

Examining Measures of the Equilibrium Real Exchange Rate (ERER):

Macro Balance Approach (MB) and the Natural Real Exchange Rate (NATREX)

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Motivation

- Much research has been conducted on the estimation of real exchange rates and its relation with the current account.
- Previous studies for Jamaica generally utilized a time series methodology while IMF methodology proposes the use of panel techniques. However, IMF panel studies have not been representative of the economic structure of Jamaica.
- Objectives:
 - To apply panel estimation techniques to determine the equilibrium exchange rate using the Macro-balance and NATREX approaches.
 - To determine whether Jamaica's exchange rate is misaligned.

Introduction

- Why should we be concerned about exchange rate misalignment?
 1. Price competitiveness
 2. Unsustainable Current Account
 3. Capital flows and international performance
 4. Growth

Conceptual and Theoretical Framework

- Approaches:
 - The Fundamental Equilibrium Exchange Rate (FEER), Macro-Balance approach, 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.
- The Macro-Balance (MB) Approach:
 - The seminal contributors to the Macro-Balance approach are Williamson (1994), Isard et al. (2001) and IMF CGER's division.
 - The equilibrium real exchange rate is the sustainable and consistent medium to long term value of a currency which ensures the sustainability of the current account balance (optimal deficit or surplus) and both full employment and price stability (Isard et al., 2001).
 - This is an indirect approach that determines the equilibrium real exchange rate that ensures both internal and external balance of an economy.

Conceptual and Theoretical Framework

- Various studies were conducted on the MB approach which includes: Williamson (1994), Isard (2001), CGER's Group etc., Williams (2008), Rochester (2010) and Robinson (2010).
- Fundamental variables include: 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).
- Newly added variables include a more comprehensive measure of relative productivity and a dummy variable capturing relative debt sustainability positions.

Conceptual and Theoretical Framework:

- NATREX Approach:
 - Stein (1994) is the seminal contributor.
 - This is a direct approach that estimates the EREER over a long-run horizon.
 - The NATREX approach holds that the equilibrium exchange rate is explained by the prevailing real economic fundamentals in the economy (Dikmen, 2008).
 - The fundamentals utilized are classified as disturbances to productivity and social thrift at home and abroad. In doing this, the aim of the NATREX is to explain why the REER varies and how it responds to changes in specific fundamentals (Williamson, 1994), Siregar and Rajan (2006)).

Data Sources and Sample Selection

- Sample Criteria:
 - Location: Western Hemisphere
 - Exchange Rate Regime: Managed Float
 - GDP per Capita
 - Trade Openness
 - Economic History
- Countries: Jamaica, Uruguay, Dominican Republic, Peru
- Sources:
 - Central banks' databases, the IMF International Financial Statistics database, the World Economic Outlook website, the World Bank database and UNDATA.

Stationarity Tests

For concreteness and statistical robustness, three stationarity tests were used.

- I. Im, Pesaran and Shin
- II. Levin, Lin, Chu
- III. Fisher Stationarity Test: Dfuller Derivation

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)

Macro-balance Approach

Methodology: MB Approach

- Steps in Calculating the MB ERER:
 - Identify each country's underlying current account position (WEO Estimates)
 - Generate the Current Account Norm (Medium-run Equilibrium Savings-Investment)
 - Estimate trade elasticities to determine the required adjustment to close the exchange rate misalignment.

Relevant MB Equations

Current Account Norm:

- $$\text{CAB} = \beta_0 + \beta_1 \text{Trade_O}_{it} + \beta_2 \text{Trade_O}_{it}^2 + \beta_3 \text{Rel_Inc}_{it} + \beta_4 \text{Rel_Inc}_{it}^2 + \beta_5 \text{LFPR}_{it} + \beta_6 \text{Fuel_Exp}_{it} + \beta_7 \text{Fin_Deep}_{it} + \beta_8 \text{NFA}_{it} + \beta_9 \text{FB}_{it} + \beta_{10} \text{FB}_{it}^2 + \beta_{11} \text{Rel_Prod} + \beta_{11} \text{Dummies} + \varepsilon_{it} + \mu_i$$

- Trade Elasticity Equations:

$$\text{LN(Exports)} = \beta_0 + \beta_1 \text{LN(REER)}_{it} + \beta_2 X_{it} + \varepsilon_{it} + \mu_i$$

$$\text{LN(Imports)} = \beta_0 + \beta_1 \text{LN(REER)}_{it} + \beta_2 Z_{it} + \varepsilon_{it} + \mu_i$$

Where β_1 measures the elasticity of trade and X,Z is a vector of independent variables influencing Exports and Imports.

- Adjustment formula (Faruquee and Isard (1998)):

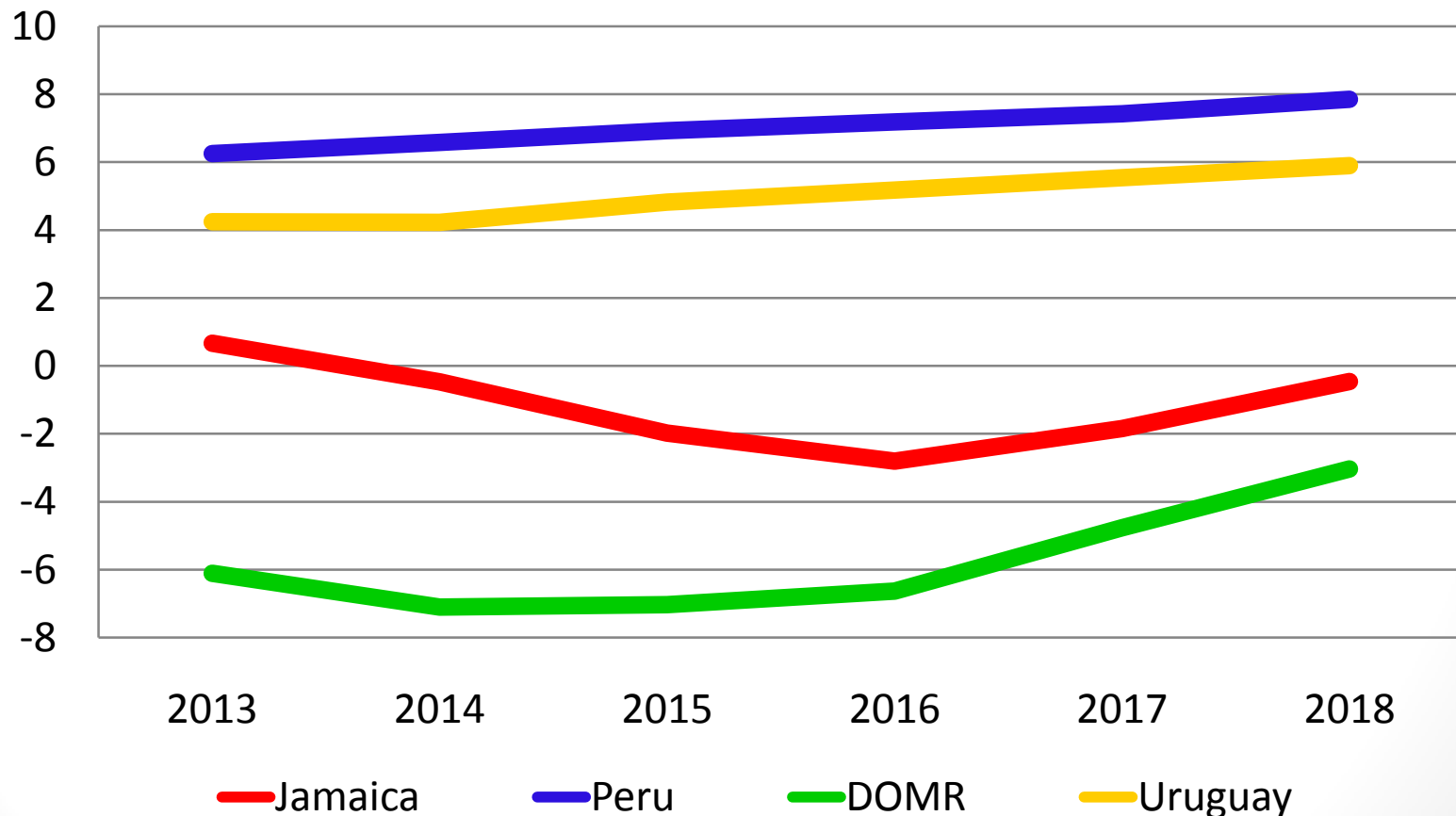
- $$(\mathbf{R}_{t-i}^E - \mathbf{R}_{t-i}^a) = \mathbf{C}_m / [m - (m\beta_m + x\beta_x)]$$

Current Account Misalignment Forecast

- Major **Assumptions**:
 - For Jamaica and the Dominican Republic, the forecast assumes that these countries will seek to move to a more sustainable debt position in the medium term and as such will seek to improve its NFA to GDP ratio over time.
 - Countries with an unsustainable fuel expenditure as a percentage of GDP would seek to implement more efficient energy substitutes following 2016.
 - Countries would improve their export to GDP ratio by at least 1.0 per cent annually in absolute value over the medium term.

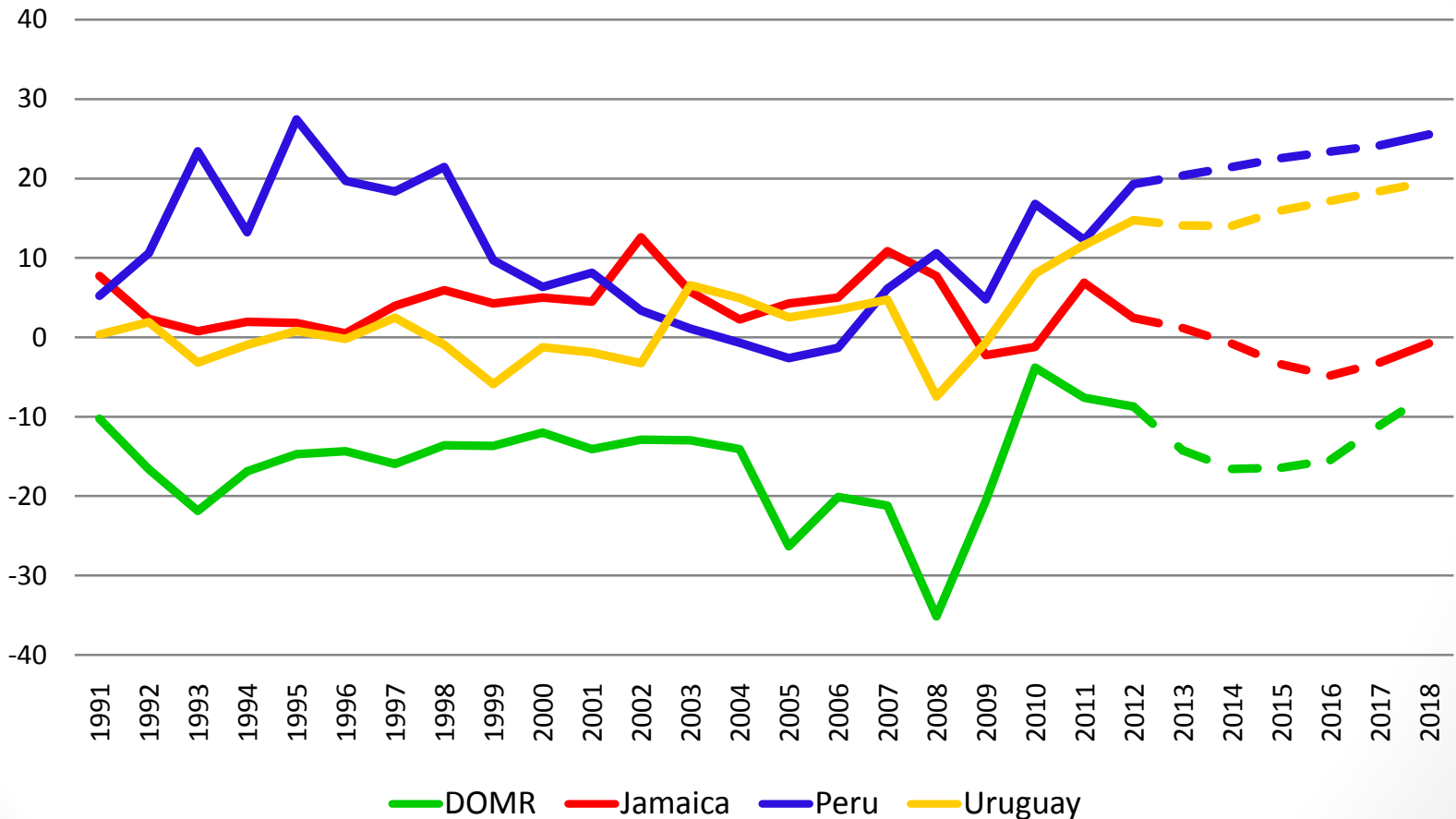
Results: Current Account Misalignment Forecast

Projected Current Account Misalignment



Results: Required Exchange Rate Adjustment

Level of Required Exchange Rate Adjustment



NATREX Approach

NATREX Methodology

- The single reduced form equation approach was used in this study. This approach directly calculates the natural real exchange rate by explicitly modeling the real exchange rate as a function of fundamentals.
- In improving the framework, a more comprehensive measure of relative productivity was utilized and fuel expenditure was included as one of the factors influencing the long run value of a country's currency.
- The ARDL estimation technique was utilized.

NATREX: ARDL Methodology

- Steps:
 - I. Estimate the unrestricted error correction model (UECM):
 - II. Conduct the bounds test procedure outlined by Pesaran et al (2001) to determine if the variables are cointegrated.
 - III. Estimate the Short-Run and Long-run models.
 - Both panel and country-specific short-run models were generated.

NATREX: ARDL Methodology

- UECM:

$$\Delta \text{LN}(\text{REER}) = \beta + \sum_{r=0}^n \beta \Delta \mathbf{Z}_{i,t-r} + \sum \phi \mathbf{Z}_{i,t-1} + \gamma \text{REER}_{i,t-1}$$

Where $\mathbf{Z}_{i,t}$ is a vector of explanatory variables, relative productivity index, social consumption, fuel expenditure, net foreign assets/liabilities.

- Short-Run and Long-Run Models:

- $\text{LN}(\text{REER}) = \beta + \sum_{r=0}^n \beta \mathbf{Z}_{i,t-r} + v_{i,t} \dots$ L.R Model
- $\Delta \text{LN}(\text{REER}) = \beta + \sum_{r=0}^n \beta \Delta \mathbf{Z}_{i,t-r} + \gamma \text{EC}_{i,t-1} + v_{i,t} \dots$ S.R Model

Where EC is the error correction term which denotes the speed of adjustment following a shock to the REER.

NB. Model specification for the ARDL was done using the AIC and BIC criterion to ensure the models were appropriately specified since this procedure is very sensitive to the model specification.

Empirical Results: NATREX

- The Bounds test suggested all variables were cointegrated at the 1.0 per cent level of significance.
- Long-Run Model
 - Higher levels of relative productivity and lower levels of debt appreciate the REER since this improves the country's ability to sustain a stronger REER.
 - Social consumption had a negligible net impact on the REER.
 - Fuel expenditure had a positive impact on the REER.
 - RPI on the REER was positive and significant, albeit negligible.

Empirical Results: NATREX

- Short-Run Model: Panel and Country-specific
 - Increased fuel expenditure depreciated the REER.
 - Increased social consumption appreciated the REER.
 - Improvements in the NFA appreciated the REER.
 - An increase in the RPI appreciated the REER.
- ECT Panel:
 - The panel error term (EC) shows that the speed of adjustment following a shock to the system was 0.46. This implies that 46% of the misalignment in the exchange rate caused by a shock to the system is corrected after a year.
 - The half life deviation procedure showed that it takes 1.1 years for exchange rate deviation in the panel to reduce by half the amount caused by a shock.

NATREX Empirical Results: Country Specific Indicators

- Country Specific ECM :
 - **Jamaica:**
 - The speed of adjustment following a shock to the system was 0.6. This implies that 60.0 per cent of the misalignment in the exchange rate caused by a shock to the system is corrected after a year.
 - The half-life speed of adjustment suggest that it takes the system 0.8 years to adjust by half following a shock.
 - Findings were consistent with Robinson (2010) who found a speed of adjustment between 0.5 – 1.08 years.
 - **Uruguay:**
 - The speed of adjustment following a shock to the system was 0.212. This implies that 21.2 per cent of the misalignment in the exchange rate caused by a shock to the system is corrected after a year.
 - The half-life speed of adjustment suggest that it takes the system 2.9 years to adjust by half following a shock.
 - **Peru and DOMR**
 - The EC adjustment for Peru and DOMR was not significant but had the correct adjustment sign.

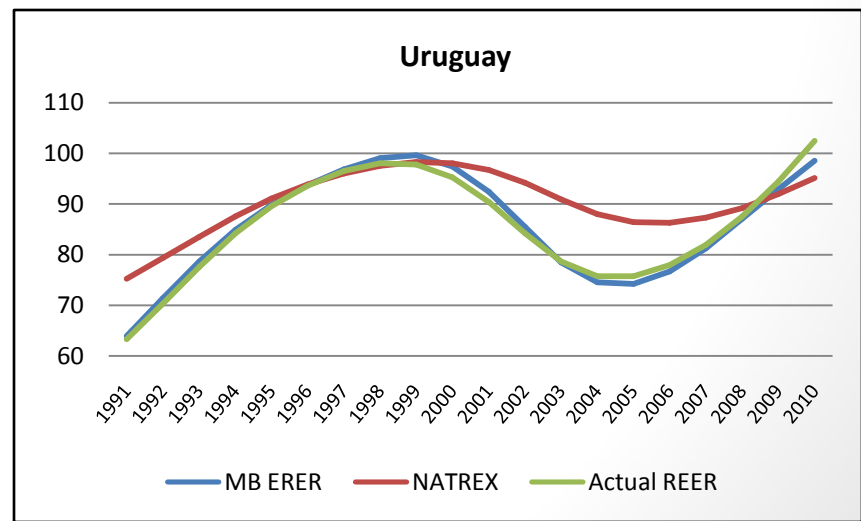
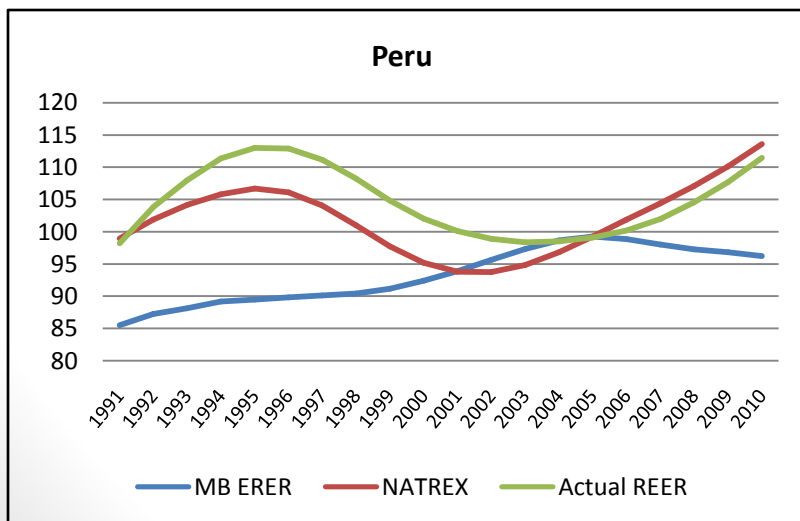
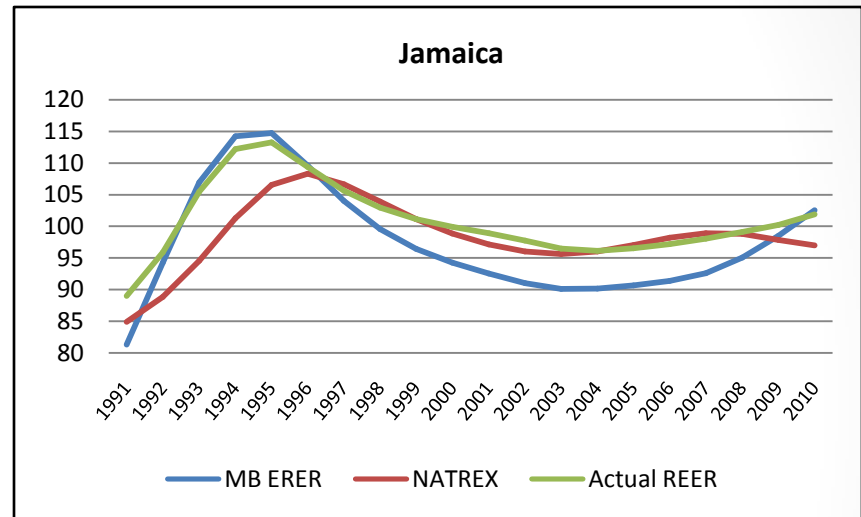
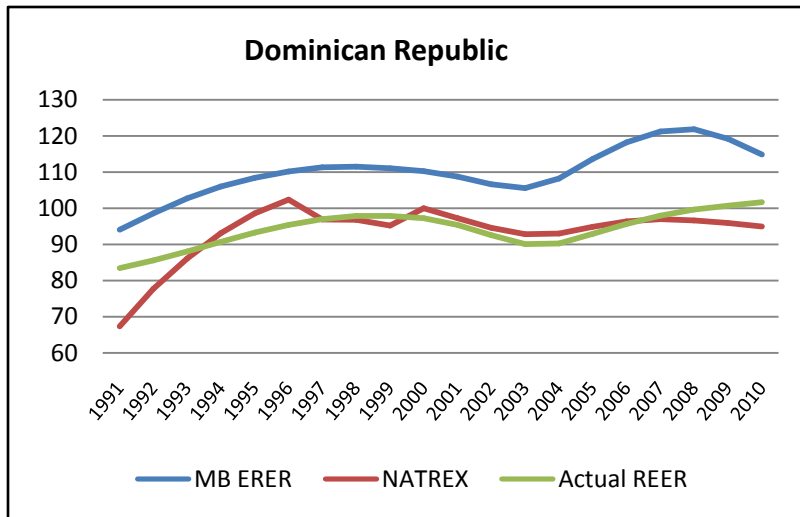
*Comparison of MB and
NATREX Results*

Comparison: MB and NATREX Results

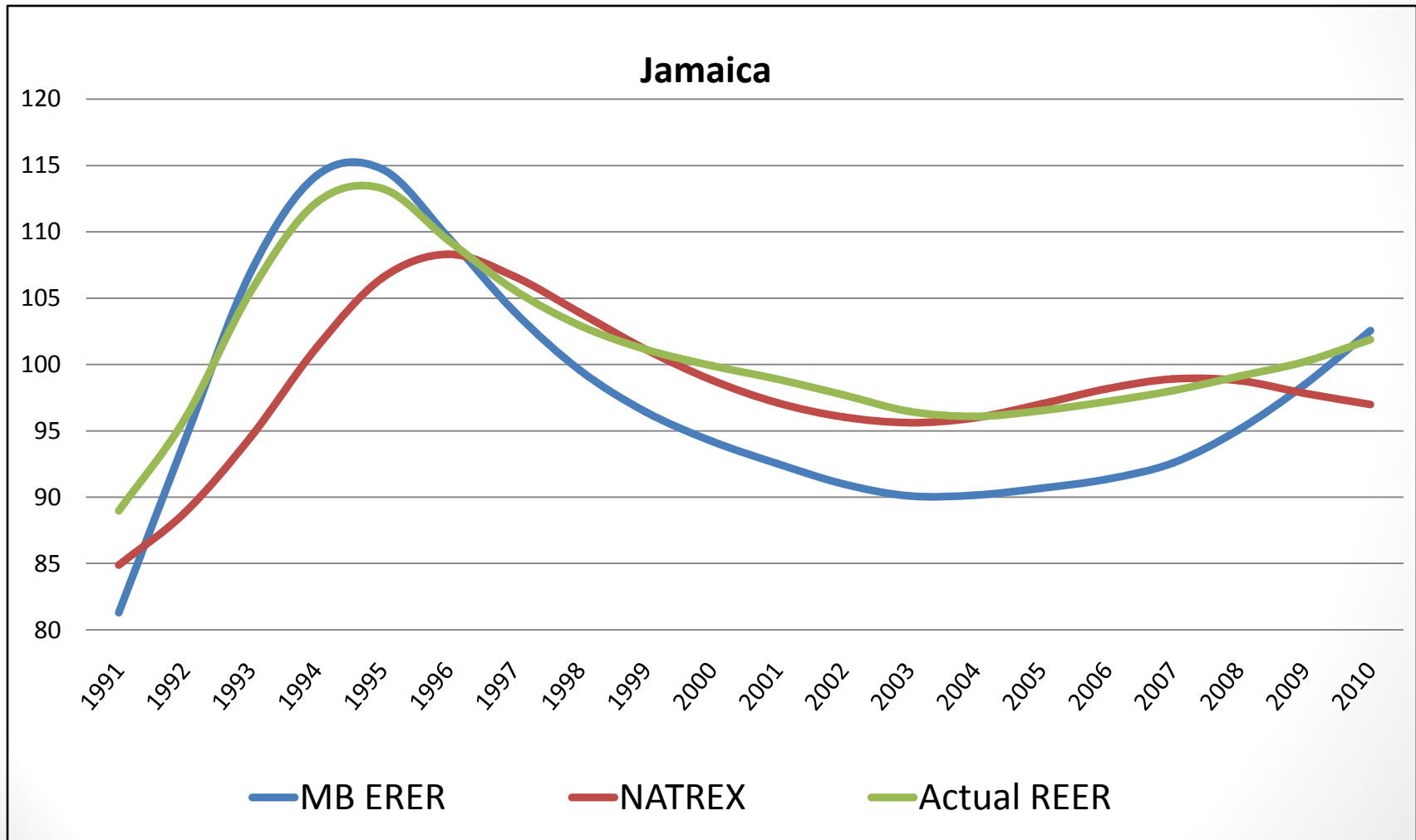
Consistent Findings

- I. The two approaches were consistent in showing that there have been several intervals of misalignment and exchange rate adjustment over the sample period.
- II. 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.
- III. 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.

Comparing the MB EREER and the NATREX



Comparing the MB EREER and the NATREX



*Conclusion
and
Policy Implications*

Conclusion

- NFA to GDP ratio, relative productivity growth, labour force participation and fuel to GDP ratio were found to be factors influencing the sustainable levels of the current account.
- Both the NATREX and MB approaches significant periods of misalignment from the equilibrium real effective exchange rate.
- In both approaches, exchange rate misalignment was found to be a stationary series which implies self-correction to equilibrium given an economic shock.
- Panel estimates suggested a half-life speed of adjustment of 1.1 years.
- The speed of adjustment for Jamaica was less than 1 year, but approximately 3 years for Uruguay.
- The speed of adjustment parameter was insignificant for Peru and DOMR.

Implications

These findings hold a plethora of implications for policy discussions moving forward.

- I. 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 behavior of these variables.

- II. 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 misalignment between the underlying current account and the current account norm may also rest on the macroeconomic fundamentals which determined the sustainable levels of the current account.

Consequently, the question which policy makers ought to be carefully examining 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.

Implications

- III. The final implication of the findings of this study shows price competitiveness is by no means the only factor which produces a favorable current account or reduces CA misalignment.
- 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.