Examining measures of the equilibrium Real Exchange Rate: Macroeconomic Balance and the Natural Real Exchange Rate Approaches

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Abstract

This paper examines two measures of the equilibrium real exchange rate using the Macroeconomic Balance (MB) and the Natural Real Exchange Rate (NATREX) approaches. Unlike previous studies, this study controls for business cycle effects and the debt sustainability position of countries on the current account, while providing a more comprehensive measure of relative productivity. A longitudinal panel econometric technique is utilized on a set of countries from the Western Hemisphere. These countries operate a managed float exchange rate system; have similar output per capita and equivalent levels of openness. The findings suggest that there were several intervals of exchange rate misalignment for each country, including Jamaica, over the 1990-2010 study period. The exchange rate misalignment series was found to be stationary which is an indication that there is a long-run equilibrium mean and a constant variance for exchange rate misalignment. This long-run misalignment mean is assumed to be zero by economic theory. The Autoregressive Distributive Lag (ARDL) error correction model suggests that disequilibrium in the exchange rate is adjusted by 46.2 per cent each year and the half-life deviation formula suggests that a half of the deviation in the exchange rate is corrected after 1.1 years for each country in the panel.

JEL Classification: F14, F31, F32

Keywords: *Macro-balance approach, NATREX, Current Account Misalignment, Real Effective Exchange Rates, Exchange Rate Misalignment, Trade.*

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Contents

1. Introduction

Exploring the value of a country's currency is always at the forefront of international economics as it influences a country's monetary policy formulations, trade policies, international competitiveness and the level of capital inflows by investors. The real equilibrium exchange rate is generally utilized as it defines the sustainable and consistent medium to long term value of a currency which underpins price stability, the sustainability of the current account balance (optimal deficit or surplus), and full employment.

The behavior of the short run nominal exchange rate has a largely unpredictable component which leads market-determined exchange rates to be substantially misaligned with medium-run macroeconomic fundamentals. Consequently, at any point in time the observed real exchange rate may be forced above or below the equilibrium real exchange rate because of unpredictable market forces. The generally accepted macroeconomic position is that the misalignment of the short and long-run exchange rate influences a country's current account balance and by extension the level of competitiveness of the country's exports. If this general view is accepted, the examination of the equilibrium exchange rate is pivotal to ensuring macroeconomic stability, current account sustainability, ensuring the effectiveness of monetary policy and pushing economy to perform at potential levels. Through robust estimation of the equilibrium real exchange rate (ERER), central banks can utilize policy to ensure faster adjustment to equilibrium and mitigate the impact of exchange rate shocks to the economy, such as those engendered by speculation.[2]

Numerous approaches have been developed to calculate the ERER and a plethora of studies have been conducted on this construct using either a cross sectional, panel-longitudinal or time series methodology. A multiplicity of estimation techniques have also been applied to the calculation of the equilibrium RER which depends on the approach utilized.[3] Husted and Melvin (2009) have argued that the development of alternative techniques has been due to the numerous criticisms

[2] This applies specifically to the managed float exchange rate regime which targets monetary aggregates in manipulating the exchange rate among other things. This includes countries such as Afghanistan, I.R. of Burundi, Gambia, The Georgia, Guinea, Haiti, Jamaica, Kenya, Madagascar, Moldova, Mozambique, Nigeria, Papua New, Guinea, São Tomé and Príncipe, Sudan, Tanzania and Uganda. See IMF (2008) source in the references section for further details of the exchange rate regime of countries.

[3] Approaches include the fundamental Equilibrium Exchange Rate (FEER), Capital Enhanced Equilibrium Exchange Rates (CHEER), the Desired Equilibrium Exchange Rate (DEER), Permanent Equilibrium Exchange Rate (PEER), Natural Real Exchange Rate (NATREX) and Dynamic Stochastic General Equilibrium Models (DSGE) among others.

levied against the Purchasing Power Parity (PPP) approach. In conforming to the other studies that have sought to evaluate the ERER, this study will model the equilibrium exchange rate using a set of macroeconomic fundamentals. Both the MB and the NATREX approaches will be utilized which is consistent with most of the literature. In utilizing the MB framework, the statistically robust fundamentals will be included, as well as additional indicators that have not been accounted for in the literature.[4]

Additionally, unlike previous studies conducted on the ERER using a panel framework, this study will consist of a panel of countries that has similar levels of income, equivalent exchange rate regimes and similar levels of openness. Consequently, this study can be considered to be more homogenous than panels in previous studies of this nature and the estimated panel parameters from this study are less likely to be biased by sample selection. Finally, this study seeks to expand the way in which some of the variables included in previous studies have been measured. The NATREX approach will then be calculated using a reduced form equation using the ARDL cointegration approach. The countries included in this study were the Dominican Republic, Jamaica, Peru and Uruguay.[5]

The next section of this paper will provide a brief summary of the economic performance of the countries analyzed. This is followed by a comprehensive review of the related findings from previous studies that have estimated the ERER and the NATREX in Section 3. Section 4 reviews the major statistical assumptions and procedures required for analyzing panel data. It also delineates the models to be utilized in estimating the desired exchange rates and summarizes the stationarity position of the variables to be used. Section 5 gives a presentation of the main findings of the study and provides robustness tests to improve the reliability and validity of the findings. The main conclusions and policy implications of the study are then discussed in Section 6.

2. Stylized Facts

Trade openness has facilitated global investment, with exchange rates being particularly important to the growth and stability of a country's economy. The currencies of small open economies such as those included in the sample are usually more susceptible to domestic and

[4] These include indicators such as recessionary periods and sustainable debt level dummies.
[5] A more detailed explanation of how the sample was selected can be found in the methodology section.

global shocks. As a result, policymakers need to monitor movements in these countries exchange rate to ensure price stability and internal and external balance. A brief outline of the trends in the respective country's Real Effective Exchange Rate (REER), exports and current account balance is outlined below.[6]

2.1 Case Study I: Jamaica

Annual data for Jamaica show that the value of Jamaican Dollar relative to the United States dollar has steadily depreciated over the period 1990 – 2010. On a nominal basis, the Dollar lost approximately 15 per cent on average yearly, while the real exchange rate, as measured by the REER, indicates an average appreciation of 3.2 per cent. In relation to the current account balance, the trade balance being the largest component, deteriorated by 10.3 per cent per annum. This was largely influenced by a 6.2 per cent increase in imports relative to a 2.1 per cent rise in exports. In particular, fuel expenditure as a percentage of GDP has grown on average by 4.4 per cent on an annual basis. This therefore contributed to a steady worsening in the current account, averaging -10.5 per cent of GDP between 2000-2010, from an average of -2.8 per cent of GDP between 1990-2000. These developments have led to a general loss in external competitiveness, albeit partly offset by the impact of significant nominal depreciations in 2003 and 2008 (see **Figure 3, Appendix**).

2.2 Case Study II: Peru

Peru has had a relatively stable economy over the past decade. This stability is mirrored through a relatively small current account deficit over the last decade despite a world economic recession in 2008. The Peruvian current account balance has averaged -0.9 per cent on an annual basis between 2000-2010 which has been underpinned by an upward trend in exports as a percentage of GDP and relatively stable fuel expenditure as a percentage of GDP. Over the sample period, the nominal Peruvian Nuevo sol has depreciated by an average 23.0 per cent per annum while the REER has appreciated by 1.8 per cent on average on a yearly basis (see **Figure 4, Appendix**).

2.3 Case Study III: Dominican Republic

The Dominican Republic has experienced two economic crises in the last decade, namely a banking crisis in 2003 and the world economic recession of 2008. This has undoubtedly

[6] The REER is the nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator or index of costs. (World Bank, 2013)

influenced the stability of the economic parameters being examined. The data show that the country's exports, its current account balance to GDP ratio, the REER and the fuel expenditure as a percentage of GDP depicted relative stability prior to 2002 (see **Figure 5, Appendix**). However, the impact of the banking crisis in 2003 led to strong structural changes in the banking industry which further resulted in an improvement in the REER and the current account balance. Prior to 2000 the current account balance had an average of -2.1 per cent which improved to a surplus of 5.0 per cent during the 2003-2004 period. However, the global economic crisis in 2008 led to a reduction in exports and by extension a deterioration in the country's current account balance which averaged -7.8 per cent. Over the review period, the country's fuel averaged 10.2 per cent of GDP, which averaged 5.2 per cent between 1990 -2000 and 15.6 per cent between 2000 -2010.

2. Case Study IV: Uruguay

Similar to the case of the Dominican Republic, Uruguay underwent two major economic crises over the last decade. This includes a domestic banking crisis in 2001-02 and the global economic recession in 2008. Following the domestic banking crisis, a significant depreciation of the country's REER occurred which led to a subsequent increase in the country's exports. Over the three year period 2002-2004, the REER depreciated on average by 11.4 per cent per annum while the export to GDP ratio grew by 29.9 per cent. The REER, however, appreciated during the 2008-2010 recessionary period by 9.7 per cent while exports fell on average by 3.3 per cent. Uruguay's fuel expenditure to GDP has averaged 4.2 per cent over the last decade. This has mirrored an average current account balance that was 0.7 per cent of GDP during the domestic crisis period and -2.9 per cent of GDP during the international economic crisis period (see **Figure 6, Appendix**).

3. Theoretical Review

In recent years, a myriad of studies have attempted to estimate the ERER utilizing varying estimation procedures (such as the FEER, BEER, PEER and the NATREX) with various samples that have vacillating levels of homogeneity. A large number of central banks in both developing and developed countries have estimated the equilibrium exchange rate for their country. This has been done in a context of the recognition of the importance of the exchange rate on the country's

current account position and by extension its overall macroeconomic performance (Westaway and Driver, 2004; Zalduendo, 2006, Eckstein and Friedman, 2011; Dunaway and Li, 2005; MacDonald and Ricci, 2003 etc.). Eckstein and Friedman (2011) postulate that in a small open economy, the real exchange rate has an important impact on countries growth trajectory and by extension, their economic stability. They added that real exchange rate misalignments "could cause output loss and cyclical, inefficient allocation of resources, including low utilization of factors of production". Siregar and Rajan (2006) similarly argue that misalignment in the real exchange rate results in a country's loss of external competitiveness and growth reduction. In addition, they note that there is a possibility that sustained overvaluation could lead to a currency crisis and sustained undervaluation could lead to overheating of the economy. It is also argued that misalignment of the real exchange rate is responsible for global macroeconomic imbalances, whereby countries with a grossly undervalued currency would automatically have an unfair competitive advantage.

This theoretical review seeks to highlight the empirical studies that have sought to estimate the equilibrium real exchange rate, placing emphasis on the importance of exchange rate disequilibrium and highlighting the major limitations of previous studies. The main approaches that will be focused on in this study are the macroeconomic balance approach and the natural real exchange rate approach.

The seminal contributions to the MB approach of calculating the equilibrium real exchange rates are owed to the IMF in the 1970s and 1980s (Isard et al, 2001) and the articulation of the FEER approach by Williamson (1994). Isard et al (2001) notes that the MB approach makes "quantitative assessments of exchange rates that are consistent with "appropriate" current account positions (external balance)" when economies are performing at potential output and stable prices (internal balance). One major criticism of the MB approach is that forecasting using this model is highly unstable because of the uncertainty surrounding the forecasted underlying current account and the assumptions made on the fundamentals moving forward. Graham and Steenkamp (2012) argue that this can be addressed by providing a band for future forecast through the use of probability distributions.

In relation to the NATREX approach, Stein (1994) is the seminal contributor to its development. This approach is conceptualized as the rate that would be actualized if unemployment was at its natural level and speculative and cyclical market factors were removed (Siregar and Rajan, 2006). In a later paper, Stein (2001) articulates that the ERER is a sustainable rate that satisfies a myriad of criteria. Among these criteria is the fact that at this rate, the economy is at full capacity, which implies that actual output is equal to potential output, unemployment is at its natural rate and inflationary adjustment is stable. In other words, internal balance is achieved. Under the NATREX approach, Stein (2001) also posits that external balance must also be achieved. This assumes that investors are indifferent between holding domestic and foreign assets and there are neither upward nor downward pressures on the exchange rate. It also implies that interest rates between the two countries converge to a stable mean and the country's debt obligations stabilize to a sustainable level.[7]

While the generally held consensus in the literature is that changes in the real exchange rate (RER) influences the current account balance, Henry and Longmore (2003) found that the RER does not play a significant role in determining Jamaica's current account. Against this background, they posit that the notion that the RER can be used as a tool for correcting the unsustainability of the current account and improve competitiveness must be revisited for the case of Jamaica and by extension other developing countries. On this basis, future studies ought to examine the extent to which exchange rate misalignment in developing countries such as Jamaica influences macroeconomic stability, especially where the current account has been found to be unresponsive to changes in the RER.

4.0 Methodological Framework

A panel analysis or longitudinal methodology was utilized which follows the same cross sectional countries across time. The procedures are outlined in this section.

[7] For a detailed discussion on previous studies done to estimate the ERER of the countries included in the sample see Williams (2008), Rochester, 2009), Robinson (2010), Gugliermino and Salas (2006), Hojman (1989), Pineda et al (2009) and Monteil et al (2007).

4.1 Data Source and Sample Selection

Four countries were randomly selected from the group of countries located in the western hemisphere, based on three selection criteria. The first criterion restricted the sample to countries which utilized a managed float exchange rate regime. From this pool of countries, the remaining criteria were applied. The second criterion utilized was the average income per capita, with an aim of selecting countries with a similar economic landscape. Therefore, the countries included in the sample were restricted to having average GDP per capita over the sample period that was between US$2500 - $6500. Finally, the countries included in the sample had similar levels of openness to the international market and largely underwent financial liberalization in the same time period in their economic history. Consequently, the final sample had a moderate degree of homogeneity.[8] As mentioned in Section 1, the four countries which fit these criteria included the Dominican Republic, Jamaica, Peru and Uruguay.

Annual data on these four countries were collected over a twenty-one (21) year time period (1990-2010) and cumulatively formed a panel consisting of 84 observations. The data were collected from a number of data sources and triangulated for accuracy and consistency. The websites of the respective central banks were first consulted for the required data.[9] However, where the required data could not be garnered from these sources, the IMF international financial statistics database, the World Economic Outlook (WEO) website, the World Bank database and UNDATA were consulted to gather the required data.[10] The sample clearly satisfies the central limit theorem which suggests that if the other assumptions of the estimation techniques are met, the estimates should be consistent.

4.2 Econometric Models

4.2.1 The MB Approach

The MB approach to estimating the ERER has three steps as dictated by Isard et al (2001). This approach is entrenched in the accounting identity which links a country's current account

[8] Failure to satisfy the condition of randomization and failure to have homogenous entities in a panel framework may lead to issues of sample selection bias and lack of consistency in estimated coefficients.
[9] Bank of Jamaica for Jamaica, Central Reserve Bank of Peru, Central Bank of Dominican Republic and the Banco Central del Uruguay (Central Bank of Uruguay).
[10] Citation for each of these websites can be viewed in the appendices.

balance to the difference between domestic saving and domestic investment. The first step of the process involves identifying each country's underlying current account position, which "is the value of the current account that would emerge at prevailing exchange rates if all countries were producing at their output levels and the lagged effect of past exchange rates changes had been fully realized" (Isard, 2001).[11] The second step of the process requires estimation of medium-run equilibrium saving investment position. This is done by estimating an equilibrium relationship between each country's current account balances and a set of fundamental determinants (Lee et al, 2006). The final step required in estimating the ERER is to compare the results from the first two steps to determine the real exchange rate adjustment that would be necessary to close the gap between the estimated underlying current account position and the medium-run equilibrium saving investment position. This is done through evaluating the current account elasticity and by evaluating how imports and exports respond to the changes in the real exchange rate.

- **The Saving-Investment (S-I) Equilibrium (Current Account Norm)**

While it is easy to attribute sustained current account deficits to the overvaluation of a country's currency, it must be highlighted here that there are a number of intervening factors which may influence the current account balance. These include the price elasticity of domestic demand for foreign goods, the type of goods imported, the extent to which a country produces goods for which it has a competitive advantage, the ease of doing business in the country and the country's stage of development. Therefore, in modeling the current account as a function of non-price fundamental factors, we are able to isolate the sustainable equilibrium current account balance and the exchange rate which ensures this is achieved.

A plethora of fundamentals have been used in the literature to determine the medium-run S-I equilibrium. Among the most robust variables are net foreign assets, fiscal balance, oil expenditure (mostly for developing economies), crises period dummies, economic growth, relative income, dependency ratios and openness indicators (Williams, 2008; Lee, 2006; Coudert & Couharde, 2005; Isard et al, 2001, among others). Williams (2008), Lee (2006) and Isard et al (2001) all found that improvements in the fiscal balance of a country improves the current

[11] The underlying current account position included in the calculation of the equilibrium RER in this paper was obtained from the IMF WEO database as at June 11, 2013. See reference list for more details.

account position of the country while there was a general inconsistency where the other variables were concerned depending on the sample utilized. That is, utilizing both oil importing and oil exporting countries in the sample without controlling for this factor may lead to biasness in the estimated parameter for the oil balance variable.

The model below defines the current account balance as a function of what the literature has collectively referred to as 'macroeconomic fundamentals'.

Equation 1: Current Account Norm

$$CAB = \beta_0 + \beta_1 Trade\_O_{it} + \beta_2 Trade\_O_{it}^2 + \beta_3 Rel\_Inc_{it} + \beta_4 Rel\_Inc_{it}^2 + \beta_5 LFPR_{it} + \beta_6 Fuel\_Exp_{it} + \beta_7 Fin\_Deep_{it} + \beta_8 NFA_{it} + \beta_9 FB_{it} + \beta_{10} FB_{it}^2 + \beta_{11} Rel\_Prod + \beta\, Dummies + \varepsilon_{it} + \mu_i \quad \ldots(1)$$

Where $\boldsymbol{Trade\_O_{it}}$ is the country's level of trade openness, $\boldsymbol{Rel\_Inc_{it}}$ is relative income to its major trading partner, $\boldsymbol{LFPR_{it}}$ is the percentage of the population that is in the labour force, $\boldsymbol{Fuel\_Exp_{it}}$ is fuel expenditure as a ratio of GDP, $\boldsymbol{Fin\_Deep_{it}}$ is the level of broad money to GDP (financial deepening), $\boldsymbol{NFA_{it}}$ is the net foreign asset balance as a ratio of GDP and ***FB is*** the country's fiscal balance as a ratio of GDP.[12] Finally, $\boldsymbol{\varepsilon_{it}+\mu}$ is the composite error of the model. The error consists of both the idiosyncratic or time varying component and the fixed effect or time constant component. The time constant error therefore consists of structural factors (that are fixed) indigenous to countries that affect their current account balance which is not readily captured in this model.

The level of trade openness and the relative income of countries are included with a squared component to determine an equilibrium position for these variables for each country. Inclusion of the squared term allows us to examine the level of these variables that are optimal to a sustainable current account. A dummy variable is also included in the regression to represent structural breaks in the economy, particularly the impact of financial depression and crisis periods on the stability of current account balance[13]. The dummy variable is extremely important because it captures the relative preference of investors during these periods and also the disturbances to the flow of capital during this period. Relative productivity is included as a

[12] The United States is the country of reference for all the variables with relative calculations.
[13] Two dummy variables are included to capture the debt sustainability levels of a country and the 2008-2009 world economic crisis period.

possible substitute for relative income, which captures the labour efficiency of the labour force of each country in the sample relative to their major trading partners.[14] Since countries were selected based on the homogeneity of their GDP per capita, there is little variation in the relative GDP income variable across the cross-sectional units.

The estimated S-I norm for the current account will then be compared with underlying current account estimates gathered from the various central banks and the equilibrium exchange rate that ensures external and internal balance will subsequently be derived.

- **Model for Current Account Adjustment: Current Account Elasticity**

The final step in the macro-balance procedure is to calculate the current account elasticity and to determine the percentage adjustment in the exchange rate that would equate the underlying and the medium run equilibrium current account. Equation 2 below shows the reduced form equation for the current account norm as derived by Isard and Faruquee (1998):

$$C_{norm} = \beta - (m\beta_m + x\beta_x)\, R_{t-i}^{E} + mR_t^{E} - m\pi_m Y_{gap}^{d} + m\pi_m Y_{gap}^{f} + macro\_fundamentals + errors \ldots (2)$$

By assuming that domestic and foreign output gaps are zero, which is a necessary condition for derivation of the underlying current account, we get equation 3. The underlying current account is estimated with prevailing exchange rates.

$$C_{underlying} = \beta - (m\beta_m + x\beta_x)\, R_{t-i}^{a} + mR_t^{a} + macro\_fundamentals + errors \ldots (3)$$

Deriving the current account misalignment ($C_m = C_{norm} - C_{underlying}$) by subtracting equations (2) and (3), we obtain equation 4.

$$C_m = -(m\beta_m + x\beta_x)\, R_{t-i}^{E} + (m\beta_m + x\beta_x)\, R_{t-i}^{a} + mR_t^{E} - mR_{t-i}^{a} - m\pi_m Y_{gap}^{d} + m\pi_m Y_{gap}^{f} \ldots (4)$$

$$C_m = [m-(m\beta_m + x\beta_x)]\,(R_{t-i}^{E} - R_{t-i}^{a}) - m\pi_m Y_{gap}^{d} + x\pi_x Y_{gap}^{f}$$

Which reduces to: $\boldsymbol{(R_{t-i}^{E} - R_{t-i}^{a}) = C_m / [m-(m\beta_m + x\beta_x)] \ldots (5)}$

[14] This variable is measured using a composite index of a country output per unit of individuals in their labour force relative to a weighted average of the output per unit of the labour force of the country's trading partner.

When there is no output gap domestically or abroad which is also an implied assumption when calculating both the underlying and current account norm and as articulated by Stein (2001). That is, the equilibrium exchange rate must exist where the economy is at full potential and there is stability in prices.

4.2.2 NATREX Approach

In analyzing the NATREX, studies have either utilized the single reduced form equation approach or a structural form equation approach.[15] Where the structural form equation modeling approach is used, several sets of behavioral equations are estimated for the key fundamentals and then the medium-run and long-run evolutions of the NATREX are examined.[16,17] On the other hand, the single reduced form equation approach directly calculates the NATREX by explicitly modeling the real exchange rate as a function of fundamentals.[18] How these fundamental variables influence the RER (positively or negatively) determines if increases in these variables will lead to an appreciation or depreciation of the real exchange rate. Once these models are estimated, we can examine how the fundamentally determined exchange rate (equilibrium) deviates from the actual real exchange rate. The residuals from these equations will represent speculative and cyclical market factors influencing the RER.

REER = *f (Trade Openness, Fuel Expenditure, Social Consumption, Rel. Prod)* ... *(6)*

The single reduced form NATREX approach of deriving the equilibrium real exchange rates, models the RER as a function of underlying fundamentals and a long-run equilibrium is established among the variables included in the model as seen in Equation 6. The choice as to which variables should be included in the NATREX long-run model varies between researchers. As pointed out by Siregar and Rajan (2006), a basic model of fundamentals in estimating the NATREX must have proxies for the country's productivity as well as its social thrift. They

[15] This study will utilize the single reduced form equation approach.
[16] Usually the consumption ratio equation *(capital to output ratio, net foreign asset to output, personal disposable income to output and real interest rate), trade balance *(real exchange rate, absorption and foreign consumption) and investment equation *(as a function of total factor productivity, productivity of capital, the real rate of interest and the real exchange rate).
[17] For a more detailed explanation of the methodology and estimation procedures see Dikmen (2008), Stein (2005), Karadi (2003) and Égert et al (2005).
[18] The fundamental are disturbances to productivity and social thrift which includes productivity indicators, terms of trade and the consumption spending of households and the government. Word interest rate and the level of FDI are also utilized in a number of studies. To evaluate studies that have utilized the single reduced form approach see Fida et al (2012), Siregar (2011), Siregar and Rajan (2006), Stein (2005) and Stein (1994).

purported that terms of trade, social thrift and productivity indicators ought to be among the variables included in a reduced form NATREX model. Additionally, Stein (2001) found that the fundamental factors which influenced the NATREX included relative time preference which is measured as the ratio of social consumption to GDP, relative productivity in the whole economy and a growth rate indicator. In concurrence with this notion, Fida et al (2012) utilizes the Vector Error Correction Model (VECM) method to estimate a NATREX model for Pakistan which included terms of trade indicator, a productivity indicator and government expenditure as a proxy for social thrift.

Consistent with the approach outlined by Stein (2001), Siregar and Rajan (2006) and Fida et al (2012), this study will include the basic component of the NATREX model while improving the framework for developing countries by adding an NFA to GDP indicator and fuel expenditure variable to the basic fundamentals. There is also a general incompleteness in the literature on how relative variables should be defined. The studies examined generally measured relative variables as the performance of one country relative to its main trading partner. However, this measure of relativity must be questioned in a world where countries have multiple trading partners and a more complete measure ought to be developed in future studies. In this study, the REER was utilized in the estimation in order to determine the performance of each country's currency relative to all its main trading partners. This gives a more holistic overview of the performance of a country's currency and more directly targets policy formation and evaluation. Similar to the REER, the relative productivity per labour force worker is calculated using weighted linear combination of the country's major trading partners. The weights were derived based on the total trade with the major partner relative to overall trade. For Uruguay, the largest share of the trade weights was skewed towards Brazil, China and Argentina. Jamaica and the Dominican Republic had majority of their trade with the USA with other trading partners having negligible weights. As such, the US was used as the main country of comparison for these two countries. Peru trade relations reflected majority trade with the USA and China. This weighted measure of relative productivity of the two countries gives a more accurate depiction, rather than the relative income measure which utilizes one trading partner for comparison.

Relative Labour Productivity per unit of the labour force is calculated using the formula:

$$\frac{{}^{Yt}/_{Lt}}{\sum_{i=1}^{n} A_{it}\left(\frac{y}{l}\right)it} \qquad \ldots (7)$$

Where Y_t is the country's GDP per capita and L_t is the total labour force of the country.

$(\frac{y}{l})_{it}$ is the output per unit of individuals in the labour force for each major trading partner. The weight of each country's trade is given by $\mathbf{A}_{it}$ and cumulatively must sum to one.[19]

4.3 Tests of Stationarity

For concreteness and statistical robustness, three stationarity tests were utilized in testing the variables of interests. These include the Levin, Lin and Chu (LLC) test, the Im, Pesaran and Shin (IPS) test and the D-Fuller derivation of the Fisher unit root test. This section will outline all the statistical assumptions of these testing procedures.

A simple panel specific model can be represented with a first-order autoregressive component as follows: $Y_{it} = \rho_i Y_{i,\,t-1} + W^{I}_{it}\Upsilon_i + \varepsilon_{it} \qquad \ldots (8)$

This can be transformed as follows:

$\Delta Y_{it} = \phi_i Y_{i,\,t-1} + W^{I}_{it}\Upsilon_i + \varepsilon_{it} \qquad \ldots (9)$

Where W_{it}^{I} can represent a panel specific term or a time trend. The LLC test makes the simplifying assumption that the autoregressive parameter is the same for all cross sectional panel in the sample ($\phi_{i=}\phi$). For this study, the test therefore assumes that the impact of lagged values of a variable on the change in that variable is the same for all countries in the sample. The Im, Pesaran and Shin and the D-Fuller derivation of the fisher's unit root tests however allows the autoregressive parameter to differ across cross-sectional units in the panel. Maddala and Wu (1999) criticize this assumption on the basis that the long-run value of some variables is

[19] The restriction on the weighting is as follows: $A_1+A_2+A_3+A_4+\ldots\ldots+A_n=1$

generally different across countries and as such, imposing this constraint is too restrictive in practice.[20]

Stationarity Results

Table 1: Stationarity Positions Conclusion Table

Variables	Stationarity Position
Financial Deepening	I(0)
Trade Openness	I(0)
CAB as a ratio of GDP	I(0)
NFA as a ratio of GDP	I(0)
Social Consumption to GDP	I(0)
Fiscal Balance Ratio to GDP	Inconclusive, mostly NS
Oil Balance to GDP	I(0)
Relative Income	I(1)
Labour Force Per Capita Relative Productivity	I(1)
REER	I(0)
Imports to GDP	Inconclusive, Stationary with lags
Govt. Spending to GDP	I(1)

The table above shows a summary of the conclusions from the three unit root tests conducted on the variables of interest, for more detailed results Table 6 in the Appendices. Three variables, namely relative income; labour force per capita relative productivity and government spending were found to be no stationary series while the fiscal balance ratio and the imports to GDP stationarity tests were largely inconclusive. The variables that were inconclusive or those that showed signs of a unit root were all differenced and then re-tested after which they were all stationary at the 1.0 per cent level of significance.

4.4 Estimation Techniques: ARDL and Random and Fixed Effects

Both the fixed and random effects estimation techniques will be used in specifying the models outlined above but the Hausman test will be utilized to choose which of the two techniques offers

[20] For a more detailed discussion of the major statistical assumption of the three unit root test utilized see Levin, Lin and Chu (2002), Maddala and Wu (1999) and STATA Reference Manual (2011).

greater efficiency and consistency. In estimating each model, serial correlation and heteroskedasticity will be controlled for in using the STATA statistical program.

There are two errors which influences a panel framework as noted above, the time constant error and the random error. The time constant error speaks to the factors that might influence the model which is indigenous to each sub-panel in the sample and does not vary with time. On the other hand, the random error has the usual desirous statistical properties of being normally distributed with mean zero, a constant variance and it is uncorrelated with itself, uncorrelated with the time constant error and uncorrelated with the explanatory variables.

In applied work, the decision between the fixed effects and random effects is reduced to the extent to which it is believed that the unobserved time constant omitted variables influences the panel. Where it is believed that omitted variables may have an impact on the dependent variable, and may be correlated with the explanatory variables then the fixed effects model is usually used. The fixed effect technique removes all time constant factors that may influence the variables in the model and as such there is no need to be concerned about these factors which are usually unable to be measured. There is also a trade-off between efficiency and consistency when deciding between the two techniques. The fixed effects model always provides consistent results but they may not be the most efficient models. The Hausman statistical procedure checks a more efficient model against a less efficient but more consistent model. The result ensures that the more efficient model also gives consistent results. Consequently, the Hausman test determines the optimal trade-off between consistency and efficiency in deciding which test procedure to utilize.

The ARDL methodology to cointegration was utilized in estimating the Equilibrium REER in the NATREX approach. This approach is ideal when the aim is to determine the long-run relationship between two or more variables regardless of their stationarity positions and the size of the sample. This criterion is critical in this study since the variables being utilized are integrated of varying order and the sample can be considered relatively small. The ARDL methodology also accounts for the common problem of weak exogeneity of the regressors (reverse causality) which ensures that the estimated parameters are efficient and valid contingent only on the model specification (Pesaran et al., 2001). The ARDL specification can be represented as follows:

$$\Delta \text{LN(REER)} = \boldsymbol{\beta} + \sum_{r=0}^{n} \boldsymbol{\beta} \Delta \boldsymbol{Z_{i,t-r}} + \sum \boldsymbol{\phi Z_{i,t-1}} + \boldsymbol{\gamma}\, REER_{i,t-1} \quad \ldots (10)$$

Where Z is a matrix of independent variables.

The first step in evaluating if a long-run relationship exists between the variables included in the unrestricted error correction model (in equation 10) is to conduct the bounds test proposed by Pesaran et al (2001). This test involves using a joint F-test in evaluating if the first lag of the independent and dependent variables have an impact on the dependent variable (H_o: $\phi = \boldsymbol{\gamma = 0}$). The result from this joint F-test is then compared to the upper and lower bound values purported by Pesaran, Shin and Smith (2001) at the varying level of significance and also those generated by Narayan (2005) for smaller samples. The null hypothesis is that the variables are not cointegrated while the alternative is that a long-run relationship exists between the variables in the system.

$$\text{LN(REER)} = \boldsymbol{\beta} + \sum_{r=0}^{n} \boldsymbol{\beta}\, \boldsymbol{Z_{i,t-r}} + \boldsymbol{v_{i,t-1}} \quad \ldots (11)$$

$$\Delta \text{LN(REER)} = \boldsymbol{\beta} + \sum_{r=0}^{n} \boldsymbol{\beta} \Delta \boldsymbol{Z_{i,t-r}} + \boldsymbol{\gamma EC_{i,t-1}} + \boldsymbol{v_{i,t-1}} \quad \ldots (12)$$

In the case where the system is cointegrated, the long-run and short run models in equations 11 and 12 respectively are estimated and the error correction term which enters the short run model measures the speed of adjustment back to equilibrium following a shock to the system.

In estimating each of the models identified above, the AIC was utilized to fit the most appropriate model and autocorrelation, heteroskedasticity and correlation between the time constant error and the explanatory variables were controlled for.

5.1 Empirical Results: Macroeconomic Balance Approach

Table 2: Current Account Norm Equation

VARIABLES	**Current Account Norm**
NFA as a ratio of GDP	3.402***
Exports as a ratio of GDP	31.26**
Relative Productivity Index Growth	-0.0565*
Broad Money to GDP Growth	-0.0271
Labour Force Participation	0.312*
Fuel Expenditure to GDP	-49.05**
World Economic Crisis 2008-2009	-2.785**
Dummy: High Debt Periods	2.328**
Constant	-17.61**
Observations	80
Number of Countries	4
R-squared	0.588
*** p<0.01, ** p<0.05, * p<0.1	

In estimating the equilibrium Saving and Investment balance, trade openness, relative income and fiscal balance were found to be insignificant and as such were omitted from the models. The impact of the growth of broad money to GDP ratio on the current account was also found to be insignificant even at the 10.0 per cent level (p=0.22), but had a large practical impact on the estimated current account norm. The table above shows the variables that were statistically significant in explaining the medium run current account balance.

The result suggests that a 0.01 increase in the export to GDP ratio increased the current account norm by 0.3 per cent while a 0.1 increase in the NFA to GDP ratio, improves the current account balance by 0.3 per cent.[21] This suggests that a lower financial debt obligation is conducive to a more favourable and sustainable current account balance.[22] A 1.0 per cent increase relative productivity index, which implies that the domestic country's labour force becomes more productive relative to its major trading partners, results in a 0.06 per cent reduction in the current account to GDP ratio. This is an indication that higher income being earned by one countries labour force relative to another negatively influenced the trade relationship and by extension the current account.

[21] Reducing the debt, the ratio becoming less negative. In the case of the countries in the sample, allowing the ratio to approach zero.

[22] Due to an extremely high correlation between the NFA and the NFA squared for the countries (-0.97, -0.99, -0.95, -0.75 for Dom. Rep, Jamaica, Peru and Uruguay respectively) included within the sample, the optimal debt level which ensures a sustainable current account could not be calculated.

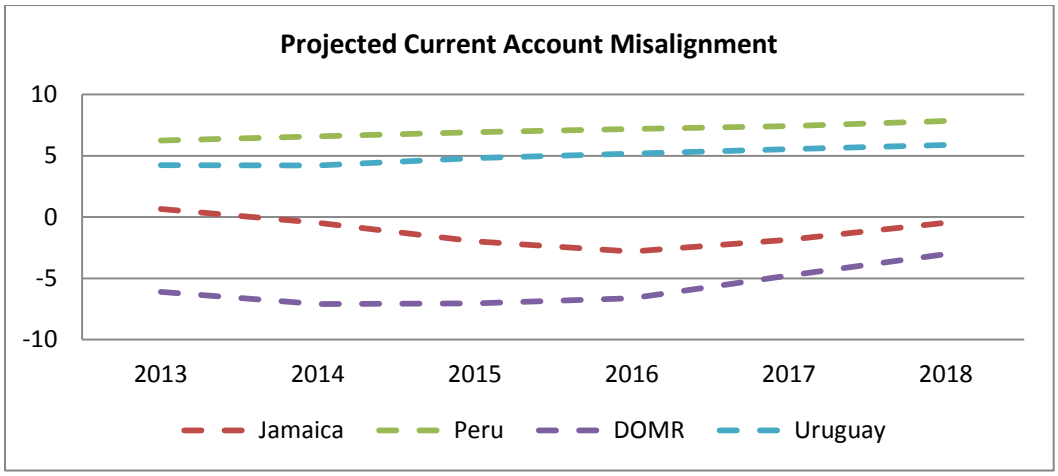
A 1.0 per cent increase in the labour force participation rate increases the current account balance by 0.3 per cent while an increase in the fuel expenditure to GDP ratio of 0.01 reduced the current account by 0.5 per cent. The labour force participation rate is also a proxy of the dependent to population ratio. Individuals who qualify to be in the labour force but stay outside willingly (such as discouraged workers) are also considered to be included in the class of individuals who aid in dissaving in the economy. Therefore, when the labour force increases, this is an indication of a lower portion of the population being younger or older than the required age criterion for the labour force or a lower portion of the population being comprised of discouraged workers. The results therefore highlight that a reduction in these sub-sections of the population improves the sustainable current account.

The current account was shown to be 2.8 per cent lower during the world economic recession of 2008-2009, which implies that crisis periods pose potential threats to the sustainable level of the current account. This is because international crisis periods influence the flows of capital, the level of exports, the price of commodities and the productivity of the labour force. The results also revealed that when a country had an NFA level that was over -60.0 per cent of GDP, then their current account surplus were 2.3 per cent higher than the converse.

Forecast Misalignment 2011-2018

The current account misalignment was calculated using the underlying current account forecast provided by the WEO Database and the current account norm forecast using the parameters outlined above. For Jamaica and the Dominican Republic, the forecast makes the assumption that these countries will seek to move to a more sustainable debt position in the medium term and as such will seek to minimize its NFA to GDP ratio over time. Another major issue which arose in forecasting the path of the sustainable current account was how to treat countries with increasing fuel expenditure as a percentage of GDP.

Figure 1: Projected Current Account Misalignment (2013-2018) for each panel in the sample



Jamaica and the Dominican Republic were identified as two of such countries and it was assumed that these countries would address their energy consumption issues by 2016, since the existing levels were largely unsustainable. The condition is also imposed on these countries that they will attempt to improve their export to GDP ratio by 1.0 per cent annually in absolute value over the medium term. Peru's norm was projected to be between 6 per cent and 8 per cent higher than the underlying current account in the medium term and Uruguay's projected current account showed similar misalignment between 4.0 - 6.0 per cent. Jamaica was estimated to have misalignment between 1per cent and -3.0 per cent over the medium term while the Dominican Republic had a current account norm which was lower than its underlying medium run current account between -3.0 per cent and -8.0 per cent.[23] The results from the trade elasticities used to calculate the percentage misalignment of the exchange rate is expressed in the table below. The trade equation results can be viewed in Table 10 in the Appendices.

Table 3: Trade and Current Account Elasticities

Forecast Elasticities (2013-2018)	Import Elasticity	Export Elasticity	Current Account Elasticity
Dominican Republic	0.466	0.8676	0.4283
Jamaica	0.0824	-0.3074	0.5804
Peru	0.5985	0.9805	0.3070
Uruguay	0.1789	0.4504	0.3012

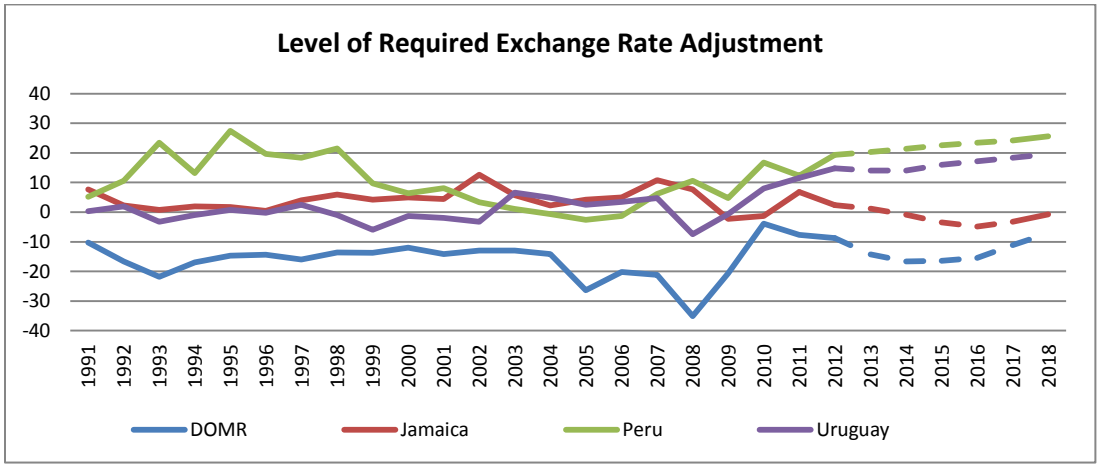
[23] See tables 7 and 8 in the appendices for more detailed projections.

Projected Exchange Rate Misalignment

The results indicate periods of strong misalignments, both overvaluation and undervaluation in all the currencies being evaluated. However, these periods of exchange rates misalignments were observed to be self-corrective through movements in the macroeconomic fundamentals and subsequent adjustments in the sustainable current account. This suggests that the misalignment in the exchange rate is a stationary series and as such is mean reverting. The three unit roots tests explained in Section 4 above were used to test whether or not this series was explosive. The results show that this series is stationary at the 5.0 per cent level without a trend, which implies that misalignment in the current account is self-correcting and does not require excessive policy action to close. This however occurs due to changes in other macro-economic fundamentals to equate the underlying and current account norm.

Figure 2 below shows the behavior of the estimated exchange rate adjustment over the sample period and forecasted to 2018. The forecasted adjustment for Jamaica shows that moving into the medium term Jamaica will be mildly undervalued; the gap approximately closing in 2018. The Dominican Republic shows highly significant signs of undervaluation moving into the medium term, ending at -7.0 per cent in 2018, the major adjustment in 2017 and 2018 highly dependent and the country correcting its fuel expenditure ratio. Peru and Uruguay both show significant signs of overvaluation moving into the medium term, with both countries levels of overvaluation trending upwards and ending at approximately 26.0 per cent and 20.0 per cent respectively in 2018.[24]

Figure 2: Exchange Rate Misalignment (1990-2018)



[24] The projected path of each countries exchange rate misalignment can be viewed in Table 6 in the Appendices.

5.2 Empirical Results: ARDL NATREX Approach

5.2.1 Bounds Test

The estimation of the unrestricted error correction model presented in Section three can be viewed in Table 8 in the Appendices. In an effort to evaluate whether or not the presented system is co-integrated, the Pesaran et al (2001) bounds test was utilized. The bounds test suggests conducting a joint test of significance on the lagged variables in the unrestricted error correction model. This joint test revealed an F-statistics of F (3, 3) =10.04. This test value was compared to upper and lower bounds values as outlined in Pesaran, Shin and Smith (2001) in an effort to determine if the variables included in the system are co-integrated. Pesaran, Shin and Smith (2001) posit that the asymptotic 1 per cent critical value upper bound for a system with unrestricted intercept and no trend term is 5.61 where k=3. Narayan (2005) notes that the bounds presented by Pesaran et al (2001) ought not to be used for small sample sizes and as such he proposes a smaller upper bound of 5.25 for samples between 30 and 80. Using both upper bounds, the results confirmed the existence of cointegration at the 1 per cent level of significance. The next step in the ARDL approach suggests that we estimate the long-run model as presented in the methodology above.

Long-run Model

The long-run model suggests that the long-run net impact of a 0.1 unit increase in the NFA to GDP ratio is a 0.02 per cent appreciation of the REER.[25] Similarly, a 0.1 unit increase in the social consumption to GDP ratio of a country appreciates the REER by 0.0011 per cent in the long-run. Therefore, increase in social consumption has a negligible impact on the REER when all lagged effects have fully passed through. A one unit increase in the relative productivity index of a countries labour force appreciates the countries REER index by 0.002 per cent. Surprisingly, the long-run impact of a 0.1 increase in the fuel expenditure to GDP appreciates the equilibrium REER by 0.08 per cent in the next period.

[25] The REER is a measure of the competitiveness of a country's currency. An appreciation of the REER is an indication of a loss in competitiveness while depreciation in the REER is an increase in the competitiveness of a country's currency relative to its trading partners.

Table 4: Long-run Model

Independent Variables:	DV: LN(REER)
NFA	0.572**
Social Consumption	0.185*
RPI	0.00160***
Lag_{t-1} Fuel Expenditure	0.813**
Lag_{t-1} NFA	-0.414*
Lag_{t-1} Social Consumption	-0.174
Lag_{t-1} LN(REER)	0.477*
Constant	2.262*
Observations	80
Number of Country Code	4
R-squared	0.429
*** p<0.01, ** p<0.05, * p<0.1	

The results above therefore suggest that when a country imports more fuel, increases private or public spending or becomes less indebted, then their currency will become less competitive relative to their trading partners. The result also implies that an increase in a countries labour productivity, relative to its trading partners, may result in a loss in external competitiveness. This is can be intuitively explained with economic theory. A country's NFA improves capital inflows relative to capital outflows, which implies that there is more purchase of foreign assets by domestic investors relative to foreign investors demand for domestic assets. This improves the domestic country's ability to sustain a stronger REER. The result of the social consumption parameter is suggestive of the Balassa-Samuelson effect whereby increased social expenditure in the non-tradable sectors relative to the tradable sector resulted in an appreciation of a country's currency. However, it is possible that this long-run impact may be different for the varying countries in the sample and as such future work should focus on country-specific results. The fuel expenditure impact is also ambiguous and may be panel sensitive. This figure may be due to the fact that in some countries within the panel, namely Peru, increases in fuel imports are accompanied by higher levels of fuel exports and higher levels of overall tradable goods exports. As a result, there are a number of periods of trade surpluses for Peru which may change the long-run panel impact of this variable. The short run impact of all these variables were however consistent with the literature.

Short Run Dynamics: The Error Correction Term

The error correction term from the short run dynamics model highlighted that the speed of convergence of exchange rate deviations from its long-run equilibrium following a shock is approximately 46.2 per cent each year. This is suggestive that the fundamentals which help to determine the equilibrium exchange rate are automatically manipulated by market conditions to ensure that exchange rate misalignments are partially corrected within the year. The short run dynamics regression was estimated with country specific error correction terms and the results suggested that only Uruguay and Jamaica had a statistically significant speed of adjustment in the exchange rate when there is a shock to the system. In the country specific equation, the results suggest that 21.2 per cent and 60.0 per cent of the misalignment in the exchange rate for Uruguay and Jamaica respectively is corrected per year. For the panel, the half-life deviation procedure suggests that the length of time it takes the exchange rate to adjust by half following a shock to the economy was 1.12 years. When the country specific error correction terms were used, the estimated half-life adjustments were 0.8 years for Jamaica and 2.9 years for Uruguay. The adjustment suggested by the insignificant half-life parameters of the Dominican Republic and Peru were 45 years and 145 years respectively. This suggests no adjustment in the exchange rate following a shock to these economies. This can be explained by the fact that this approach estimated these currencies as being closely aligned over the sample period.[26] The half-life speed of adjustment found for Jamaica in this study (that is between 0.76 and 1.12 years) coincides with the finding of Robinson (2010) who found a half-life adjustment between 0.5-1.08 years using three approaches to calculate the equilibrium RER. Zalduendo (2006) and MacDonald and Ricci (2003) found a half-life speed of adjust of 2.5 years for Venezuela and South Africa Respectively. They however note that the speed of adjustment is dependent on the structure of the economy and the performance of the macroeconomic fundamentals. The result from this holds critical policy implications since it suggests that if left to itself, exchange rate misalignments are self-corrective and furthermore, that self-correction is completed over the short run.

[26] A presentation of the country specific error correction terms can be seen in Table 12 of the Appendices.

Table 5: Short Run Dynamics: Full Panel

Independent Variables:	DV: Δ LN(REER)
Lag_{t-1} ECM	-0.462**
Δ NFA	0.535**
Δ Social Consumption	0.604**
Δ Fuel Expenditure	-1.372*
Δ RPI	0.00328*
Lag_{t-1} Δ Fuel Expenditure	-0.302
Lag_{t-1} Δ Social Consumption	-0.152
Constant	0.0109**
Observations	76
Number of Country Code	4
R-squared	0.467
*** p<0.01, ** p<0.05, * p<0.1	

Comparison of Empirical Findings: NATREX and Macro-Balance Approach

The results from the NATREX and the MB approaches are not readily comparable because of the nature of the underlying assumptions of the two methodologies. The NATREX estimates a dynamic long-run equilibrium exchange rate that is consistent with macroeconomic fundamentals while the MB approach estimates the exchange rate misalignment over the medium term that would ensure internal and external balance simultaneously. Additionally, while the NATREX is a direct approach to calculating the EREER, the MB approach utilizes an indirect methodology to calculate exchange rate misalignment. Nevertheless, the two approaches were consistent in showing that there have been several intervals of misalignment and exchange rate adjustment over the sample period. Most of the factors which were found to significantly influence the current account norm, were also found to have long-run relationships with the REER. The most consistent and important findings between the two approaches is that exchange rate misalignment is a stationary series which is largely self-corrective. This implies that in the long-run, there should be no misalignment in the exchange rate since macroeconomic fundamentals will adjust to ensure that both exchange rate and current account gaps are closed. Finally, the resulting equilibrium exchange rates were highly similar using the two approaches, with deviations occurring mainly between recessionary periods.[27]

[27] This may be due to model specification where the crisis dummies were insignificant and omitted from the NATREX long-run model, while it was significant in estimating the CA norm.

6. Conclusion and Policy Implications

The study found that the critical factors influencing the sustainable levels of the current account included a country's NFA to GDP ratio, relative productivity growth, labour force participation and fuel to GDP ratio. World economic crisis periods were also found to significantly reduce the sustainable levels of the current account, which can be explained by shocks to the flow of capital during these periods. The results from this study also revealed that there have been a number of years over the sample period where the current account for the various countries has been significantly misaligned. As a result, the MB approach has found that the exchange rates for each of the countries in the study have had significant periods of misalignment from the ERER. The required level of exchange rate adjustment was found to be a stationary series over the sample period, which confirmed the assumption that in the long-run, a current account misalignment and by extension an exchange rate misalignment from its equilibrium positions, should be self-corrective.

The NATREX approach similar to the MB approach found that the EREER was determined by a country's net assets, the level of government and foreign consumption, the effectiveness of the labour force and the fuel expenditure of the country. Shocks to the EREER were found to be self-corrective for all countries in the sample (negative error correction term) but significant corrections were only found for Jamaica and Uruguay. The speed of adjustment was found to be relatively quick based on both the half-life deviation and the error correction term.

These findings hold a plethora of implications for policy discussions moving forward. The most notable among these is the self-corrective nature of exchange rate misalignment found by both procedures. The implication of this is that since the real exchange rate is determined by long-run macroeconomic fundamentals, exchange rate misalignment will be corrected through the behaviour of these variables. The second notable implication is that less emphasis should be placed on exchange rate misalignment as the sole factor influencing current account misalignment. The results implicitly show that a current account misalignment may also rest on the macroeconomic fundamentals which determined the sustainable levels of the current account. Consequently, the question which policy makers should carefully examine is the extent to which these fundamentals are performing optimally and whether price adjustment is the only factor which can impose optimality on these macroeconomic fundamentals. The final implication of the

findings of this study suggests that price competitiveness is by no means the only factor which produces a favorable current account. This is seen by the fact that the countries in the sample have had several periods of both undervaluation and overvaluation. However, the current account has not responded to these periods of misalignment. In the case of Jamaica for example**,** the current account has steadily deteriorated despite fluctuations in the REER and periods of misalignments in both direction. Therefore, the structural factors influencing the current account must be evaluated rather than looking to price competitiveness as the only means of restoring favourable and sustainable current account performances.

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Appendices

Figure 3: Trends in Selective Economic Data: Jamaica

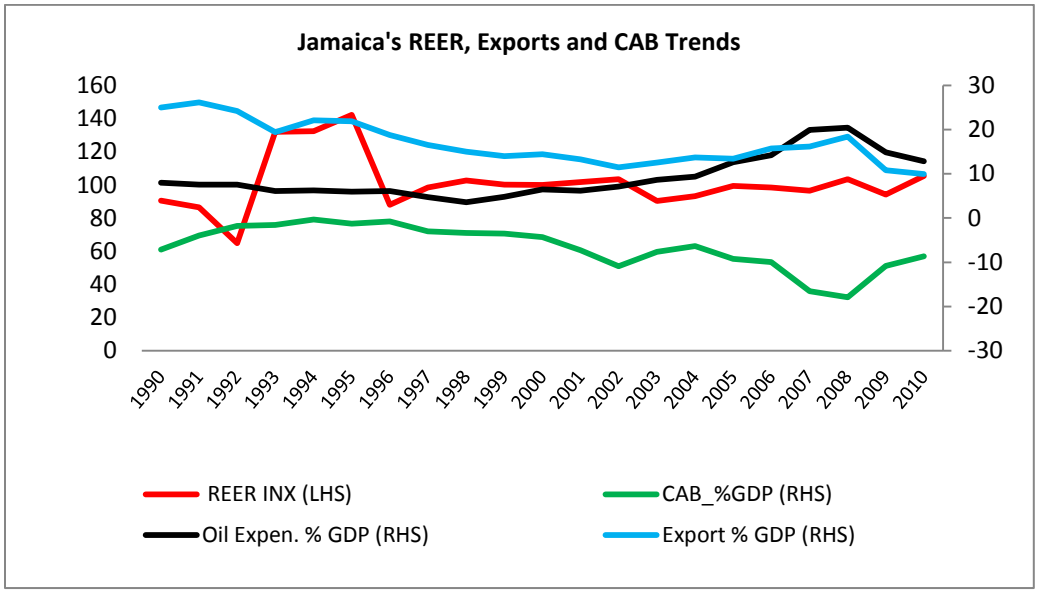

Figure 4: Trends in Selective Economic Data: Peru

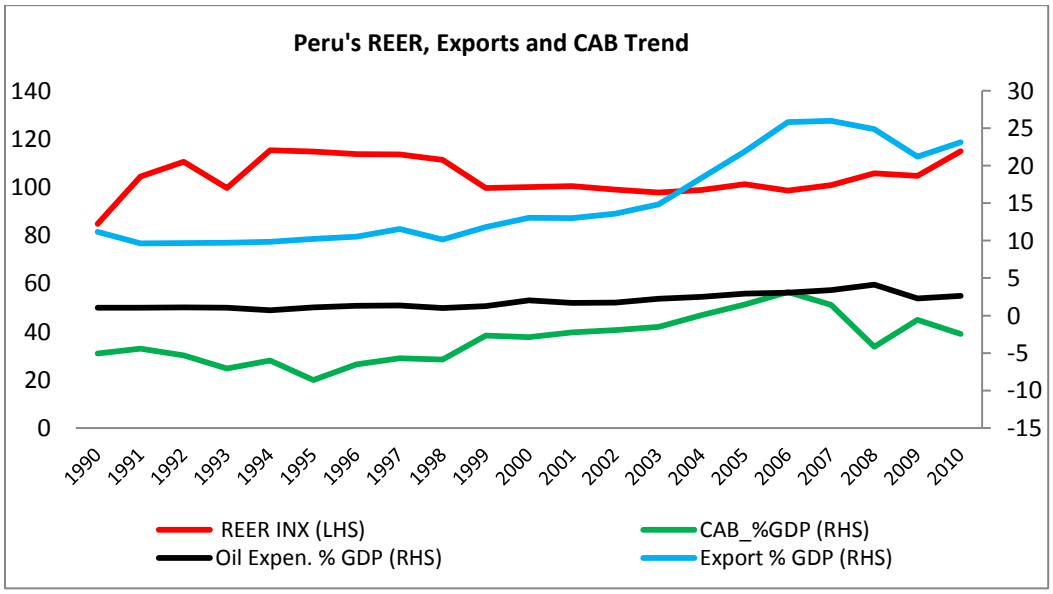

Figure 5: Trends in Selective Economic Data: Dominican Republic

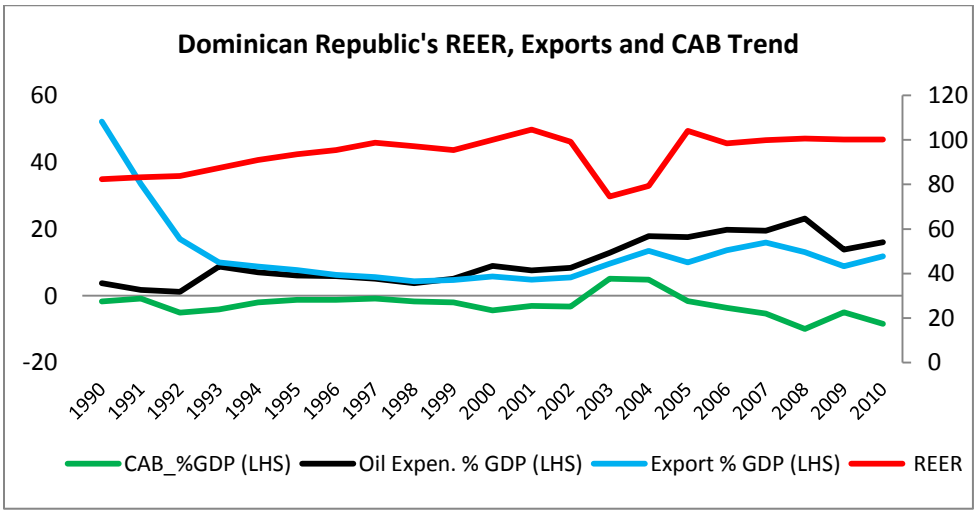

Figure 6: Trends in Selective Economic Data: Uruguay

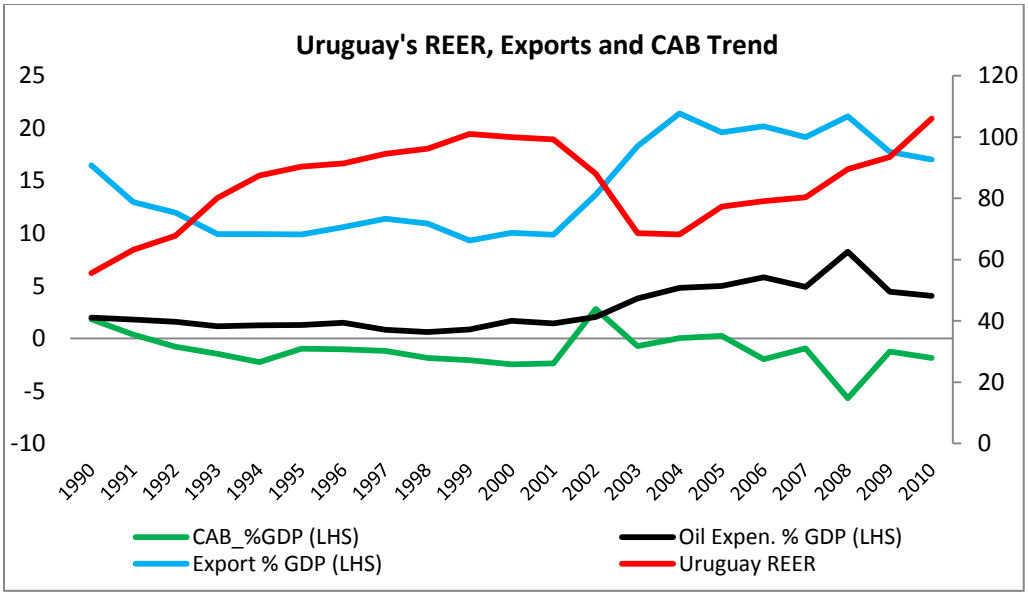

Table 6: Unit Root Test Details

Variable Name	Test	Demeaned, lags(AIC), trend p-value	Lags(AIC), trend p-value	Demeaned, trend p-value	Conclusion
Financial Deepening	IPS	P=0.004 mean lags=0.50	P=0.004 mean lags=0.50	P=0.003 No Lags	This variable was found to be stationary at the five percent level of significance.
	LLC	P=0.001 mean lags=0.50	P=0.045 mean lags=1.50	P=0.046 1 Lag	
	Fisher[28]	P=0.06 mean lags=1	P=0.74 mean lags=1	P=0.02 No Lags	
Trade Openness	IPS	P=0.017 mean lags=2.50	P=0.001 mean lags=1.50	P=0.0001 No lags	This variable was found to be stationary at the one percent level of significance.
	LLC	P=0.000 mean lags=0.75	P=0.000 mean lags=0.50	P=0.02 1 Lag	
	fisher	P=0.00 mean lags=2	P=0.11 mean lags=2	P=0.003 No lags	
Current Account Balance as a ratio of GDP	IPS	P=0.009 mean lags=0.50	P=0.011 mean lags=1	P=0.01 No lags	This variable was found to be stationary at the five percent level of significance.
	LLC	P=0.012 mean lags=0.50	P=0.02 mean lags=0.50	P=0.19 1 Lag	
	fisher	P=0.07 mean lags=1	P=0.22 mean lags=1	P=0.03 No lags	
Net international position as a ratio of GDP	IPS	P=0.000 mean lags=1.25	P=0.001 mean lags=1.25	P=0.001 No lags	This variable was found to be stationary at the one percent level of significance.
	LLC	P=0.000 mean lags=1.25	P=0.000 mean lags=1.25	P=0.000 1 Lag	
	fisher	P=0.00 mean lags=1	P=0.10 lags=1	P=0.000 No lags	
Social Consumption to GDP	IPS	P=0.004 mean lags=2	P=0.0000 mean lags=1.25	P=0.16 No lags	This variable was found to be stationary at the one percent level of significance.
	LLC	P=0.000 mean lags=2	P=0.000 mean lags=1.25	P=0.000 1 Lag	
	fisher	P=0.04 mean lags=2	P=0.0000 mean lags=1	P=0.21 No lags	
Fiscal Balance Ratio to GDP	IPS	P=0.12 mean lags=0.75	P=0.23 mean lags=1	P=0.008 No lags	Largely inconclusive, non-stationary conclusion based on Fisher and IPS.
	LLC	P=0.053 mean lags=1.25	P=0.034 mean lags=1.50	P=0.30 1 Lag	
	fisher	P=0.50 mean lags=1	P=0.37 mean lags=1	P=0.01 No lags	
Oil Balance to GDP	IPS	P=0.000 mean lags=0.50	P=0.000 mean lags=1	P=0.003 No lags	This variable was found to be stationary at the one percent level of significance.
	LLC	P=0.000 mean lags=0.50	P=0.01 mean lags=0.1.5	P=0.000 1 Lag	
	fisher	P=0.000 mean lags=1	P=0.002 mean lags=1	P=0.000 No lags	
Relative Income	IPS	P=0.86 mean lags=1.25	P=0.80 mean lags=1	P=0.72 No lags	All panel stationarity tests give an indication of non-stationarity in this series.
	LLC	P=0.93 mean lags=1.25	P=0.94 mean lags=1	P=0.94 1 Lag	
	fisher	P=0.973 mean lags=1	P=0.99 mean lags=1	P=0.997 No lags	
Labour Force	IPS	P=0.16	P=0.52	P=0.015	All panel stationarity tests

[28] The D-Fuller approximation is utilized.

Per Capita Relative Productivity		mean lags=0	mean lags=1	No lags	give an indication of non-stationarity in this series.
	LLC	P=0.002	P=0.06	P=0.0.04	
		mean lags=0	mean lags=1	1 Lag	
	fisher	P=0.54	P=0.83	P=0.12	
		mean lags=1	mean lags=1	No lags	
REER	IPS	P=0.03	P=0.016	P=0.00	This variable was found to be stationary at the five percent level of significance.
		mean lags=0.00	mean lags=0.5	No lags	
	LLC	P=0.01	P=0.04	P=0.067	
		mean lags=0.00	mean lags=0.5	1 Lag	
	fisher	P=0.06	P=0.04	P=0.02	
		mean lags=1	mean lags=0.00	mean lags=0.00	
Imports	IPS	P=0.6	P=0.00	P=0.37	This variable was found to be stationary at the one percent level of significance with lags and trend but non-stationary otherwise.
		mean lags=2.75	mean lags=3.25	No lags	
	LLC	P=0.91	P=0.00	P=0.82	
		mean lags=2.75	mean lags=3.25	1 Lag	
	fisher	P=0.79	P=0.05	P=0.65	
		mean lags=4	mean lags=4	mean lags=0.00	
Government Spending	IPS	P=1	P=0.0.66	P=1	All panel stationarity tests give an indication of non-stationarity in this series.
		mean lags=2	mean lags=1.75	No lags	
	LLC	P=0.95	P=1	P=1	
		mean lags=2	mean lags=2	1 Lag	
	fisher	P=1	P=0.95	P=0.91	
		mean lags=2	mean lags=2	mean lags=0.00	

Table 7: Current Account Misalignment Forecast for 2013-18

Forecast Period	Jamaica	Peru	DOMR	Uruguay
2013	0.6674034	6.2498803	-6.10657	4.237265
2014	-0.4708692	6.5798581	-7.10248	4.223814
2015	-1.9821202	6.9215493	-7.03489	4.81596
2016	-2.8103311	7.1799711	-6.6288	5.171705
2017	-1.8494663	7.4191409	-4.7658	5.537054
2018	-0.4603869	7.8470760	-3.03408	5.893011

Table 8: Exchange Rate Forecast Adjustments

Forecast Period	DOMR	Jamaica	Peru	Uruguay
2013	-14.26	1.15	20.36	14.07
2014	-16.58	-0.81	21.43	14.02
2015	-16.43	-3.42	22.54	15.99
2016	-15.48	-4.84	23.39	17.17
2017	-11.13	-3.19	24.17	18.38
2018	-7.08	-0.79	25.56	19.56

Table 9: Stationarity of Exchange Rate Misalignment

Test		With trends, AIC determined lags	AIC determined lags and no trend
LLC	Exchange Rate Misalignment	• Demeaned, 0.25 mean lags, p=0.029 • Not demeaned, o.25 mean lags, p=0.065	P=0.08
IPS		• 0.25 mean lags, P=0.14	0.50 mean lags, p=0.0488
Fisher			1 lag, P=0.02

Table 10: Trade Equations

VARIABLES	Export Growth	Imports Growth
Jamaica REER growth	-0.307***	0.0824***
Peru REER growth	-0.980***	0.599**
DOMR REER growth	-0.868**	0.466**
Uruguay REER growth	-0.450***	0.179
Δ Govt. Expenditure		5.64e-05
GDP Growth		0.0273***
WEC		-0.120***
Relative Productivity Growth	0.00651*	
Imports Growth	0.513**	
Constant	0.0228**	-0.0160
Observations	80	80
R-squared	0.632	0.504
Number of Country Code	4	4
Robust standard errors in parentheses	*** p<0.01, ** p<0.05, * p<0.1	

Table 11: Unrestricted Error Correction Model

Independent Variables:	DV: Δ LN(REER)
Δ NFA	0.298**
Δ Social Consumption	0.628*
Δ Fuel Expenditure	-1.150*
Δ RPI	0.00511**
Lag_{t-1} LN(REER)	-0.564**
Lag_{t-1} NFA	0.0780**
Lag_{t-1} Social Consumption	0.0942
Lag_{t-1} Fuel Expenditure	-0.248
Lag_{t-1} RPI	0.00184
Lag_{t-1} Δ LN(REER)	0.331***
Lag_{t-1} Δ Social Consumption	-0.344
Lag_{t-1} Δ Fuel Expenditure	-0.225
Lag_{t-2} Δ Fuel Expenditure	1.102
Lag_{t-1} Δ NFA	-0.261
Lag_{t-2} Δ NFA	0.353
Lag_{t-1} Δ RPI	-0.00214
Constant	2.357**

Observations	68
Number of Country Code	4
R-squared	0.683
*** p<0.01, ** p<0.05, * p<0.1	

Table 12: SR Dynamic: Country Specific

Independent Variables:	DV: Δ LN(REER)
Lag_{t-1} ECM JAM	-0.599***
Lag_{t-1} ECM PERU	-0.00476
Lag_{t-1} ECM DOMR	-0.0159
Lag_{t-1} ECM URU	-0.212***
Δ NFA	0.586**
Δ SC	0.591**
Δ Fuel Expenditure	-1.054
Δ RPI	0.00349*
Lag_{t-1} Δ Fuel Expenditure	-0.348
Lag_{t-1} Δ Social Consumption	-0.136
Lag_{t-1} Δ NFA	-0.0461
Constant	0.0174***
Observations	76
Number of Country Code	4
R-squared	0.493
*** p<0.01, ** p<0.05, * p<0.1	

Half-Life Deviation

The Half-Life Derivation formula as adopted from an IMF working paper by Zalduendo (2006) is as follows:

The cointegrating equation provides a means to assess the speed of adjustment; namely, the time in years, *t*, necessary to reduce the initial deviation from equilibrium can be calculated by estimating $(1-\gamma)^t = (1-\delta)$, where γ is the estimated cointegrating coefficient and δ is the share of the catch-up being targeted (e.g., 0.5 for a half-life reduction).

$T = [\text{Ln}(1-\delta)] / [\text{Ln}(1-\gamma)]$