US$533877. Over 90% of our electricity consumption is obtained from oil which must be imported. Food and machines and transactions were the second and third largest import goods coming into the country. Jamaica's current account deficit at the end of that quarter was approximately US$420.3 million. Since Jamaica has not so far been able to find cheaper sources of alternative energy and the country's productivity capacity is not able to meet the local demands for certain products, imports are necessary and as the demand grows the deficit is likely to get wider.

4.2 Guyana

Gr owing CAD was also observed in the case of Guyana. It has worsened significantly over the years increasing from US$144.30 million in 2010 to US$231.9 million in the 2nd quarter of 2012. The deterioration has been due to rising trade deficits on account of the economy growing from a low economic base and negative service balance (Economic Commission for Latin America and the Caribbean 2012). Merchandise trade deficit amounted to US$367.3 million at June end 2012 coming from US$ 287.59 at end of June 2010. This was mainly on account of a US$ 87.9 million increase in imports which surpassed the US$48.9 million growth in exports for

that period. Exports are concentrated in the sugar, gold and bauxite industries and while petroleum capital equipment and consumer products account for the bulk of imports. Total export receipts amounted to US$582.1 million, a 9.2 per cent more than what was recorded in the 2nd half of 2011 while total merchandise imports amounted to US$949.4 million at the end of the June quarter. The current account deficit has also been attributed to the negative service balance which at the end of the June quarter 2012 amounted to US$118.5 million coming from US$74.5 million for the corresponding period in 2011. This was attributed to lower net inflows of portfolio investment and higher payments for non-factor services. The transfer balance however, which partly offsets the CAD, recorded an increase of US$37.9 million to US$253.9 million in June-end 2012. This was a 17.6 per cent increase from the corresponding period 2011 (Bank of Guyana Half year Report, 2012).

4.3 Barbados

Barbados current account has fluctuated over the years with greater periods of deficits (Greenidge, Holder and Moore, 2009). From 1997 to 2012 current account deficit has persisted with 2008 recording an alarming figure of BDS$973 million increasing from BDS$499.3 million in 2007 (ECLAC, 2012). There was further widening of the deficit in 2011 when it rose to BDS$731.8 million from BDS$517.4 million in 2010. This was attributed to an increase in the trade deficit which resulted from an increase in the import bill of BDS$3.1 billion from BDS$3.013 billion in the previous year. Additionally, inflows from tourism fell by 6.3 per cent (ECLAC, 2012). In 2012 however, the CAD narrowed to BDS$498.9 million, a 5.7 per cent of GDP compared to a deficit of 8.7 per cent in 2011. This was largely attributed to a 7.9 per cent reduction in imports. Data suggests that imports of consumer goods such as food and beverages, clothing and tobacco fell by BDS$148 million while imports of intermediate goods rose from 40 percent to 50 per cent of total imports due to higher oil prices in 2007. Exports grew by 5 per cent in 2012 which was predominantly driven by an increase in rum exports of BDS$12 million. Exports to GDP have trended upwards from 5.2 per cent in 2009 to 6.9 per cent in 2012 (Central Bank of Barbados Economic Review, December 2012). Like other Caribbean islands, Barbados export mostly services which accounts for 70 percent of GDP, 80 per cent of exports and 75 per cent of employment (Jessen and Vignoles, 2004).

4.4 Trinidad and Tobago

Unlike other Caribbean countries, Trinidad and Tobago is endowed with energy resources such as oil and gas which plays a dominant role in the country's export performance and thus its current account balance. Like Barbados, Trinidad's current account balance has fluctuated over the years but has recorded persistent surpluses since 1999 to present (IMF database). It recorded a deficit at the end of 1982 until 1985 when it acquired some improvements after the devaluation of the currency. The current account then remained in deficit between 1986 and 1989 until 1990 when it registered a surplus for the first in 10 years. This was attributed to immense fuel exports and decreasing imports (Jordan and Stanford, 2005). In 2010, the surplus increased to US$ 4.173 billion accounting for 20 per cent of GDP and an estimated 21 percent in 2011 (US$2.898 billion) up from 8 percent in 2009. This stemmed mainly from the improvement in energy prices and a recovery in non-energy exports. However, in 2012, merchandise trade declined. Exports had fallen by 13 per cent to $US12983.30 million from US$14943.90 million in 2011 while imports fell by 5 per cent to US$9064.98 million from US$9510.95 million in the previous year which led to a fall in the current account surplus to US$1.323 billion (Central Bank of T&T database).

4.5 Dominican Republic

CADs have persisted in the Dominican Republic since 1980 until 2012 with only two surpluses recorded in 2003 and 2004 of US$1.036 billion and US$1.034 billion, respectively (IMF database). In 2012, the deficit stood at 7.2 per cent of GDP, a fall from the previous year's 7.9 per cent which was an account of an improvement in the trade balance (ECLAC, 2013). The recorded figure was US$4.012 billion coming from US$4.391 billion in 2011. Trade balance fell from US$8916.4 million in 2011 to US$8670.3 million in 2012 owing to export growth of US$577 million (Central Bank of Dominican Republic database). Unlike the trade balance, the services balance showed a surplus of US$3489.9 million, a 9 per cent increase compared to 2011. Driving this growth was an increase in travel which stood at US$5759.4 million in 2012.

5.0 Methodological Framework

This paper employs panel analysis to estimate the bilateral trade relationship between the US and the five developing countries. Bilateral trade data was used on the grounds that it reduces measurement errors caused by biases in aggregating the data (Rose and Yellen 1989) and the estimation of bilateral trade equations allows for the differences in the composition of trade across trading partners and yields estimates which are more relevant for country specific trade policy analysis than those obtained from multilateral trade equation (Bahmani-Oskooee and Goswami, 2003). The US was used as it was the countries' main trading partner in imports as well as exports. Each observation represents a particular country at a particular point in time. The procedures are outlined as follows:

6.0 Model Specification

The models used in this study are conventional formulations previously employed in other studies. Here, we try to derive the short and long-run responsiveness of trade balance to a change in the exchange rate. The reduced form of the trade equation is as follows:

$$TB_{jt} = \beta_0 + \beta_1 Yd_{jt} + \beta_2 Yf_t + \beta_3 E_{jt} + \beta_4 WTI_t + \varepsilon_t \qquad (1)$$

Where TB denotes the measure of bilateral trade balance constructed as the ratio of the value of exports to imports[5]. Based on this construct, an increase in the ratio would signal an improvement in the trade balance and a decrease would indicate a deterioration in the balance. Yd and Yf are the measure of domestic and foreign income, respectively. The bilateral exchange rate is denoted by E and is the period average selling rate. The rate is measured such that an increase represents a nominal depreciation of the domestic currency while a decrease would represent an appreciation. The WTI is the West Texas intermediate as a measure of oil prices.

The M-L condition is assumed to be met if the long-run coefficient on β_3 is positive and significant. However, if the trade balance exhibits a J-curve pattern, following a depreciation the trade balance will initially worsen, that is, β3 will be negative in the short run followed by a

[5] This construct of the trade balance has been used in studies such as Bahmani-Oskooee & Kantipong as it enables the trade balance to be expressed in logarithmic form and is insensitive to units of measurement. See also, Bahmani-Oskooee and Alse (1994).

positive and significant value. There is no apriori sign expected for the domestic income (Yd). A negative relationship will be observed between trade balance and domestic income as an increase in a country's income boosts their imports. The relationship can however be positive if the increase in income is due to an increase in the production of import substitute goods (Bahmani-Oskooee, 1986). By the same token, we can expect either a positive or negative relationship between trade balance and the income of the country's trading partner. Finally, the sign on the coefficient of oil price is expected to be negative for oil importing economies as an increase in oil price is expected to result in an increase in the value of imports which, all else remaining constant, would lead to a worsening of the trade balance.

7.0 Econometric model

Following previous work we employ the ARDL model of cointegration to test our model. This approach was first introduced by Pesaran and Shin (1999) and extended by Pesaran et al. (2001). The ARDL model is considered an ideal technique for small samples and is useful in capturing the dynamic adjustment process through lagged independent variables. Cointegration can be applied irrespective of the order of integration of the variable and the long-run and short-run coefficients of the model are estimated simultaneously. Consistent with the extant literature, we outline the following model:

$$\Delta lnTB_{j,t} = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} \Delta lnYd_{j,t-i} + \sum_{i=1}^{n} \alpha_{2i} \Delta lnYf_{t-i} + \sum_{i=1}^{n} \alpha_{3i} \Delta lnE_{j,t-i} + \sum_{i=1}^{n} \alpha_{4i} \Delta lnWTI_{t-i} + \sum_{i=1}^{n} \alpha_{5i} \Delta lnTB_{j,t-i} + \beta_1 lnYd_{j,t-1} + \beta_2 lnYf_{t-1} + \beta_3 lnE_{j,t-1} + \beta_4 lnWTI_{t-i} + \beta_5 lnTB_{j,t-1} + e_t \quad (2)$$

Where:

Δ is the first difference operator

α_0 is the drift term

e_t is the white noise process

$\beta_1 - \beta_3$ corresponds to the long-run relationship

$\alpha_1 - \alpha_3$ corresponds to the short-run dynamics

ln represents the natural logs

The long run estimate in this formulation is $\beta_{1-4}/-(\beta_5)$. The ARDL is performed by applying the bounds testing procedure of cointegration as outlined in Pesaran, et al. (2001) then estimating an error correction model (ECM). The cointegration procedure is based on the (Wald-test) F-test with a null hypothesis of no cointegration:

$$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$$

$$H_1: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq 0$$

Two critical values are given by Pesaran et al. (2001) for the cointegration test. The lower critical bound assumes all the variables are I(0) meaning that there is no cointegration relationship between the examined variables while the upper bound assumes that all the variables are I(1) and are cointegrated. If the F-statistic is greater than the upper bound critical value, then the H_0 is rejected (the variables are cointegrated) while if it is below the lower bound critical value, then the H_0 cannot be rejected (there is no cointegration among the variables). It should be noted that if F-statistics falls between the lower and upper bound, then the results are inconclusive. In such an instance, following Kremers, Ericsson and Dolado (1992) and Banerjee, Dolado and Mestre (1998), if a negative and significant error correction term is attained the variables are said to be cointegrated.

The error correction version of ARDL model related to equation (2) is outlined below:

$$\Delta lnTB_{j,t} = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} \Delta lnTB_{j,t-i} + \sum_{i=1}^{n} \alpha_{2i} \Delta Yd_{j,t-i} + \sum_{i=1}^{n} \alpha_{3i} \Delta Yf_{t-i} + \sum_{i=1}^{n} \alpha_{4i} \Delta E_{j,t-i} + \sum_{i=1}^{n} \alpha_{5i} \Delta WT_{t-i} + \gamma EC_{t-1} + u_t \quad (3)$$

Where:

Υ is the speed of adjustment parameter

EC is the residuals that are obtained from the estimated cointegration model

u_t is the error term

8.0 Results

8.1 Test of Stationarity

The Levin-Lin-Chu (LLC, 1993) and the Im-Pesaran-Shin (IPS, 1997) stationarity tests were utilized to test the order of integration for each variable. These tests were selected on the basis that individual unit roots tests such as the Dickey-Fuller and Phillips Perron have limited power hence the need for more robust testing procedures. Both procedures test the variables under the null hypothesis that they contain unit roots against the alternative that they are stationary in levels. The LLC test makes the assumption that the autoregressive parameter is homogenous for all cross-sectional units in the sample while the IPS is not as restrictive as it allows for heterogeneous coefficients. The LLC has great power if the time dimension T is large but low power for a small T hence, for concreteness we will analyze the outcome of both the LLC and IPS unit root tests.

Based on the IPS test, domestic GNI, the RER and the WTI price showed persistence which gave them their I(1) time series properties while the others were difference stationary. It should be noted that where the test results differ, the IPS test is chosen over the LLC test. The Table below displays the results:

Stationarity Results

Variables	Order of integration	
	LLC	IPS
GNI	I(1)	I(1)
US GNI	I(0)	I(0)
Trade Bal.	I(0)	I(0)
RER	I(0)	I(1)
WTI	I(1)	I(1)

8.2 Empirical Findings

A Vector Auto Regression (VAR) was formulated to determine the appropriate lag length. We report on the Schwarz Information criterion which selected one lag out of a maximum of five.

With the selected lag orders, equation 2 was estimated for each country using both the nominal and real exchange rates. Report is made only on the formulation with the real exchange rate as the results are more robust and the estimates appear to make more economic and statistical sense. Results for the nominal measure of exchange rate can be found in Tables 5 and 6 in the appendix. Of particular interest are the signs and statistical significance of the exchange rate coefficient which measures the impact of a depreciation/devaluation on the trade balance.

Results of the bounds testing procedure are reported in Table 2 below. It can be seen that for countries such as Barbados, Trinidad, Guyana and Jamaica, the calculated F-statistic was greater than the upper bound critical value suggesting that the variables in the equation had long-run relationships. The inference was however inconclusive for Dominican Republic. As a measure of robustness, we use the long-run coefficient estimates from the ARDL to form a lagged error-correction term, ECM_{t-1}. Having replaced the linear combination of the lagged level variables in equation (2) by ECM_{t-1}, we re-estimate the model, imposing the optimal number of lags. A significant negative coefficient for ECM_{t-1} provides additional and stronger support for cointegration. The results for the error correction version of the ARDL are found in Table 3. As shown, the estimates of all five error correction parameters are found to be significant with the expected negative signs at all conventional levels of significance, supporting the conclusion of the bounds test. Notwithstanding the inconclusive finding for Dominican Republic, error correction modeling showed that there exists some long-run equilibrium. The small magnitudes of the estimates suggest that after a short-run deviation, the variables adjust slowly back to their long-run equilibrium.

Table 2: Results of F-test for Cointegration[6]

Countries	F-statistic	Decision
Barbados	4.838	Cointegration
Trinidad	4.219	Cointegration
Guyana	8.606	Cointegration
Jamaica	4.542	Cointegration
Dominican Republic	2.63	Inconclusive

Short Run Dynamics

The existence of a long-run steady-state relationship highlights the appropriateness of the ARDL approach. Table 3 below gives the coefficients of the estimated model. The short-run coefficients indicate the short-run dynamic effects of the variables on the trade balance.[7] The sign of the exchange rate coefficient determines the existence of the J-curve pattern that is, an initial negative sign followed by a positive sign. The contemporaneous coefficients proved to be insignificant with very low R-squares reported hence the model was estimated with only one (1) lag. Additionally, the results showed that the ARDL estimates yield no clear J-curve pattern as the inclusion of more lags led to the short run estimates becoming largely insignificant. Hence, only one lag was used as indicated by the SIC criterion.

Analysis showed that the short-run coefficient on ΔLRER for Barbados, Trinidad and Dominican Republic were insignificant indicating that exchange rate movement in the short-run may not have any implication for trade policy and thus the M-L condition does not hold. This is consistent with general findings of Bahmani-Oskooee and Ratha (2004) who found that the short-run adjustment process of trade balance to exchange rate depreciation does not follow any specific pattern and is typically not significant. Furthermore, Rose and Yellen (1989) and Rose (1991), not only found that the trade balance does not improve after depreciation, but also found

[6] With 5 regressors (k = 5), an intercept and no trend, the 5% critical value bound of the F-statistic is 2.62 and 3.79.
[7] Since Barbados has a fixed exchange rate regime, coefficients could not be estimated using the nominal exchange rate

no statistical relationship between the two variables.[8] On the other hand, both Guyana and Jamaica showed signs of improvement in their trade balance following a depreciation which is indicative by the positive significant sign on the exchange rate in the short-run. It should be noted that the real exchange rate for Barbados, Trinidad and Dominican Republic, though insignificant, also carried a positive sign.

World oil price carried a positive sign in most cases, except for Barbados and is significant in the results for Jamaica and Guyana. The implication being that for these oil-importing economies terms of trade shocks emanating from an increase in the price of oil would result in a sharp contraction in the volume of the commodity demanded such that the trade balance would improve in the short-run.[9]

Domestic income was mostly insignificant and varied in signs. The coefficient was however positive and significant for Jamaica indicating that increase in domestic income improves the trade balance in the short-run. This is similar to results obtained by Bahmani-Oskooee (1986) who posited that the improvement in trade balance following a rise in domestic income can be explained by the production of import substitute goods resulting in fewer imported goods. Income in the US only showed significance for Guyana and carried the expected positive sign. This likely reflects the sensitivity for the demand for the country's exports, including gold, which increasing income in the United States improves. Finally, evidence of a structural break for the recent downturn in the global economy was observed for Guyana as indicated by the significant dummy variable.

[8] Wilson (2001) posited that the presence of insignificant short-run relationships may be as a result of the size of developing countries. Since small countries are price takers, elasticity of their imports and exports infinite hence, the price and imports and exports coated in international currency will be constant.

[9] Oil prices was excluded from the model for Trinidad as the LM test revealed that it was redundant and therefore inclusion of it would result in inefficient estimates

Table 3: Short-run Dynamics

	Dependent variable : LTB				
	Countries				
Regressors	Barbados	Trinidad	Guyana	Jamaica	Dom Rep
ΔLTB_{t-1}	0.238	-0.024	0.298	-0.14	0.017
	(1.421)	(-0.103)	**(2.529)****	(-0.941)	(0.081)
$\Delta LRER_{t-1}$	0.528	1.032	0.035	0.477	0.106
	(0.324)	(1.219)	**(2.955)*****	**(3.178)*****	(0.856)
ΔLUS_GNI_{t-1}	2.046	-1.304	1.65	1.214	-0.094
	(1.507)	(-0.573)	**(2.117)****	(1.446)	(-0.060)
$\Delta LGNI_{t-1}$	-0.563	-0.179	-0.015	0.689	0.103
	(-0.723)	(-0.558)	(-0.165)	(3.719)***	(0.606)
$\Delta LWTI_{t-1}$	-0.129	-	0.188	0.158	0.071
	(-1.576)	-	**(2.296)****	**(2.207)****	(0.757)
DUM	-0.079	-0.137	-0.101	0.008	-0.095
	(-0.679)	(-0.849)	**(-2.42)****	(0.108)	(-1.254)
ECT_{t-1}	-0.676	-0.695	-1.219	-0.623	-0.686
	(-3.871)***	**(-2.980)*****	**(-3.483)*****	**(-2.897)*****	**(-2.528)****
Adjusted R^2	0.379	0.307	0.641	0.439	0.126
SC	-0.558	0.387	-1.569	-1.22	-0.887
DW	2.348	2.052	2.291	2.285	1.971

***, **, * represents 1%, 5% and 10% significance respectively
T-statistics are in parentheses

Long-run estimates

The results of the long-run estimates indicate that for all the countries, the coefficient on the exchange rate changes from positive to negative but are only significant for Trinidad, Guyana and Jamaica (see Table 4 below). Our findings appear to be similar to those found in Boyd et al (2001) who observed an L-effect (the converse to the J-curve effect) of exchange rate depreciation on the trade balance of 6 OECD countries. This implies that improvement in the

trade balance following depreciation of the exchange rate is not sustainable as in the long-run, the balance eventually deteriorates. Note that for Trinidad, the relationship was not significant in the short-run inferring that exchange rate depreciation will only affect the trade balance in negatively in the long-run.

A negative significant coefficient on oil price in the long-run can be seen for all the countries in the model. The results for Jamaica and Guyana would indicate that an improvement in the trade balance following an increase in oil prices is not sustainable as the trade balance showed signs of improvement but then worsened in the long-run. Domestic income was not significant in any of the countries while income in the US was only positively significant in Trinidad.

Overall, depreciation in the exchange rate signaling an increase in competitiveness will have a dual effect on a country's trade balance. Firstly, given that similar to most developing countries, the countries in this study are price takers. As a consequence, depreciation of the real exchange rate will result in competitive gains by producing agents resulting in increased profitability as local cost which is fixed in the short-run will become a relatively smaller proportion as compared to the foreign currency revenue when converted in local currency. At this point, producing agents may reinvest these profits to export more resulting in an increase in exports and an improvement in the trade balance in the short-run. For the long-run however, rising local cost due to increased cost of inputs will erode competitive gains resulting in a contraction in exports and a negative impact on the trade balance. Secondly, from the import side, a depreciated currency may have a price effect as consuming agents will respond to the increasing prices by temporarily reducing their consumption of imported items, contributing to an improvement in the trade balance in the short-run. In the long run however, this is not sustainable as without strong import substitutability, consuming agents will revert to their original consumption patterns demanding more imports and thus contributing to deterioration in the trade balance.

Table 4: Long-run estimates[10]

Countries	Dependent variable: LTB			
	Regressors			
	$LRER_{t-1}$	$LGNI_{t-1}$	$LUSGNI_{t-1}$	$LWTI_{t-1}$
Barbados	-0.006	1.244	-1.76	-0.34
	(-2.92)	-1.09	(-1.64)	(-2.52)**
Trinidad	-2.81	-0.85	4.71	-
	(-2.21)**	(-1.72)	(2.37)**	-
Guyana	-0.03	0.02	0.02	-0.24
	(-2.90)***	-0.35	-0.35	(-4.91)***
Jamaica	-0.086	-0.009	0.07	-0.17
	(-2.19)**	(-0.066)	-0.199	(-2.57)**
Dom Rep	-0.007	0.006	-0.04	-0.192
	(-0.104)	-0.04	(-0.103)	(-1.74)*

***, **, * represents 1%, 5% and 10% significance respectively
T-statistics are in parentheses

9.0 Diagnostic and Robustness Analysis

The Durbin –Watson test statistic indicated that the residuals were serially uncorrelated. In the presence of heteroskedasticity use was made of White's diagonal standard errors and covariance which is robust to all forms of heteroskedasticity, but not robust for any type of correlation over time of across cross-section (See table 3). The normality test indicated that the residuals were normally distributed and were mostly well-behaved. Test of endogeneity of the independent variables were also conducted using two methods. The first method involves regressing an instrumental variable with the other independent variables on the suspected endogenous variable and collecting the residuals. The predicted value is then calculated by subtracting the residual from the endogenous variable and placed back in the original equation after which a two-stage least square test is performed on the model. If the estimates are different from the OLS estimates then there is endogeneity. The second method is similar only that the residual is included in the original regression as an additional explanatory variable. The system is consistent if the Hausman residual (Hausman 1978) is not statistically different from zero (Davidson and MacKinnon, 1993). Following Henry and Longmore (2003) who performed an endogeneity test

[10] $Long-run\ estimates = \frac{\sum(long-run\ estimates)}{-(\sum estimate\ of\ long-run\ trade\ balance)}$

on the Real Effective Exchange Rate using Broad money as an instrument, we adopt the same procedure. Both procedures yield the same results that the RER is an exogenous variable

We test the robustness of our approach in three dimensions: the number of lags in the ARDL model and the inclusion or exclusion of certain variables. The omitted variable test revealed that remittances are relevant in the model for Jamaica. However, when included, the variable was insignificant both in the short- and long-run and the results is not significantly different hence it was left out of the model (see Panel A in the appendix). Also, results of the redundant variable test indicated that the WTI was a redundant variable for Trinidad and was therefore taken out of the model (see Tables 7 and 8). Correctly choosing the lag order is essential to the estimation of any time series or panel analysis. The SC criteria, on which we rely, selected one lag length however with the inclusion of three lags, most variables became insignificant. The same results occurred with 5 lags. The results can be seen in Tables 9 and 10 of the appendix.

Policy Discussion & Conclusion

10.0 Policy Discussion

The principal policy concern that arises from these observations is that the responsiveness of trade flows to exchange rate adjustments is a crucial issue in designing policies for these two macroeconomic variables given the size and openness of Caribbean economies. A correct policy response is twofold. For the short-run, currency depreciation may improve competitiveness in some of these economies resulting in an improvement in the trade balance. For the long run however, structural adjustments such as finding alternate energy sources to reduce energy cost is essential for continued improvements in the trade balance in the long run. Furthermore, reducing a trade deficit in the long run requires economies to achieve relatively low inflation with sufficient productive capacity to meet the domestic demand from consumers whilst sufficiently promoting exports through increased competitiveness. More specifically, the ability of an economy to achieve sustained growth in exports whilst meeting the challenge of imported goods and services depends critically on implementing effective supply-side policies juxtaposed on a period of low inflation, low interest rates and a competitive exchange rate matched with sufficient non-price competitiveness in overseas markets. Against this background, governments may employ supply side policies which aim at improving the productivity and competitiveness

of the economy which may result in export becoming more attractive. More specifically, countries may institute policies which encourage local businesses to seek and exploit opportunities in export markets overseas.

Additionally, countries may gear their policies to focus on resources in industries where there exists a comparative advantage, are exportable and in high demand. Furthermore, policies should also focus on encouraging industries to invest in research in innovation of existing production techniques and development new products aimed at potentially high growth markets with high income elasticities. Also, policies should aim at encouraging countries to employ more aggressive marketing strategies with the aim of gaining greater market share in global markets.

Whilst conventional economic wisdom may encourage deflationary fiscal and monetary policies, this is not most efficient. On the monetary side, deflationary monetary policy through higher interest rates whilst reducing demand may also result in an appreciation of the exchange rate and a worsening of the deficit. On the fiscal side, whilst higher tax rates may result in a reduction in the consumer's disposable income leading to a decline in consumer spending and less spending on imports, this may also have the undesirable effect of fomenting an economic slowdown. Alternatively, countries should instead focus on fiscal consolidation which seeks to improve the efficiency of tax collection through broadening the tax net. This may result in an increase in tax inflows which would provide resources for governments to implement further export growth strategies such as export subsidies and investment tax allowances. A combination of all these policies augurs well for sustained improvement in a countries trade balance in the long-run.

11.0 Conclusion

Conventional wisdom dictates that devaluations is associated with improvement in trade balances given that the trade elasticities satisfy the Marshall-Lerner condition however much controversy surrounds the size of these elasticities with mixed evidence which usually stems from inappropriate statistical or theoretical framework. This paper is designed to test the concepts of the M-L condition and the J-curve and discuss the policy that would target this relationship. We examined the long and short-run bilateral relationships between trade balance of merchandise goods and the real exchange rate using data from Jamaica, Barbados, Trinidad, Guyana and Dominican Republic and their major trading partner, the US, on an annual basis

over the period 1980-2012. Based on the partial reduced form model of Rose and Yellen (1989) derived from the two-country imperfect substitute model, this paper uses the bounds testing approach to cointegration. Overall, the results point to the several conclusions that follow.

The ARDL bounds test revealed evidence of cointegration for 4 out of the 5 countries, except for Trinidad, verifying the presence of a long-run equilibrium relationship between bilateral trade balance domestic income, foreign income, oil price and the real exchange rate. Together with this result, all the negative and significant error correction terms found in our study confirm the existence of strong cointegration relations among the variables in all cases.

We also document that in the case of Jamaica and Guyana adjustments in the real exchange rate as well as oil price has similar effect on the balance of trade in these two countries. The M-L condition seems to have been met in the short-run as the real exchange rate carries a positive and significant coefficient, implying that a depreciation of the real exchange rate will lead to improvement in the bilateral trade balance with these countries in the short-run. Similarly, oil price for these countries carried a positive and significant coefficient further indicting improvement in the short-run trade balance. The results however do not persist in the long-run as evidence from Jamaica, Guyana and Trinidad suggest that depreciation will eventually lead to deterioration in the trade balance in the long-run. The initial positive response of the trade balance to exchange rate and oil price changes is attributed to cutbacks in overall imports and the import of oil respectively nevertheless the heavy dependence of imported raw material and essential consumer items causes agents to revert to their usual consumption patterns which will eventually boost the value of imports hence a worsening of the balance. On the export side, producers will be faced with higher production cost due to increase in raw materials like oil and may either increase the cost of their products or cut back on supply. Either way, the trade balance will worsen as foreigners will demand less of locally produced goods due to the higher cost or the value of exports will fall due to cutbacks in supply.

Our findings also show that a rise in the short-run income level of Jamaica has a significant and positive impact on its bilateral trade balance while an increase in income in the US has a positive and significant relationship with the trade balance of Guyana. Meanwhile other findings revealed that the exchange rate does not have a significant impact on the trade balances of Trinidad,

Barbados and Dominica Republic and the majority of short-run dynamics do not support the J-curve phenomenon.

Improvement of the trade balance in the long-run is fundamental to the stabilization policies of the International Monetary Fund especially those enacted in the wake of the recent financial crises. Though depreciation/devaluation is regarded as a remedy for restoring competiveness, the window of opportunity it opens may be short-lived.

References

Baek, J., Koo, W.W., & Mulik, K. (2009). Exchange rate dynamics and the bilateral trade balance: The case of U.S. agriculture. *Agriculture and Resource Economics Review*, 38(2), 213-228.

Bahmani-Oskooee, M. (1986). Determinants of international trade flows: The Case of developing countries. *Journal of Development Economics*, 20, 107-123.

Bahmani-Oskooee, M., & Goswami, G. (2003). A disaggregated approach to test the J-curve phenomenon: Japan versus her major trading partners. *Journal of Economics and Finance*, 27, 102-113.

Bahmani-Oskooee, M., & Ratha, A. (2004). Dynamics of US trade with developing countries. *Journal of Developing Areas*, 37(2), 1-11.

Bahmani-Oskooee, M., & Kara, O. (2008). Relative responsive of trade flows to a change in prices and the exchange rate in developing countries. *Journal of Economic Development*, 33(1), 147-163.

Bahmani-Oskooee, M., & Kantipong, T. (2001). Bilateral J-curve between Thailand and her trading partners. *Journal of Economic Development*, 26(2), 107-117.

Banerjee, A., Dolado, J.J., & Mestre, R. (1998). Error-Correction mechanism tests for cointegration in a single-equation framework. *Journal of Time Series Analysis*, 19(3), 267–284.

Blanchard, O., & Milesi-Ferretti, G. (2011). (Why) Should current account balances be reduced? IMF Staff discussion Note, SDN/11/03.

Boyd, D., Caporale, G.M., & Smith, R. (2001). Real exchange rate effects on the balance of trade: Cointegration and the Marshall-Lerner Condition. *Department of Economics*, University of East London.

Brown, D., & Williams, C. (2007). Current Account determinants for the Jamaican economy. *Bank of Jamaica*.

Calderon, C.A., Chong, A., & Loayza, N.V. (2002). Determinants of current account deficits in developing countries. *B.E. Journal Of Macroeconomics*, 2(1), 1-33.

Caporale, G.M., Gil-Alana, L., & Mudida, R. (2012). Testing the Marshall-Lerner Condition in Kenya. Brunel University Working Paper No. 12-22.

Gangal, V.L.N., & Agarwal, A. (2013). Current account imbalance and exchange rate adjustment. A study of India. *Global Journal of Management and Business Studies*, 3(2), 125-130.

Goldstein, M., & Khan M.S. (1985). Income and price effects in foreign trade. *Handbook of International Economics*, 2, 1041-1105.

Greenidge, K., Holder, C., & Moore, A. (2007). Current account deficit sustainability: The case of Barbados. *Central Bank of Barbados*.

Davidson, R., & MacKinnon, J.G. (1993). *Estimation and Inference in Econometrics*. London: Oxford University Press.

Debelle, G., & Faruqee, H. (1996). What determines the current account? A cross-sectional and panel approach. *IMF Working Paper*, No. 96/58.

Hausman, J.A. (1978). Specification tests in Econometrics. *Econometrica*, 46, 1251–1272.

Henry, C., & Longmore, R. (2003). Current Account dynamics and the Real Effective Exchange Rate: The Jamaican experience. *Bank of Jamaica*.

Jessen, A., & Vignoles, C. (2004). Barbados: Trade and integration as a strategy for growth. Institute for the Integration of Latin America and the Caribbean and Integration, Trade and Hemispheric Issues Division, Inter-American Development Bank Occasional Paper 28.

Kandil, M., & Mirzaie, A. (2005). The effects of exchange rate fluctuations on output and prices: Evidence from developing countries. *Journal of Developing Areas*, 38, 189-219.

Kremers, J.J.M., Ericson, N.R., & Dolado, J.J. 1992. The power of cointegration tests. *Oxford Bulletin of Economics and Statistics*, 54(3), 325–348.

Kulkarni, K., & Clarke, A. (2009). Testing the J-curve hypothesis. Case study from around the world. International Economics Practicum.

Lee, J., & Chinn, M. (2006). Current account and real exchange rate dynamics in the G7 countries. *Journal of International Money and Finance*, 25, 257-274.

Marwah, K. & Klein, L.R.(1996). Estimation of J-curve: United States and Canada. *Canadian Journal of Economics*, 19(3), 523-539.

Nasir, A., Chowdhury, A., & Mridha, H. (2009). Do bilateral trade balances adjust to exchange rate shocks? Evidence from bilateral trade of Bangladesh with G-5 countries. *International Journal of Applied Economics*, 6(2), 51-69.

Oyinlola, M.A., Adeniyi, A., & Omisakin, O. (2010). Responsiveness of trade flows to a change in exchange rate and relative prices: Evidence from Nigeria. *International Journal of Economic Sciences and Applied Research*, 3(2), 123-141.

Pesaran, M. H. & Shin**, Y.** (1998). Generalized Impulse Response Analysis in Linear Multivariate Model. *Economic Letters*, 58, 271-275.

Pesaran, M. H., Shin, Y., & Smith, R. (2001). Bound Testing Approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3), 289-326.

Rose , A.K., & Yellen, J.L. (1989). Is there a J-curve? Journal of Monetary Economics, 58, 53-68

Sachs, J. (1981). The Current Account and macroeconomic adjustment in the 1970s. *Brookings Papers on Economic Activity* 1, 201-268.Wilson, P. (2001). Exchange rates and the trade balance for dynamic Asian economies – Does the J-Curve exist for Singapore, Malaysia and Korea? *Open Economics Review*, 12(4), 389-413.

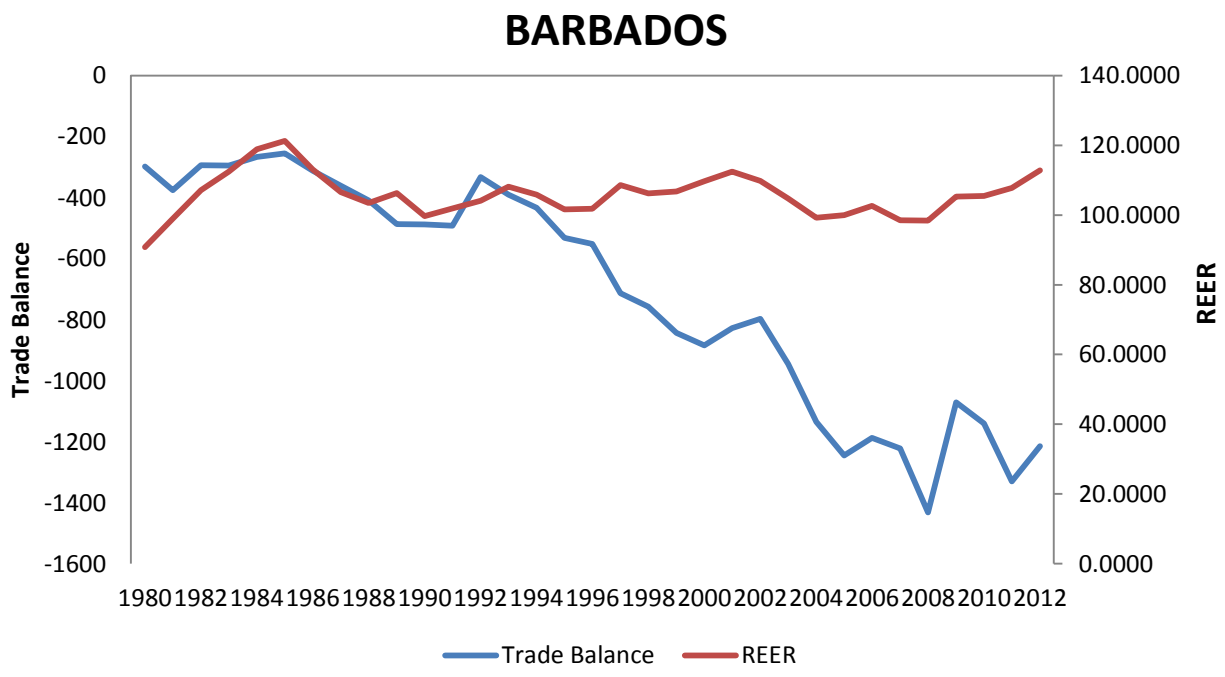
Shirvani, H., & Wilbratte, B. (1997). The Relation between the real exchange rate and the trade balance: An Empirical Reassessment," *International Economic Journal*, 11(1) , 39-50.

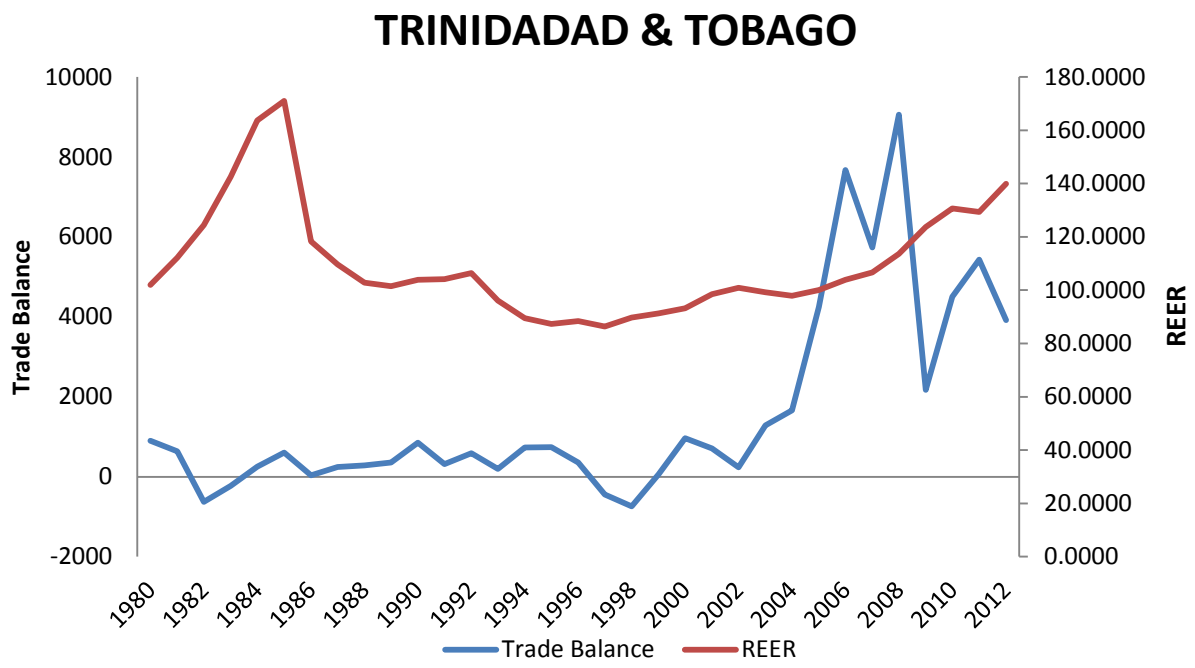
Appendix

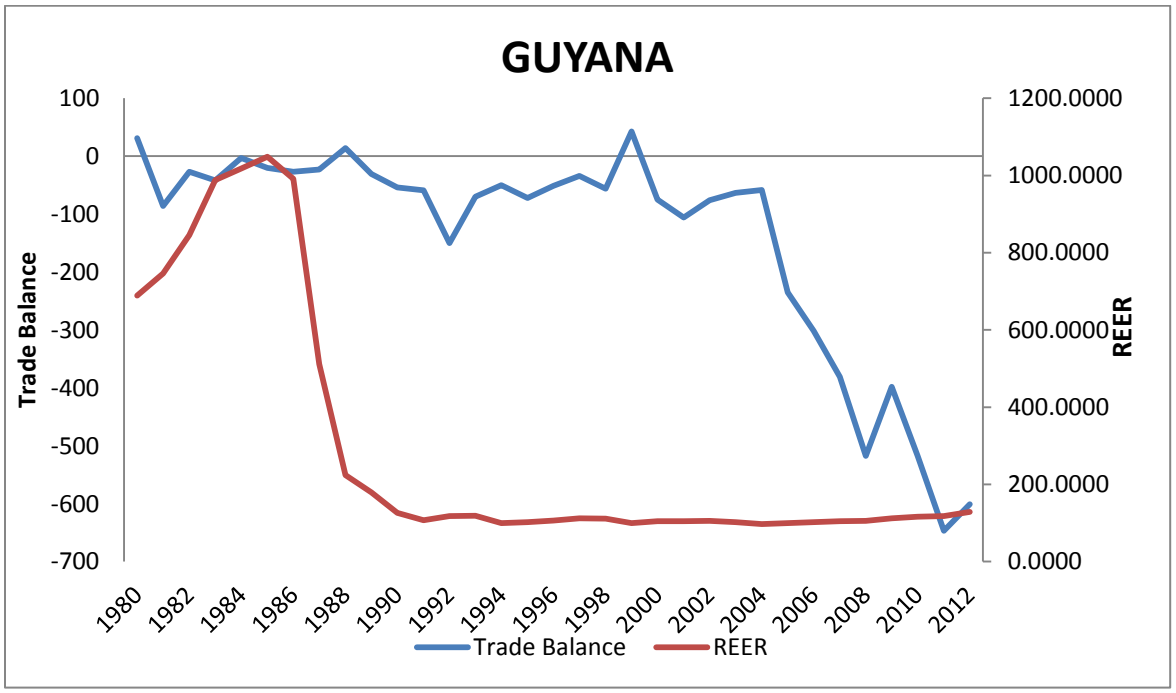
Table 1: Data Source

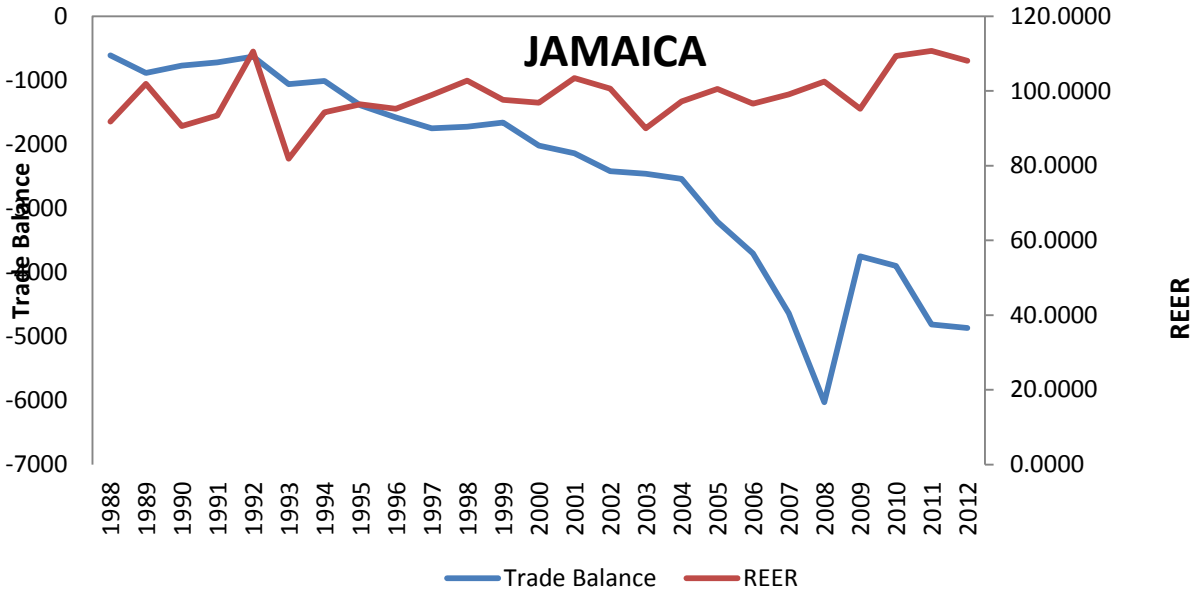
Variables	Description	Source
Gross National Income	Income received domestically and internationally measured in US$B	WDI
Trade Balance	Ratio of exports to imports of tradable merchandise goods measured in US$B	WTO
West Texas Intermediate	Crude oil spot price measured in US$ per barrel	Bloomberg
Nominal Exchange rate	Average period selling price US$ per domestic currency	IFS
Broad Money	Sum of demand, time and foreign currency deposits and money market securities other than those of the central government (LCU end of period)	WDI

FIGURE 1: Relationship between REER and Trade Balance 1980-2012 for each country




TRINIDADAD & TOBAGO
Trade Balance
REER
10000
8000
6000
4000
2000
0
-2000
180.0000
160.0000
140.0000
120.0000
100.0000
80.0000
60.0000
40.0000
20.0000
0.0000
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
Trade Balance
REER


GUYANA
Trade Balance
REER
100
0
-100
-200
-300
-400
-500
-600
-700
1200.0000
1000.0000
800.0000
600.0000
400.0000
200.0000
0.0000
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
Trade Balance
REER


JAMAICA
Trade Balance
REER
0
-1000
-2000
-3000
-4000
-5000
-6000
-7000
120.0000
100.0000
80.0000
60.0000
40.0000
20.0000
0.0000
1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012
Trade Balance
REER

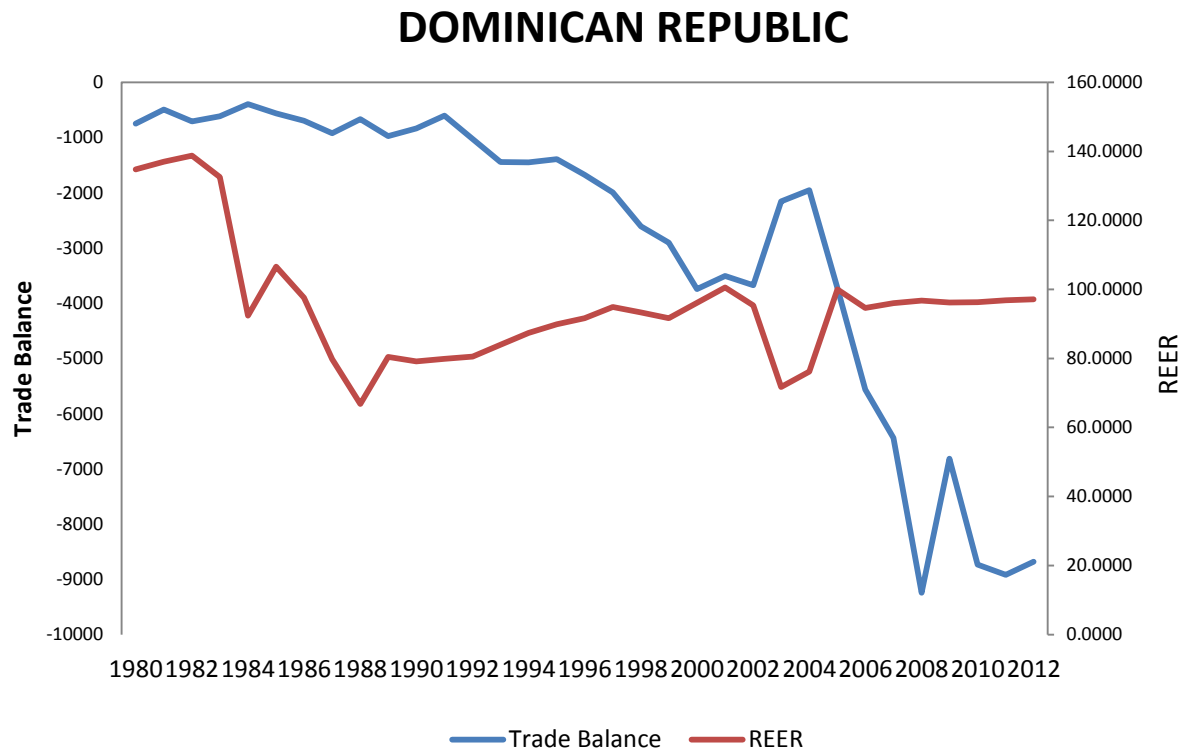

DOMINICAN REPUBLIC
Trade Balance
REER
0
-1000
-2000
-3000
-4000
-5000
-6000
-7000
-8000
-9000
-10000
160.0000
140.0000
120.0000
100.0000
80.0000
60.0000
40.0000
20.0000
0.0000
1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012
Trade Balance
REER

Table 5: Short-run Dynamics (Nominal exchange rate)

	Regressors						
Countries	ΔLTB_{t-1}	$\Delta LRER_{t-1}$	ΔLUS_GNI_{t-1}	$\Delta LGNI_{t-1}$	$\Delta LWTI_{t-1}$	DUM	ECT_{t-1}
Trinidad	0.015	0.932	-0.266	-0.042		-0.024	-0.681
	(0.058)	(1.133)	(-0.112)	(-0.085)		(-0.126)	(-2.844)***
Guyana	0.085	-0.170	1.740	-0.306	0.185	-0.034	-0.985
	(0.563)	(-1.97)*	(2.010)*	(-2.28)**	(2.580)**	(-0.521)	(-4.280)***
Jamaica	-0.160	0.521	0.212	0.636	0.122	-0.016	-0.540
	(-0.790)	(1.915)*	(0.213)	(2.389)**	(1.552)	(-0.177)	(-2.426)**
Dom Rep	0.023	0.159	-0.144	0.147	0.068	-0.099	-0.680
	(0.109)	(0.667)	(-0.113)	(0.567)	(0.800)	(-1.193)	(-2.579)**

***, **, * represents 1%, 5% and 10% significance respectively

T-statistics are in parentheses

Table 6: Long run estimates (Nominal exchange rate)

Countries	Regressors			
	Exchange rate	GNI	US GNI	WTI
Barbados	-	-		-
	-	-		-
Trinidad	-1.47	-0.36	1.59	-
	(-1.08)	(-0.73)	-1.24	-
Guyana	-0.03	0.07	0.06	-0.29
	(-1.35)	-1.36	-0.57	(-4.72)***
Jamaica	-0.21	-0.16	0.33	-0.19
	(-1.59)	(-0.77)	-0.63	(-1.87)*
Dom Rep	-0.03	-0.03	0.04	-0.181
	(-0.23)	(-0.21)	-0.09	(-1.696)

***, **, * represents 1%, 5% and 10% significance respectively

T-statistics are in parentheses

Table 7: Omitted variable test
Omitted variables: Δlremitt and lremitt
H_0: the variables are jointly irrelevant

Country	F-stat	Probability	Decision rule
Barbados	1.691	0.222	Fail to reject
Trinidad	2.296	0.135	Fail to reject
Guyana	-	-	-
Jamaica	4.813	0.027	Reject
Dominican Republic	0.031	0.969	Fail to reject

Table 8: Redundant variable Test
Redundant Variables: $\Delta lwti_{t-1}$ and $lwti_{t-1}$
H_0: Variables are redundant

Country	F-stat	Probability	Decision rule
Barbados	3.126	0.067*	Reject
Trinidad	1.659	0.217	Fail to reject
Guyana	19.248	0.000***	Reject
Jamaica	3.935	0.037**	Reject
Dom Rep	1.62	0.062*	Reject

Table 9: Robust Analysis (3 lags)

Lag Order of Exchange Rate					
	Short-run			Long-run	
Country	1	2	3	1	Adj R^2
Barbados	1.285	-0.435	2.24	-0.324	
	(0.640)	(-0.242)	(1.438)	(-0.188)	0.233
Trinidad	1.384	0.754	-0.025	-2.523	
	(1.630)	(1.278)	(-0.044)	(-1.877*)	0.207
Guyana	0.034	0.007	-0.015	-0.033	
	(1.623)	(0.429)	(-0.877)	(-2.132**)	0.59
Jamaica	0.391	-0.165	0.019	-0.046	
	(2.602**)	(-1.132)	(0.186)	(-0.410)	0.6
Dom Rep	-0.022	-0.174	0.042	-0.037	
	(-0.146)	(-1.42)	(0.490)	(-0.286)	0.241

***, **, * represents 1%, 5% and 10% significance respectively. T-statistics are in parentheses

Table 10: Robust Analysis (5 lags)

Country	Lag Order of Exchange Rate						
	Short-run					Long-run	
	1	2	3	4	5	1	Adj R^2
Barbados	1.125	-1.623	-0.609	1.719	0.05	0.596	
	(0.417)	(-0.609)	(0.575)	(0.969)	(0.027)	(0.208)	0.236
Trinidad	2.19	1.403	0.449	0.233	-0.361	-7.15	
	(2.365**)	(2.120*)	(0.691)	(0.464)	(-0.777)	(-2.713)	0.318
Guyana	0.032	0.0018	-0.017	0.01	-0.0075	-0.032	
	(1.225)	(0.079)	(-0.905)	(0.475)	(-0.285)	(-1.699)	0.517
Jamaica	0.461	-0.226	0.048	-0.049	-0.088	0.058	
	(3.675***)	(-1.208)	(0.438)	(-0.677)	(-1.267)	(0.650)	0.568
Dom Rep	0.039	-0.147	0.084	-0.096	0.035	-0.018	
	(0.230)	(-1.156)	(0.799)	(-1.249)	(0.492)	(-0.101)	0.256

***, **, * represents 1%, 5% and 10% significance respectively
T-statistics are in parentheses

Panel A: Regression Results for Jamaica (including Remittances).

$$DLTB = -0.12 - 0.97LTB_{t-1} - 0.10LRER_{t-1} + 0.05LUS\_GNI_{t-1} - 0.09LGNI_{t-1} - 0.19LWTI_{t-1} + 0.11LREMITT_{t-1} - 0.16DLTB_{t-1} +$$

(-0.213694) (-2.837752) (-2.108986) (0.151249) (-0.525521) (-2.271655) (0.85901) (-0.927537)

$$0.52DLRER_{t-1} + 1.50DLUS\_GNI_{t-1} + 0.74DLGNI_{t-1} + 0.17DLWTI_{t-1} - 0.08DLREMITT_{t-1} + 0.01DUM$$

(3.25956) (1.347498) (3.799138) (1.998231) (-0.616536) (0.103362)

Adj. R2 =0.391771 *Durbin-Watson stat =2.321804*