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# GROWTH FORECAST FOR FOREIGN EXCHANGE CONSTRAINED ECONOMIES

BY

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# Growth Forecasts for Foreign Exchange Constrained Economies

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***Abstract***

Insufficiency of foreign exchange may at times constrain the growth of small open economies which lack the domestic resources to produce import substitutes for their consumption, investment and input needs. This study explores the foreign exchange constraint in three small open Caribbean economies, using a structural model of the relationship of foreign exchange earnings and growth, and the economies' openness to international markets. The model is used to evaluate the prospects of economic growth for these economies, based on the forecast availability of foreign exchange.

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## *Introduction*

This study explores patterns of growth in three Caribbean economies which are small, open, and without the potential for import substitution. Growth in these economies is limited by the pace of expansion in the sectors that earn and save foreign exchange, because they do not have the resources to produce substitutes for a wide range of imports at internationally competitive prices. The foreign exchange earning sectors must therefore generate finance for the imports that fuel the growth of output. The study focusses on the relationship between foreign exchange earnings and growth, and the possible limitation of growth potential that may result from slow expansion in foreign exchange earnings.

Small open economies in general have virtually no potential for substituting domestic production for imports because their limited human and material resources are fully occupied in producing a handful of commodities at internationally competitive prices[4]. This is as true of industrialised countries such as Iceland and Singapore, as it is of the Caribbean countries which are the subject of this study. Overall growth in all of these countries is constrained by the rate of growth of the limited number of tradables in which they specialise. Those activities provide the foreign exchange to fund imports of consumer and producer goods, encompassing a very much wider scope of commodities.

This study derives an indicator of the magnitude of the foreign exchange constraint of Barbados, Jamaica and Trinidad and Tobago since 1980, and forecasts growth and the foreign exchange limits to which growth may be subject over a 5 year forecast period. The next section of the paper reviews the literature on this subject; that is followed by a section where we define the constraint, examine indicators of the constraint for the three countries, and undertake a simple forecast to explore the future potential for a limitation on growth because of inadequate foreign exchange. We then repeat the forecast, using a four equation model of the economy, and including the foreign exchange limitation as an explanatory variable.

## *Literature Review*

Economic growth in small countries is dependent on the availability and cost of foreign exchange (Senbata, 2011), as domestic output can only be expanded if foreign exchange is available to purchase imports of consumer goods, raw material and technology (Porter & Ranney, 1982; Lensink, 1995; Marquez, 1984; and Bougrine & Seccareccia, 2009-2010). Foreign exchange is a crucial input which constrains production, employment and other macroeconomic variables (Agénor & Montiel, 2008; Stiglitz, Ocampo, Spiegel, Ffrench-Davis, & Nayyar, 2006; and Iqbal, 1995). Stiglitz et al. (2006) suggest that under

[4] The relationship between size and export concentration is documented in Carter (1997).

many circumstances, the availability of foreign exchange is the principal factor limiting economic activity.

The concept that the balance of payments represents an important constraint on economic growth is formalised by Thirlwall (1979)[5]. His simple rule is, in effect, the dynamic analogue of the Harrod trade multiplier; it states that the rate of growth of any country in the long run is equal to the growth rate of the volume of exports divided by the income elasticity of demand for imports. Devaluation, relative price changes and real exchange rate changes will not induce growth in this model; long term growth is achievable through an increasing rate of export volume or a fall in the country's desire for imported goods. In the case of small economies only the former option is available, because of the lack of a wide range of competitively priced import substitutes.

The foreign exchange constraint is a feature of two gap models of economic growth, which include a savings gap (the difference between domestic savings and the target needed to finance desired investment) and a foreign currency gap (the difference between the inflows of foreign exchange and what is needed to finance imports). A third gap, the fiscal, is sometimes added to create a three-gap model (Bender & Löwenstein, 2005; Taylor, 1994). Recent applications of the model include James (2009), Zhang and Chen (2012) and Garcia-Molina and Ruiz-Tavera's (2009) 'unified dynamic gap model'.

Small open economies sit at the bottom of the pyramid of international reserve currencies (Bourgrine and Seccareccia, 2009-10). As a result they are not able to engage in international transactions in their own currencies, as the US, Japan and euro countries are able to do. Reserve currency countries may partly finance balance of payments deficits through the bonds held by countries which hold their currencies as a reserve asset. This additional source of balance of payments financing is not available to the rest of the world's currencies, which do not enjoy reserve currency status.

### *The Foreign Exchange Constraint*

Marquez (1984) measures the availability of foreign exchange as total exports or the balance of payments surplus/deficit. Moran (1989) provides us with two indicators of import capacity – total foreign exchange inflows and international reserves. Emran and Shipli (2007), use a constraint in the form of $F_t - P_t M_t \geq 0$ ( $F_t$ being foreign currency available, $P_t$ a price index and $M_t$ the value of imports). . In the paper by Antzoulatos and Peart (1998) the foreign exchange constraint binds when current desired imports exceed the sum of current export earnings, foreign exchange reserves and the amount that can be borrowed in the international financial markets: $IM_t \leq EX_t + RES_{t-1} + U_t$. Senbata (2011) imposes a more production-specific constraint: $P_{F,t}.M_t/\varepsilon_t \leq \Omega_t$, where $P_{F,t}$ is the average price level of imported goods in terms of domestic currency, $M_t$ is imported intermediate inputs, $\varepsilon_t$ is the nominal exchange rate, and $\Omega_t$ is the quantity of

[5] See Thirlwall (2011) for a history and overview of the model, and a review of its applications in economic literature

foreign exchange available at the beginning of period *t* to import intermediate inputs for production during that period.

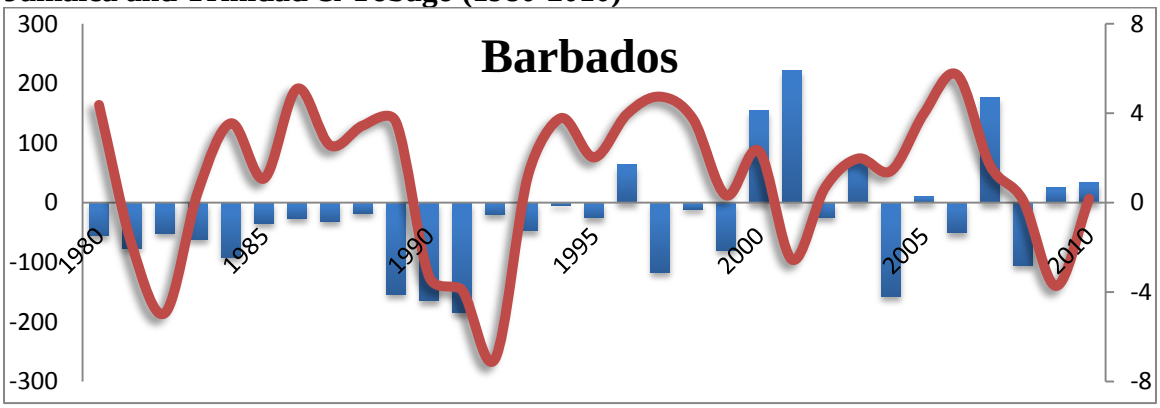
Khemraj and Langrin (2011) apply the same basic concept to the financial sector in a Caribbean context, where the constraint becomes the total quantity of foreign currencies purchased in time period *t* minus the total sales of foreign currencies in the same period. Foreign currency is earned through exports of goods and services, remittances or capital inflows, and the constraint is binding when the difference is less than zero.

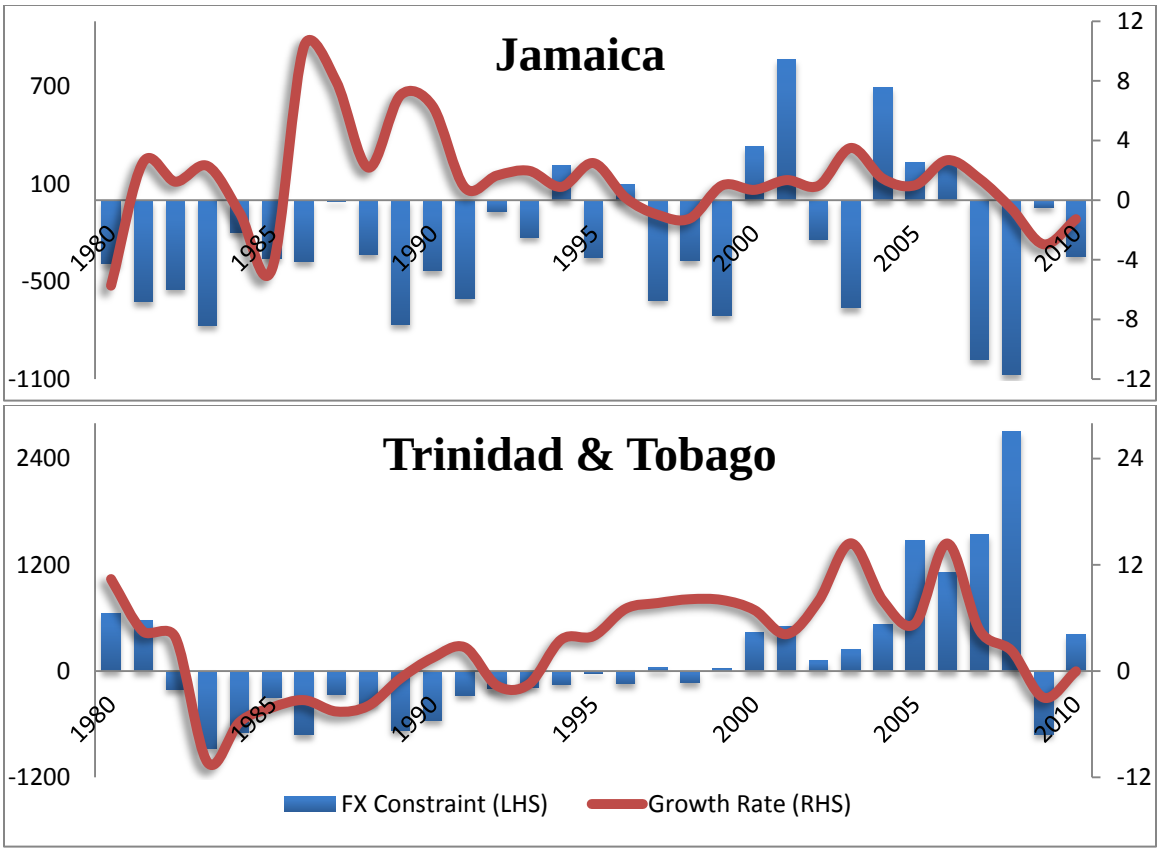
Central Banks usually hold international reserves with the motive of financing seasonal and other variations in international transactions and correcting for unexpected difficulties in payments (Edwards, 1983). Reserves form a spending cushion for the country, allowing it to spend more than it earns for short periods, and acting as a smoothing tool or shock absorber. However, this is not a sustainable growth policy in the longer term since there is a limit to the reserves and to the debt-financing of reserves.

In this paper we measure the availability of foreign exchange by the deficit/surplus on the balance of payments, minus the amount needed to bring international reserves up to the equivalent of three months of imports, which is the accepted international norm. The relationship between foreign exchange availability and economic growth is highlighted in Figure 1. The availability of foreign exchange becomes a constraint when the value of the indicator is negative.

Foreign exchange appears to have been a major drag on Barbadian growth in the 1989-1991 period. Apart from that there were no large deficits sustained for successive years. Jamaica appears to have suffered a shortage of foreign exchange for much of the last three decades. In Trinidad and Tobago, the foreign exchange limit was not severe, except perhaps in the early 1980s, and there were sizeable surpluses in the 2005-08 period.

**Figure 1: Foreign Exchange Constraint and Real GDP Growth for Barbados, Jamaica and Trinidad & Tobago (1980-2010)**






***Trend Forecasts***

Figures 2 to 4 show five-year forecasts of growth and the foreign exchange constraint for Barbados, Jamaica and Trinidad-Tobago. The forecasts are based on the trends in output of tourism, manufacturing, minerals and agriculture over three alternative horizons, as well as trends in the price of tradables over those time horizons. The parameters for the forecast (the import propensity, the relative prices and the export propensity) are the average of the last 5 years of the sample.

The prospects for the three countries are all somewhat different, on these oversimplified assumptions. The Barbados economy looks to be in danger of contraction, particularly if short term trends persist. However, this poor prospect is not as a result of the foreign exchange constraint; in fact the forecast shows small balance of payments surpluses for each year of the forecast. The GDP forecast for Jamaica shows an economy in stagnation: the medium term trends produce slight growth, while the long and short term trends yield slight contraction. However, even these modest results cannot be realised without a very substantial increase in foreign capital flows. The foreign exchange deficit rises to the equivalent of about 10% of GDP by the end of the forecast period. In contrast to the other two, the Trinidad-Tobago forecast is for moderate to strong growth based on any of the trend periods, and there is no foreign exchange constraint at any time for any of the forecasts.

**Figure 2: 5-Year Trend Forecasts for Barbados**

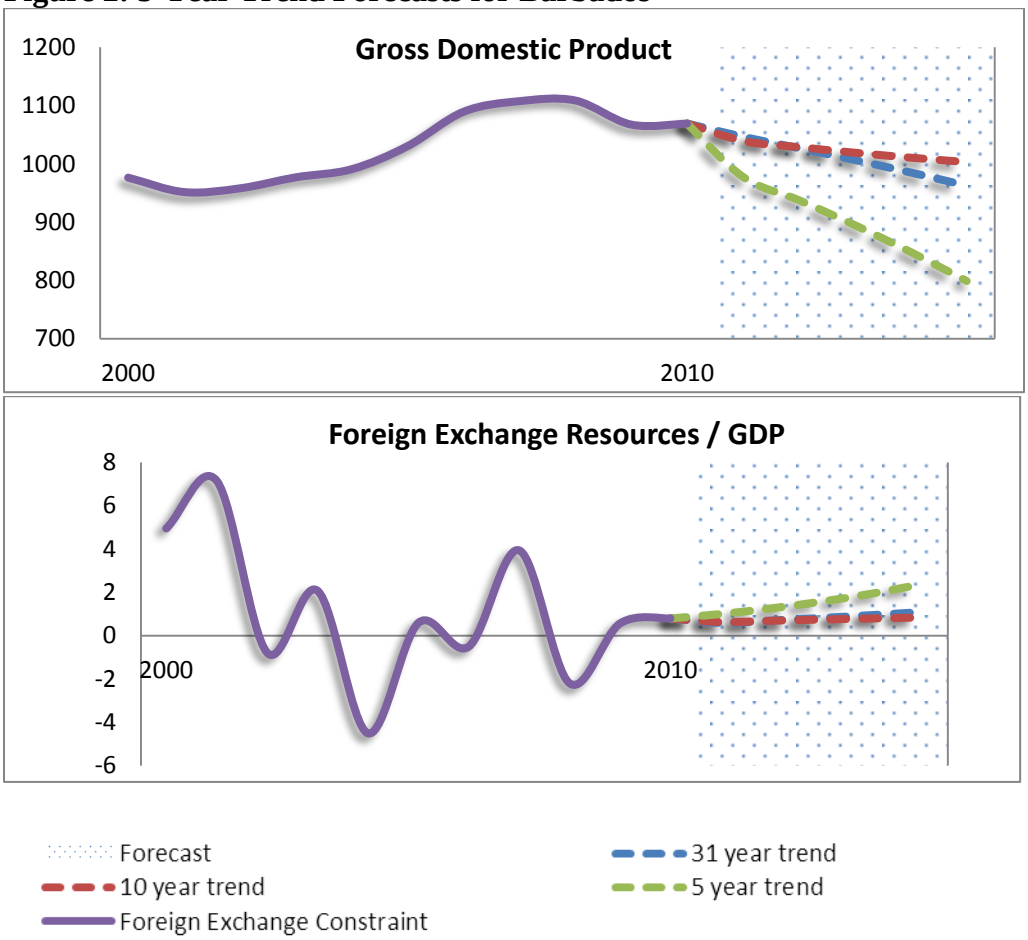
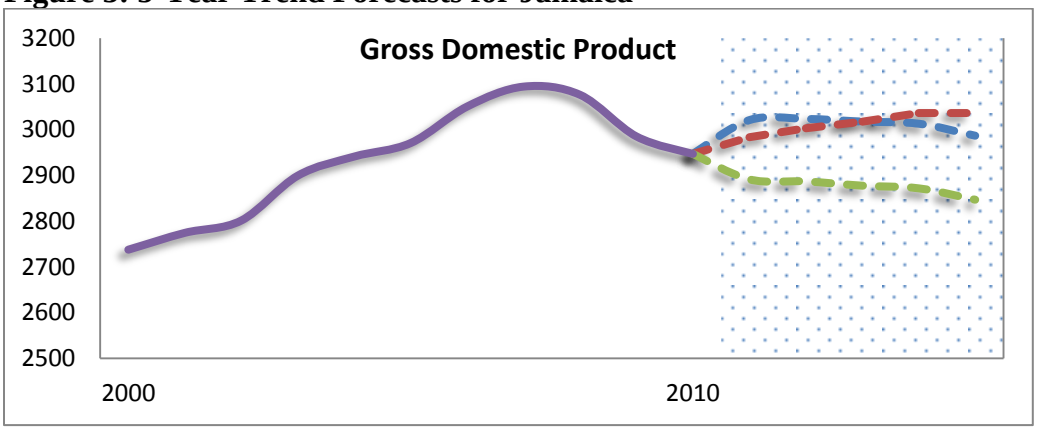



**Figure 3: 5-Year Trend Forecasts for Jamaica**



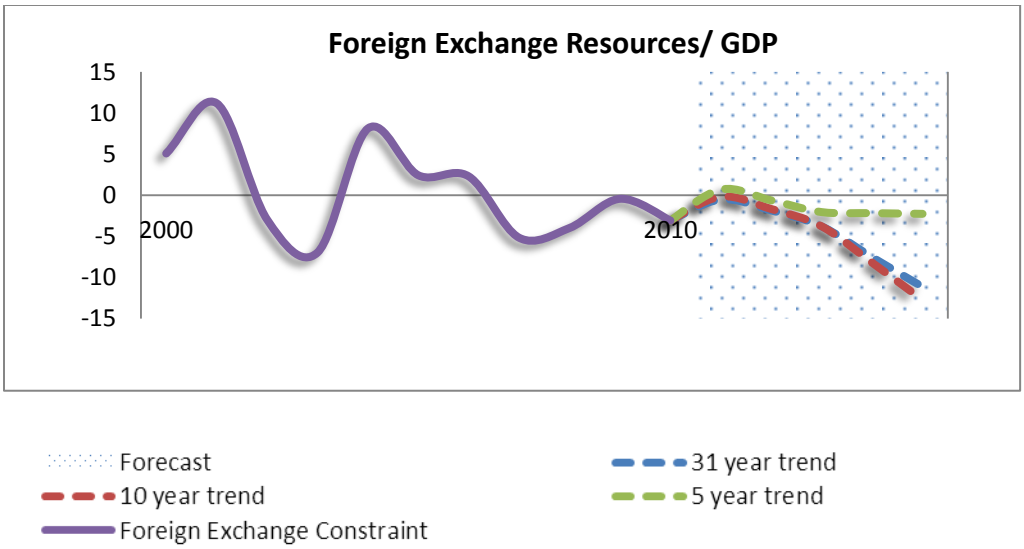
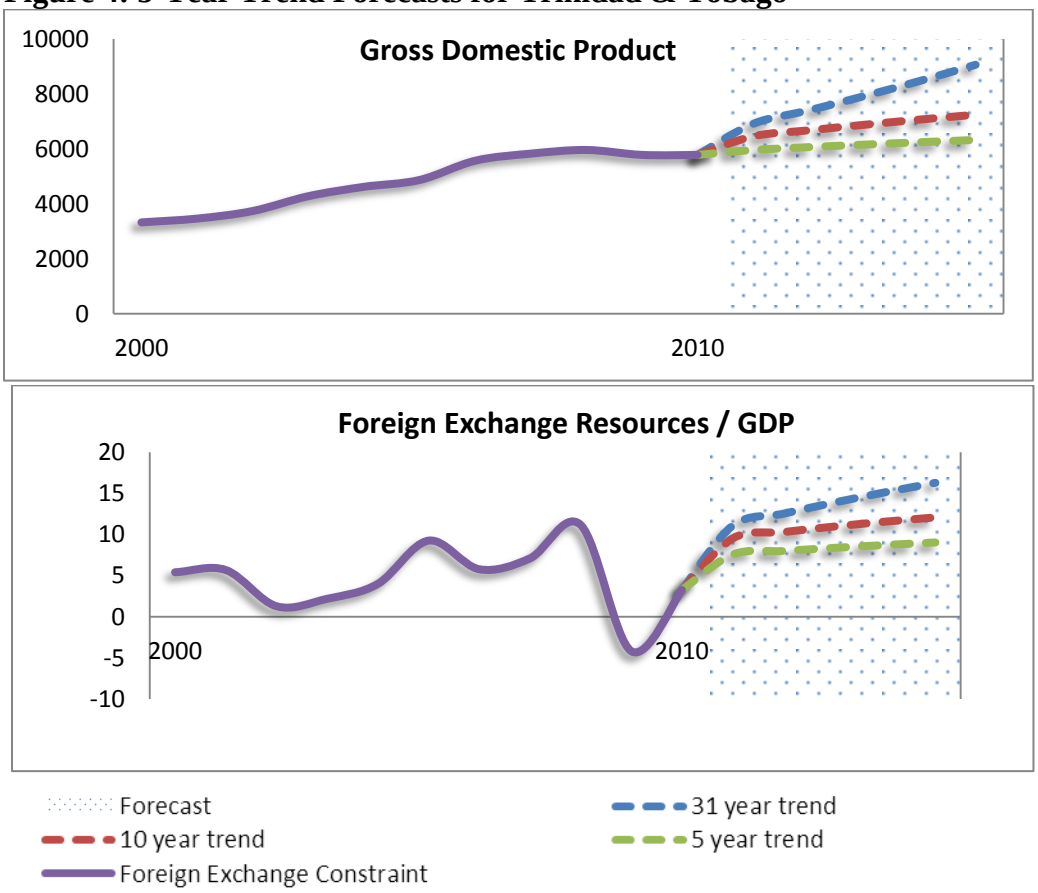



**Figure 4: 5-Year Trend Forecasts for Trinidad & Tobago**



***The Model***

Our estimating equations are drawn from Worrell's (1992) model, based on the economic characteristics of the Caribbean, where the expansion paths of tradable sectors and non-tradable sectors are linked through the balance of payments. External balance is the outcome of the supply of foreign exchange, generated by tradable output, and the demand for foreign exchange for the purchase of imports. From this relation the model generates a measure of the foreign exchange availability which is included as a constraint on the growth of the real sectors of the economy.

The model is as follows[6]:

1. $Q = Q_t + Q_n$
2. $Q_t = f(\emptyset, I, PC, Q_{t-s}, Y^*, r\ )$
3. $Q_n = f\left(q^*, \frac{P_n}{P_t}, Prod, r, I\right)$
4. $q^* = Q_{t-1} \pm f\left(\frac{\partial CB^g}{P} + \frac{\partial CB^b}{P} + \frac{\partial FX_R}{P}\right)$
5. $I = f\left(\ \sigma FX_R, K_p, K_g, FDI,\right)$
6. $XGS = f(Y_t)$
7. $M = f\left(Y, \frac{P_n}{P_t}\right)$
8. $FX_R = (XGS - M) + K_p + K_g + FDI + OTH + FX_{R,-1}$
9. *If* $FX_R < M_3^*$, $M \leq XGS + Income + Current\ Transfers + [M_3^* - FX_R]$
   *otherwise,* $M \leq XGS + Income + Current\ Transfers$
10. $P_t = f^{p_t}\left(\bar{P}_{oil}, \bar{P}_{commodity}, \bar{P}_{US}, \varepsilon\right)$
11. $P_n = f^{q_t}\left(Q, \frac{P_n}{P_t}\right)$
12. $P = P_n\left(\frac{Q_n}{Q}\right) + P_t(\frac{Q_t}{Q})$
13. $Y = Y_t + Y_n$ *where* $Y_t = P_t \times Q_t$ *and* $Y_n = P_n \times Q_n$

Output in the traded sectors of the economy depends on their ability to match world prices, the extent of spare capacity, investment, and the cost of financing, i.e. the interest rate (Equation 2). Output in the non-traded sector (Equation 3) is influenced by both supply factors such as investment, interest rates, the productivity of labour and the relative price of non-traded goods to traded goods, as well as demand factors such as expected expenditure and the relative price of nontradables (Equation 3). Expected aggregate domestic demand in the current period is influenced by the previous period's output, along with the wealth effects, represented by money creation (Equation 4).

Investment is a function of the rate of return, foreign portfolio capital inflows, government capital inflows, foreign direct investment, and the volatility of foreign reserves, a measure of investor confidence (Equation 5).

[6] The variables are defined in Appendix Table 1.

The export of goods and services is determined solely by the output of tradable goods and services, since most tradable output is exported (Equation 6). The import equation is a standard demand function, with nominal income and relative prices as arguments (Equation 7).

The foreign exchange constraint is expressed explicitly in the model in Equation 9. It constrains total imports to be less than the sum of exports of goods and services, income and current transfers on the balance of payments, plus any amounts needed to restore foreign reserves to the minimum level equivalent to 3 months of imports.

Equations 10, 11 and 12 describe the manner in which prices are determined in the model. Prices of tradable goods are determined by exogenous foreign factors, along with the nominal exchange rate. The price of non-tradable goods is the outcome of supply and demand, and the overall price is the weighted sum of the prices of tradables and nontradables.

### *Estimation*

The seemingly unrelated regression (SUR) method of system estimation is a multivariate regression which allows the estimation of the system parameters while accounting for heteroscedasticity and contemporaneous correlation in the errors across equations. Proposed by Zellner (1962), it applies Aitken's generalized least-squares to a whole system of equations and has been found to be more efficient than an equation-by-equation estimation of least squares[7].

The SUR model takes the form of:

$$y_i = X_i\beta_i + \varepsilon_i, \qquad i = 1 \dots M$$

$$\text{Where } \varepsilon = [\varepsilon_1', \varepsilon_2' \dots \varepsilon_M']'$$

$$\text{And } E[\varepsilon | X_1, X_1, \dots X_M] = 0$$

$$E[\varepsilon\varepsilon' | X_1, X_1, \dots X_M] = \Omega$$

$$\text{With the SUR estimator being: } b_{SUR} = (X'(\hat{\in} \otimes I_T)^{-1}X)^{-1}X'(\hat{\in} \otimes I_T)^{-1}y$$

$$\text{The error covariance matrix being given by: } V = \in \otimes I_T.$$

The first of two steps is the collection of residuals from an initial OLS regression which are used to estimate the elements of the $\in$ matrix. The second step involves the use of generalized least squares using the error covariance matrix. This method allows us to gain efficiency by combining information on different equations.

[7] Regression done using Weighted Least Squares showed no significant variance in the estimates

Data sources used were the IMF, ECLAC and the World Bank. The proxy for spare capacity is the output gap calculated by the diversion of actual real GDP from its expected path based on its trends. GDP per worker is used as a proxy for labour productivity, US GDP growth is used to describe performance in international markets and the international price level is captured by US inflation. PCI is a measure of price competitiveness calculated on the basis of a comparison of goods production prices of each economy with international competitors' prices for the same commodities[8]. The interest rate is captured by the Treasury bill rate for each country and investment is measured by gross capital formation. All real variables were expressed in natural log form and those with unit roots were differenced.

The estimation takes the form of the four equations of interest:

1. $Q_{t,t} = \alpha_1 + \alpha_2 I_t + \alpha_3 \emptyset_t + \alpha_4 \partial Y^* + \alpha_5 \pi^* + \alpha_6 PCI + \alpha_7 Q_{t,t-1} + \alpha_8 r + \alpha_9 iDUM_{t-1} + \alpha_{10} iDUM_{t-2} + \varepsilon_{1t}$
2. $Q_{n,t} = \beta_1 + \beta_2 I + \beta_3 r + \beta_4 PROD + \beta_5 \frac{P_n}{P_t}_t + \beta_6 iDUM_{t-1} + \beta_7 iDUM_{t-2} + \varepsilon_{2t}$
3. $M = \gamma_1 + \gamma_2 \frac{P_n}{P_t}_t + \gamma_3 Y_t + \gamma_4 iDUM_{t-1} + \gamma_5 iDUM_{t-2} + \varepsilon_{3t}$
4. $XGS = \delta_1 + \delta_2 Y_{t,t} + \delta_3 iDUM_{t-1} + \delta_4 iDUM_{t-2} + \varepsilon_{4t}$

These equations, drawn from the theoretical model, represent the growth patterns of the economy and the manner in which it impacts the import and export of goods and services. The variable $iDUM$ is an interaction dummy which is calculated by multiplying the foreign exchange resources by 1 in each year the constraint is in effect. Since the constraint is in effect when foreign exchange available is less than zero, the interaction dummy would be negative and is instead multiplied by -1 for ease of interpretation. The coefficient on this variable represents the effect of the foreign exchange constraint on economic growth. The variable $iDUM$ is lagged, on the plausible assumption that the foreign exchange constraint takes some time to bite.

**Table 1: Coefficients of Interaction Dummies**

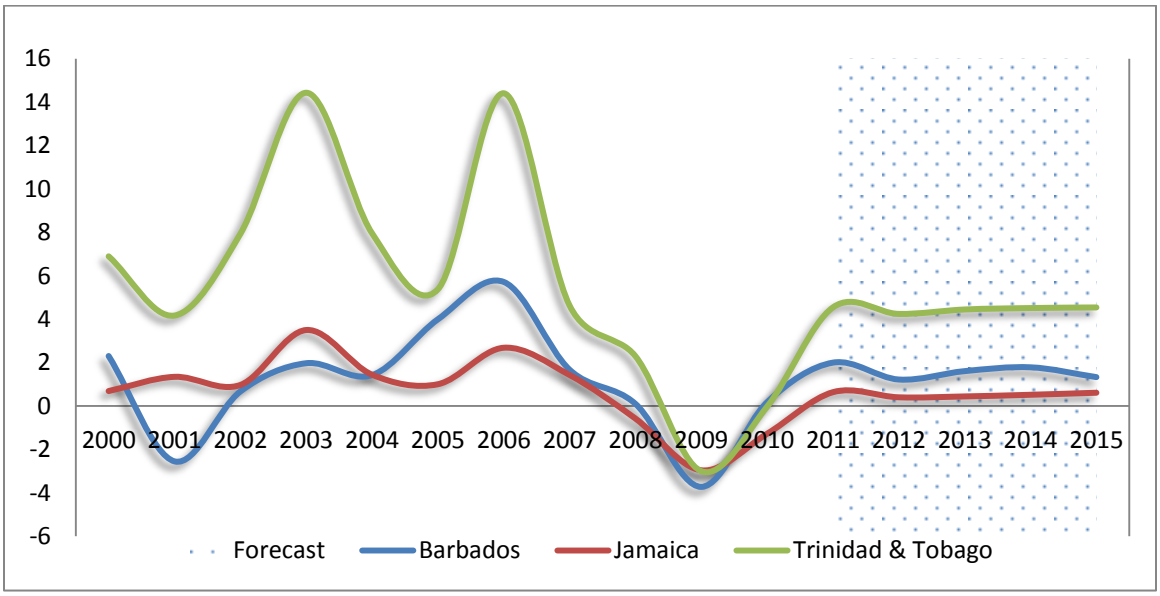
| | | Barbados | Jamaica | Trinidad |
|---|---|---|---|---|
| Traded | $\boldsymbol{iDUM_{t-1}}$ | 0.001699 | 0.00179* | -0.00451* |
| | $\boldsymbol{iDUM_{t-2}}$ | 0.00414 | -0.00032 | -0.00285 |
| Non-traded | $\boldsymbol{iDUM_{t-1}}$ | -0.00257 | -0.00246* | -0.00701* |
| | $\boldsymbol{iDUM_{t-2}}$ | -0.00219 | -0.00208* | 0.001632 |
| Imports | $\boldsymbol{iDUM_{t-1}}$ | -0.02359* | -0.00272 | 0.004199 |
| | $\boldsymbol{iDUM_{t-2}}$ | 0.005279 | -0.00895* | -0.00255 |
| Exports | $\boldsymbol{iDUM_{t-1}}$ | 0.00561 | 0.003445 | -0.00942* |
| | $\boldsymbol{iDUM_{t-2}}$ | 0.00006 | -0.01082* | 0.013424* |

[8] See Worrell, Greenidge & Lowe, 2012.

The coefficients of the interaction dummies represent the impact on the economic growth rate when the foreign exchange constraint is binding in the previous two years. For Barbados, three of the eight interaction dummies are negative, while six are negative for Jamaica and five for Trinidad. However, not all of these coefficients are statistically significant, and all are of a very small order of magnitude. On the basis of these results the foreign exchange constraint has not been a binding one for any of the three economies in the 1980-2010 period. This is not inconsistent with our preliminary observations for Barbados and Trinidad-Tobago, where we observed no extended periods when the constraint was binding, but is surprising in view of the Jamaica data.

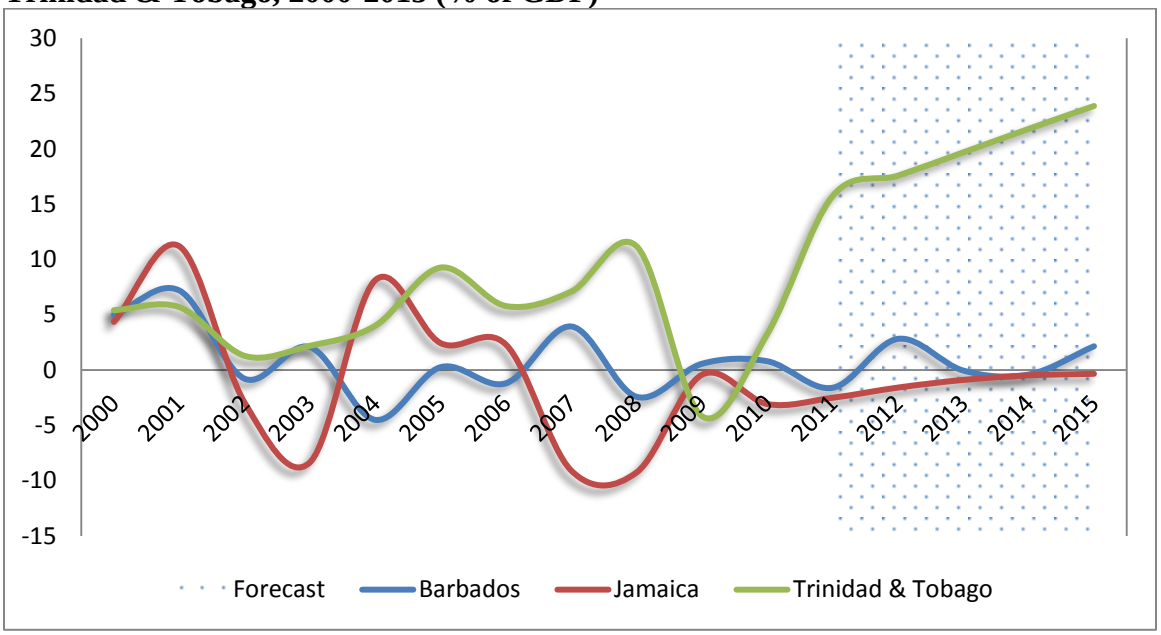
***Forecasting***

**Figure 5: Growth Rate Forecasts for Barbados, Jamaica and Trinidad & Tobago, 2000-2015 (%)**




The estimates for the model were used to forecast five years into the future, with the foreign exchange constraint as an endogenous variable, equal to the dollar value of the constraint when the constraint is binding, and zero otherwise. Forecasting for the three simultaneous equation models was done holding the exogenous variables constant. The forecast growth rates for Trinidad-Tobago are highest, followed by Barbados and Jamaica in that order (Figure 5).

**Figure 6: Foreign Exchange Constraint Forecast for Barbados, Jamaica and Trinidad & Tobago, 2000-2015 (% of GDP)**



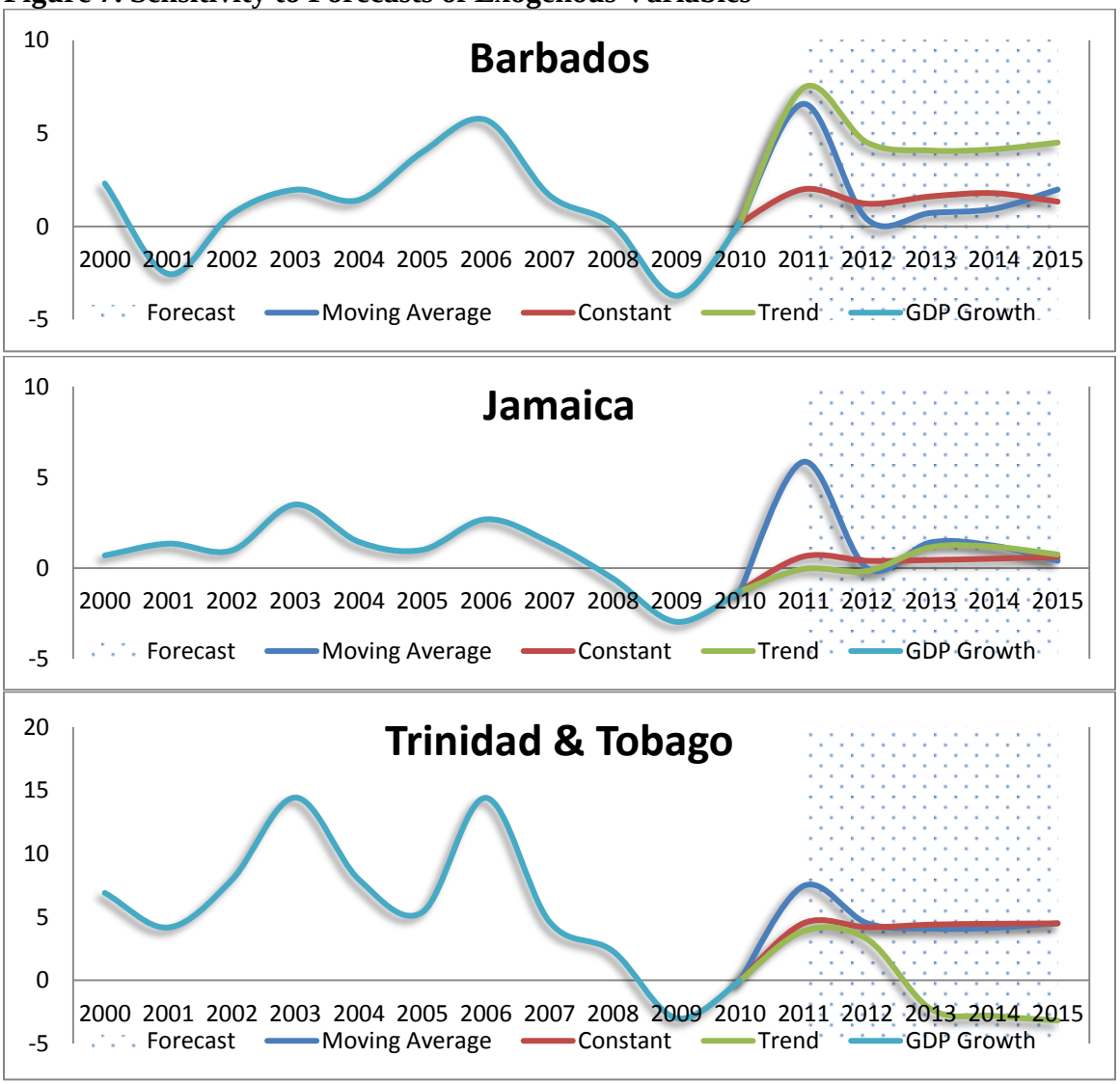

Holding all other aspects of the balance of payments constant, we use the forecast imports and exports of goods and services to derive an expected constraint for the three countries, expressed as a percentage of nominal GDP (Figure 6). The constraint is binding and in the range of 0.3% to 2.5% of GDP for Jamaica. It does not appear to be binding for Barbados, because there are no two successive years in which there is a foreign currency deficiency. Trinidad-Tobago is forecast to have large foreign reserve surpluses. Table 2 below documents the forecast values.

**Table 2: Forecasts for Barbados, Jamaica and Trinidad & Tobago, 2011-2015**

| | | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|
| **Barbados** | Growth | 1.999814 | 1.220314 | 1.608008 | 1.783421 | 1.331351 |
| | FXC/GDP | -0.12784 | 0.225101 | -0.00398 | -0.0329 | 0.171744 |
| **Jamaica** | Growth | -0.05084 | -0.15989 | 1.144343 | 1.168793 | 0.748849 |
| | FXC/GDP | -2.50453 | -1.5848 | -0.89401 | -0.48128 | -0.33885 |
| **Trinidad & Tobago** | Growth | 4.503023 | 4.190281 | 4.392096 | 4.458111 | 4.486631 |
| | FXC/GDP | 15.65247 | 17.40912 | 19.43002 | 21.46897 | 23.46095 |

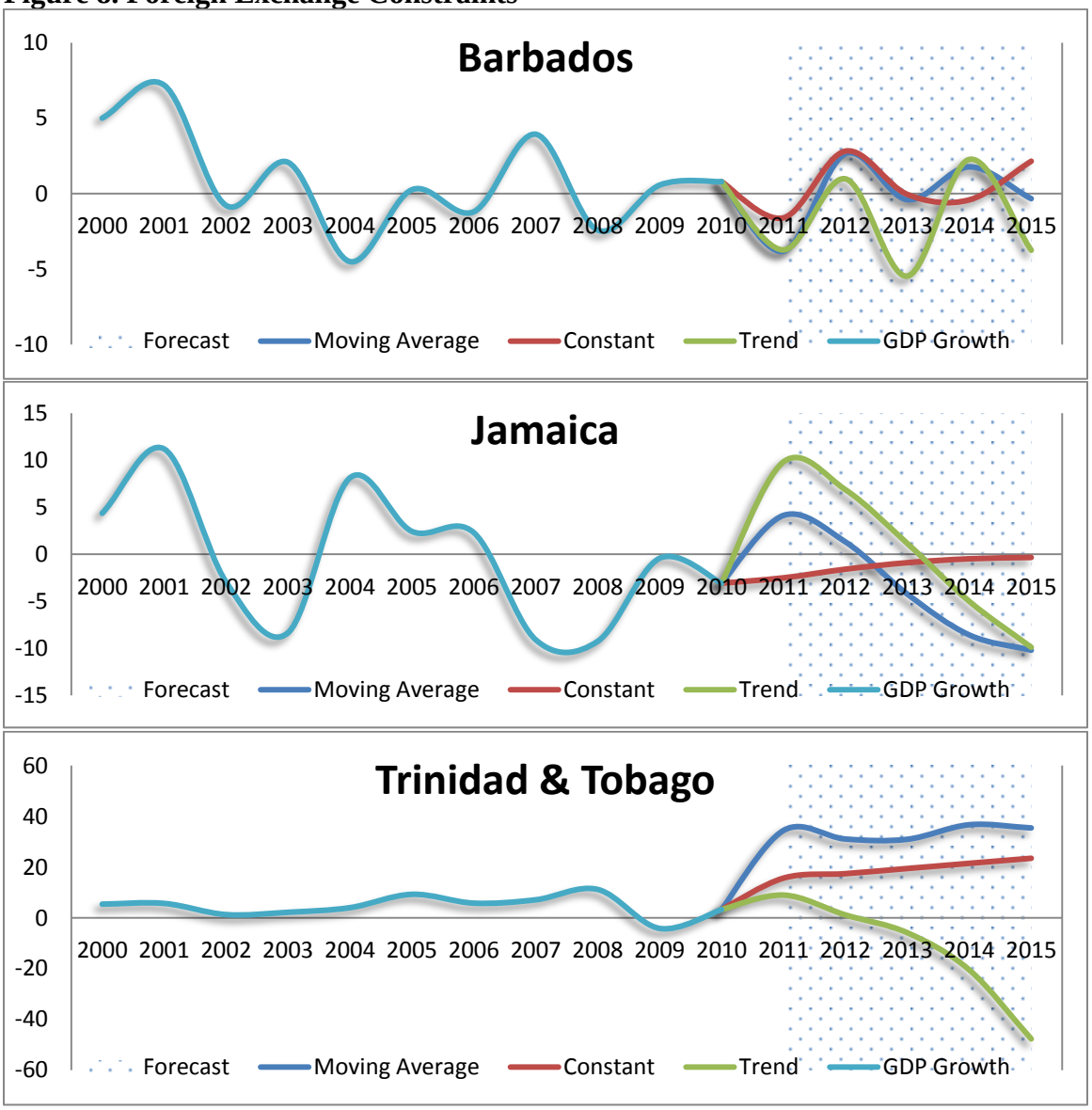
***Sensitivity Tests***

**Figure 7. Sensitivity to Forecasts of Exogenous Variables**




In this section we report on a number of sensitivity tests that were applied to our results. In Figure 7 two alternatives to the forecast of exogenous variables are considered: the exogenous variables were forecast based on their own trend (using a structural time series forecast) and as a moving average, and the results plotted against the base assumption of constant values. Growth rates for the moving average forecast do not vary significantly from the base forecast, apart from the first two periods (2011 and 2012) for each country. The structural time series derives more divergent forecasts, particularly for Barbados and Trinidad & Tobago.

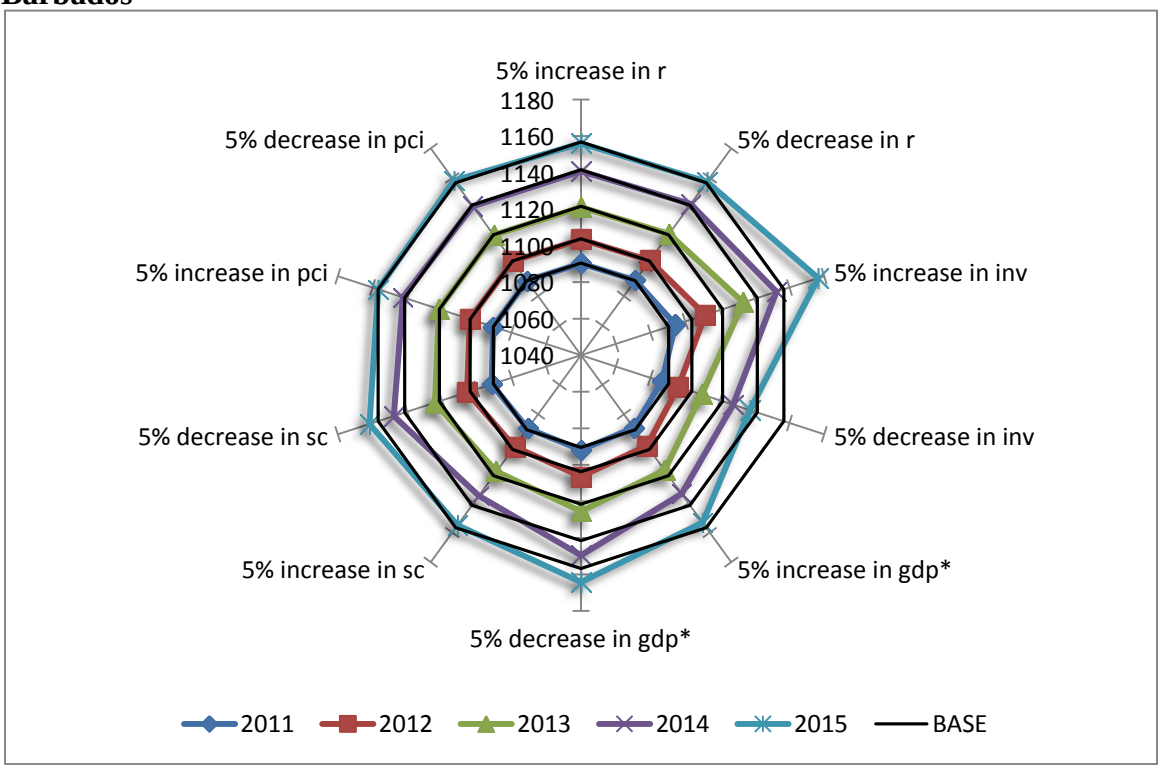
**Figure 8. Foreign Exchange Constraints**



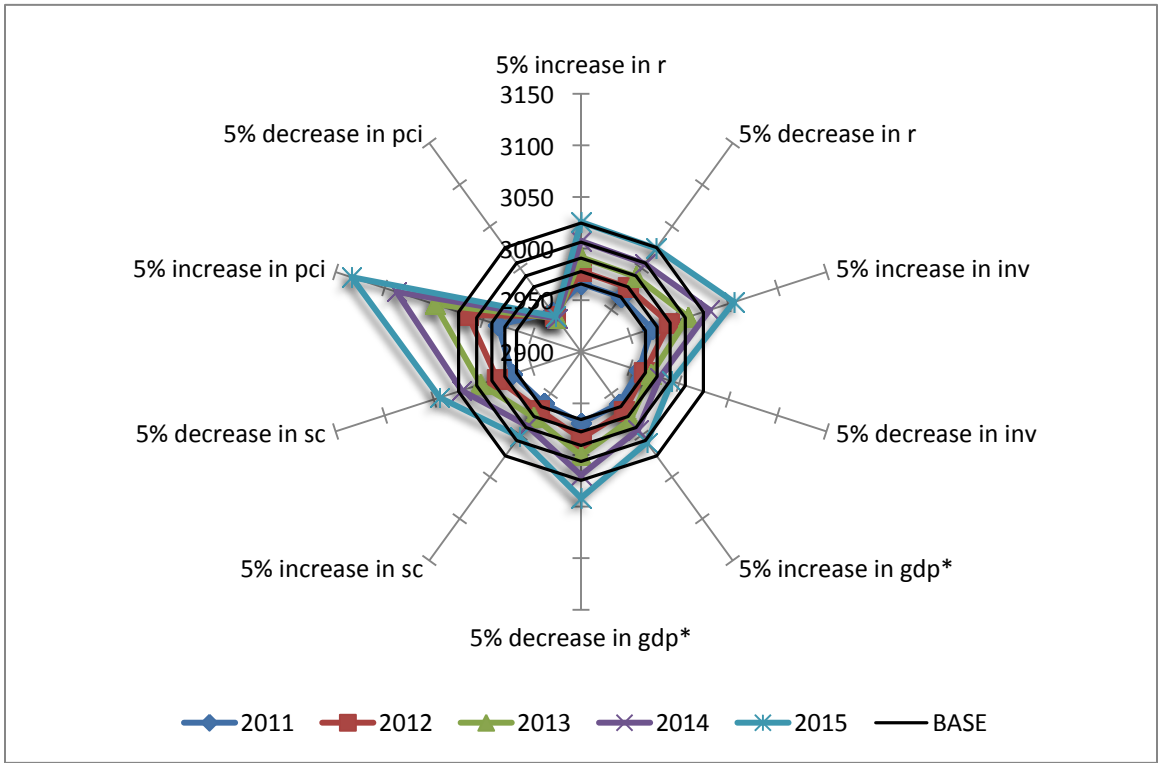

The foreign exchange constraints forecast under the alternative scenarios are shown in Figure 8. The forecast foreign exchange resources are expected to be a constraint on growth in Jamaica in the later years of the forecast (2013-2015) for both of the alternate forecasts. The structural time series forecast for Trinidad & Tobago predicts a significant constraint in the region of -5.87% to -47.70% of GDP for 2013 to 2015, due to the influence on the forecast of a large fall-off in the price of Trinidad & Tobago's tradable goods for 2008-2010.

**Figure 9. Sensitivity Tests**

**Barbados**




**Jamaica**



**Trinidad-Tobago**

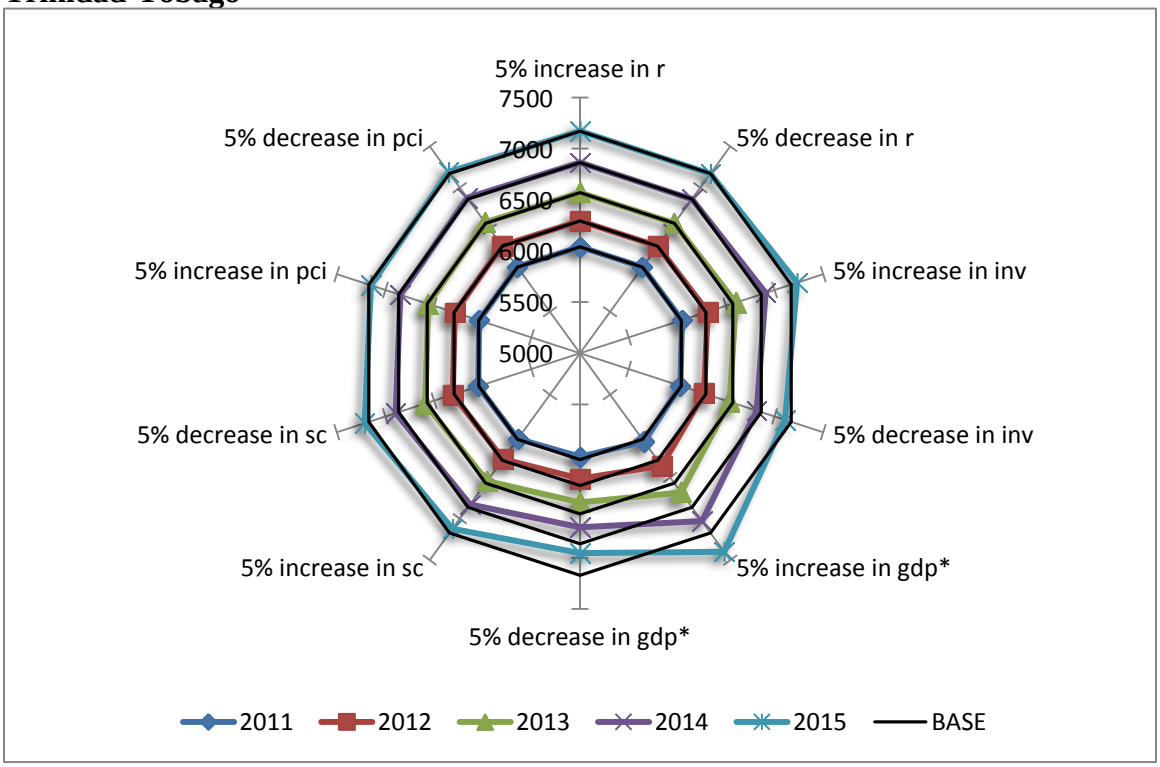



Figure 9 presents sensitivity tests, showing the divergence from the base forecast when an exogenous variable is allowed to increase or decrease by 5% each year, holding all else constant. Barbados' growth rates are quite sensitive to investment (*inv*) assumptions, and less so to assumptions about spare capacity (*sc*) and international market performance (*GDP**). Jamaica displays high sensitivity to assumptions about each of the variables, except interest rates (*r*). The growth forecast is extremely sensitive to price competitiveness assumptions (*pci*). Trinidad & Tobago exhibits sensitivity to changes in international market performance, as measured by US GDP (*GDP**), but not much else.

## *Conclusion*

Our results reflect the complex nature of the relationship between growth and the use of foreign exchange in the small open economy. Whether or not the foreign exchange constraint is binding depends on the nature of the export mix: the substantial inflation in the price of petroleum and petroleum products has completely eliminated Trinidad-Tobago's foreign exchange constraint. The availability and growth of foreign exchange depends on the fluctuations in the international demand for exports of goods and services from the Caribbean, on changes in international prices, and on investment in increasing Caribbean production capacity and the marketing of Caribbean products and services. Our results reflect the complexity of these relationships, and should be interpreted with them in mind. It does appear that the foreign exchange constraint has been binding in Jamaica, but not in Barbados or in Trinidad-Tobago, and that this may well continue to

be the case going forward. However, there are scenarios where the constraint could be binding in either Barbados or Trinidad-Tobago. We should also bear in mind that the tested model is a truncated version of the reality, which excludes the important fiscal and financial sectors, in the interest of tractability. Fiscal policy changes in particular would have the potential to relieve the foreign exchange constraint by reducing aggregate demand and the demand for foreign exchange. This does not affect the validity of the estimation, but it may well be that values of the parameters estimated reflect changes in fiscal policy stance from time to time, along with the impact of the exogenous factors that are explicitly included in our model. Additional insight may also be gained from further exploring the nature of the foreign exchange constraint. Preliminary work using a threshold estimation technique shows promise for detecting the magnitude of the foreign exchange deficit which the economy may sustain before a contraction in output sets in.

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***Appendix: Definition of Variables and Results***

**Table 1: Definition of Variables**

$$Q - real\ output\ in\ the\ economy$$
$$Q_t - real\ output\ in\ the\ traded\ sectors$$
$$Q_n - real\ output\ in\ the\ nontraded\ sectors$$
$$\emptyset - spare\ capacity$$
$$I - investment$$
$$PC - international\ price\ competitiveness$$
$$Y^* - international\ market\ performance$$
$$r - interest\ rate$$
$$M - total\ good\ imports$$
$$m_{INT} - intermediate\ imports$$
$$m_{CAP} - capital\ imports$$
$$m_{CONS} - consumer\ imports$$
$$M_3^* - equivalent\ to\ 3\ months\ of\ imports$$
$$q^* - domestic\ demand$$
$$P_t - price\ of\ tradables$$
$$P_n - price\ of\ nontradables$$
$$ULC - unit\ labour\ cost$$
$$FX_R - foreign\ exchange\ reserves$$
$$\sigma FX_R - foreign\ exchange\ reserves\ volatility$$
$$\partial CB^g - change\ in\ central\ bank\ credit\ to\ government$$
$$\partial CB^b - change\ in\ central\ bank\ credit\ to\ commercial\ banks$$
$$\partial FX_R - change\ in\ foreign\ reserves$$
$$K_p - capital\ inflows\ to\ private\ sector$$
$$K_g - capital\ inflows\ to\ government$$
$$FDI - foreign\ direct\ investment$$
$$XGS - exports\ of\ goods\ and\ services$$
$$Income - income\ on\ balance\ of\ payments$$
$$Current\ Transfers - current\ transfers\ on\ balance\ of\ payments$$
$$\bar{P}_{oil} - international\ price\ of\ oil$$
$$\bar{P}_{commodity} - international\ price\ of\ commodities$$
$$\bar{P}_{US} - US\ price\ level$$
$$\varepsilon - nominal\ exchange\ rate$$
$$Y - nominal\ output\ in\ the\ economy$$
$$Y_t - nominal\ output\ in\ the\ traded\ sectors$$
$$Y_n - nominal\ output\ in\ the\ nontraded\ sectors$$

**Table 2: SUR Results for Barbados**

| Dependent Variable | Regressor | Coefficient | Probability |
|---|---|---|---|
| **Real Traded Output**<br>$R^2$ = 0.669255<br>Adj. $R^2$ = 0.536957 | Constant | -0.006906 | 0.3195 |
| | Investment | -0.117754 | 0.0038 |
| | Price Competitiveness | 0.002604 | 0.9521 |
| | Spare Capacity | 0.000990 | 0.0000 |
| | Traded Output (-1) | -0.112177 | 0.2719 |
| | Interest Rate | -0.001006 | 0.4719 |
| | International Market | -0.112788 | 0.7229 |
| | Interaction Dummy (-1) | 0.001699 | 0.5194 |
| | Interaction Dummy (-2) | 0.004140 | 0.1529 |
| **Real Non-traded Output**<br>$R^2$ = 0.738077<br>Adj. $R^2$ = 0.666644 | Constant | 0.012860 | 0.0055 |
| | Investment | 0.123354 | 0.0000 |
| | Price Non-traded/ Price Traded | 0.018289 | 0.3258 |
| | Productivity | 0.232141 | 0.0417 |
| | Interest Rates | -0.000267 | 0.7410 |
| | Interaction Dummy (-1) | -0.002572 | 0.1110 |
| | Interaction Dummy (-2) | -0.002194 | 0.2122 |
| **Imports of Goods & Services**<br>$R^2$ = 0.378594<br>Adj. $R^2$ = 0.275026 | Constant | 0.019793 | 0.3101 |
| | Nominal Output | 1.092291 | 0.0021 |
| | Price Non-traded/ Price Traded | -0.050818 | 0.5743 |
| | Interaction Dummy (-1) | -0.023586 | 0.0022 |
| | Interaction Dummy (-2) | 0.005279 | 0.4849 |
| **Exports of Goods & Services**<br>$R^2$ = 0.660074<br>Adj. $R^2$ = 0.603420 | Constant | 0.014795 | 0.1399 |
| | Nominal Traded Output | 0.597425 | 0.0000 |
| | Interaction Dummy (-1) | 0.000561 | 0.8857 |
| | Interaction Dummy (-2) | 6.08E-05 | 0.9879 |

| System Residual Portmanteau Tests for Autocorrelations Null: No Autocorrelation | Lags | Q-Stat | Prob. |
|---|---|---|---|
| | 1 | 17.39667 | 0.3604 |
| | 2 | 31.82421 | 0.4755 |
| | 3 | 52.18072 | 0.3147 |
| | 4 | 59.80871 | 0.6254 |
| | 5 | 78.40931 | 0.5294 |

| | Real Traded Output | Real Non-traded Output | Imports | Exports |
|---|---|---|---|---|
| **Jarque-Bera Test for Normality** | 1.022845 | 2.911779 | 2.044461 | 0.100110 |
| **Probability** | 0.599642 | 0.233193 | 0.359791 | 0.951177 |

**Table 3: SUR Results for Jamaica**

| Dependent Variable | Regressor | Coefficient | Probability |
|---|---|---|---|
| **Real Traded Output** $R^2 = 0.878068$ Adj. $R^2 = 0.820310$ | Constant | -0.006563 | 0.1870 |
| | Investment | 0.060738 | 0.0466 |
| | Price Competitiveness | 0.096505 | 0.0000 |
| | Spare Capacity | 0.000234 | 0.0000 |
| | Traded Output (-1) | -0.071053 | 0.2993 |
| | Interest Rate | -0.000259 | 0.2942 |
| | International Market | -0.042713 | 0.8219 |
| | Interaction Dummy (-1) | 0.001790 | 0.0776 |
| | Interaction Dummy (-2) | -0.000319 | 0.7543 |
| **Real Non-traded Output** $R^2 = 0.826921$ Adj. $R^2 = 0.769228$ | Constant | 0.023862 | 0.0000 |
| | Investment | 0.025581 | 0.4007 |
| | Price Non-traded/ Price Traded | -0.038074 | 0.0017 |
| | Productivity | 0.888162 | 0.0000 |
| | Interest Rates | 0.000491 | 0.0844 |
| | Interaction Dummy (-1) | -0.002456 | 0.0418 |
| | Interaction Dummy (-2) | -0.002078 | 0.0939 |
| **Imports of Goods & Services** $R^2 = 0.891729$ Adj. $R^2 = 0.855638$ | Constant | 0.017218 | 0.2154 |
| | Nominal Output | 1.301218 | 0.0000 |
| | Price Non-traded/ Price Traded | -0.090356 | 0.0020 |
| | Interaction Dummy (-1) | -0.002721 | 0.3881 |
| | Interaction Dummy (-2) | -0.008949 | 0.0075 |
| **Exports of Goods & Services** $R^2 = 0.875759$ Adj. $R^2 = 0.848750$ | Constant | -0.005738 | 0.7061 |
| | Nominal Traded Output | 1.437500 | 0.0000 |
| | Interaction Dummy (-1) | 0.003445 | 0.3324 |
| | Interaction Dummy (-2) | -0.010823 | 0.0035 |

| **System Residual Portmanteau Tests for Autocorrelations Null: No Autocorrelation** | **Lags** | **Q-Stat** | **Prob.** |
|---|---|---|---|
| | 1 | 19.40932 | 0.2480 |
| | 2 | 41.23084 | 0.1271 |
| | 3 | 54.78674 | 0.2328 |
| | 4 | 69.04763 | 0.3108 |
| | 5 | 87.87035 | 0.2562 |

| | **Real Traded Output** | **Real Non-traded Output** | **Imports** | **Exports** |
|---|---|---|---|---|
| **Jarque-Bera Test for Normality** | 0.609744 | 0.784865 | 1.377463 | 0.110960 |
| **Probability** | 0.737218 | 0.675412 | 0.502213 | 0.946031 |

**Table 4: SUR Results for Trinidad & Tobago**

| Dependent Variable | Regressor | Coefficient | Probability |
|---|---|---|---|
| **Real Traded Output** $R^2 = 0.698855$ Adj. $R^2 = 0.578396$ | Constant | 0.019413 | 0.0018 |
| | Investment | 0.068781 | 0.0024 |
| | Price Competitiveness | -0.009584 | 0.5771 |
| | Spare Capacity | 6.79E-05 | 0.0014 |
| | Traded Output (-1) | 0.273246 | 0.0231 |
| | Interest Rate | 0.000127 | 0.9431 |
| | International Market | 0.317267 | 0.3449 |
| | Interaction Dummy (-1) | -0.004513 | 0.0638 |
| | Interaction Dummy (-2) | -0.002853 | 0.2430 |
| **Real Non-traded Output** $R^2 = 0.600357$ Adj. $R^2 = 0.491363$ | Constant | 0.015746 | 0.0151 |
| | Investment | 0.010774 | 0.6945 |
| | Price Non-traded/ Price Traded | -0.034531 | 0.2410 |
| | Productivity | 0.696106 | 0.0009 |
| | Interest Rates | 0.001171 | 0.5362 |
| | Interaction Dummy (-1) | -0.007012 | 0.0200 |
| | Interaction Dummy (-2) | 0.001632 | 0.5815 |
| **Imports of Goods & Services** $R^2 = 0.401490$ Adj. $R^2 = 0.301738$ | Constant | 0.001545 | 0.9399 |
| | Nominal Output | 0.955468 | 0.0007 |
| | Price Non-traded/ Price Traded | 0.234646 | 0.0326 |
| | Interaction Dummy (-1) | 0.004199 | 0.6988 |
| | Interaction Dummy (-2) | -0.002550 | 0.7961 |
| **Exports of Goods & Services** $R^2 = 0.884139$ Adj. $R^2 = 0.845519$ | Constant | 0.002936 | 0.7956 |
| | Nominal Traded Output | 0.740748 | 0.0000 |
| | Interaction Dummy (-1) | -0.009416 | 0.0892 |
| | Interaction Dummy (-2) | 0.013424 | 0.0175 |

| System Residual Portmanteau Tests for Autocorrelations Null: No Autocorrelation | Lags | Q-Stat | Prob. |
|---|---|---|---|
| | 1 | 18.04826 | 0.3211 |
| | 2 | 27.93511 | 0.6726 |
| | 3 | 40.56289 | 0.7683 |
| | 4 | 54.14434 | 0.8053 |
| | 5 | 69.74793 | 0.7866 |

| Jarque-Bera Test for Normality | Real Traded Output | Real Non-traded Output | Imports | Exports |
|---|---|---|---|---|
| | 3.049897 | 0.109028 | 1.606643 | 2.730902 |
| **Probability** | 0.217632 | 0.946945 | 0.447839 | 0.255266 |