Current Account and Interest Differentials in Developing Economies

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Abstract

This paper presents an analysis of the joint behavior of the post-1975 cyclical fluctuations of the current account and the real interest rate differential for a large number of developing economies. In contrast to industrialized economies, we find that the volatility of the current account and of the interest differential, as well as the contemporaneous correlations between the current account and output and between the interest differential and output generally display very wide ranges across countries. We verify whether these varying features can be explained by small open economy real business cycle model with varying levels of taxes and corruption.

JEL Classification Codes: E32, F41, G15.
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1. Introduction

This paper presents an analysis of the joint behavior of the cyclical fluctuations of the current account and the real interest rate differential for developing economies. These variables provide particularly relevant information to policy makers in developing economies. The current account provides information about changes in foreign indebtedness. This information is relevant for countries that experience sudden-stop phenomena, that run large current account deficits, and that are amongst the most heavily indebted in the world. The interest differential yields information on the real cost of borrowing faced by residents at home relative to the real cost of borrowing in industrialized countries. This information is relevant for policy makers in countries that finance their foreign debt from loans provided by commercial banks established in industrialized economies. The cyclical fluctuations in these variables also provide relevant information to policy makers. It is generally agreed that stabilization policies must alter the interest differential and the current account to affect the course of the business cycle in open economies. In this context, it is particularly relevant to study the comovements at the business cycle frequency of the current account and interest differential for developing economies.

To our knowledge, our paper offers the first study of the joint behavior of the current account and the interest differential for developing economies. Our first objective consists of documenting the joint behavior of the current account and the interest differential over the post-1975 period for a large number of developing economies. These economies include 13 countries in Africa, 8 countries in the Americas, and 7 countries in Asia for a total of 28 countries. Interestingly, we find that the cyclical fluctuations of these countries display a fair amount of heterogeneity in certain dimensions. The volatility of the current account and of the interest differential, as well as the contemporaneous correlations between the current account and output and between the interest differential and output generally display very wide ranges across countries. For example, the current account is less volatile than the interest differential in only half of the developing countries. Also, the
current account and the interest differential are countercyclical for only half of the developing countries. Our empirical findings are at odd with previous findings for developing economies. Recent studies document that net exports and the real interest rate are countercyclical for all selected countries (e.g. Aguiar and Ginopah 2004; Neumeyer and Perri 2005). Note, however, that these studies rely on data from only few countries. In addition, our empirical findings for developed economies differ from those found for industrialized economies. That is, the current account is more volatile than the interest differential, that the current account is countercyclical, and that the interest differential is procyclical for almost all countries (e.g. Boileau and Normandin 2004).

We also find that the cyclical fluctuations of developing countries feature a fair amount of homogeneity in other dimensions. In particular, the correlations between lags of the current account and the interest differential are negative, while the correlations between leads of the current account and interest differential are positive for almost all countries. This asymmetric shape of the cross-correlation function resembles a horizontal S. This S-curve parallels the shape of the cross-correlation function between net exports and the term of trade documented for many developing and industrialized economies (e.g. Senhadji 1998; Backus, Kehoe, and Kydland 1994). This finding is reminiscent of earlier work on the popular J-curve, where net exports initially decline to eventually increase after unfavorable movements in the terms of trade. The asymmetric shape of the cross-correlation function between the current account and the interest differential is also found for most industrialized countries (e.g. Boileau and Normandin 2004).

Our second objective is the challenging task of explaining both the heterogenous and homogenous features of the behavior of the current account and the interest differential of developing economies. For this purpose, we construct an economy that departs from the traditional small open economy real business cycle model in two important ways. One modification imposes that residents of the small open economy have only an imperfect access to world financial markets. We assume that residents in the small economy face country-specific real return on their holdings of foreign assets. We further assume that the interest differential is negatively related to the country’s net foreign asset position and to its output. Hence, the interest differential rises following a current account deficit
that worsens the country’s net foreign asset position, so that the supply of foreign funds is upward sloping. The interest differential, however, reduces following an increase in the country’s output, since this improves its ability to support a higher foreign debt. These assumptions are consistent with the presence of risk premia and with costly international financial markets (e.g. Senhadji 1997; Boileau and Normandin 2004). Our assumptions are also consistent with the empirical negative relation between the interest differential and the current account (e.g. Bernhardsen 2000) and between the interest differential and the net foreign asset position (e.g. Lane and Milesi-Ferretti 2002).

The other modification imposes that residents of the small economy face important distortions in their access to financial and capital markets. We assume that these distortions create a loss of resources to the consumers that is transferred to the government, via taxes to both the bonds and physical capital markets. From a broader perspective, we could alternatively assume that the distortions generate a resource drain on the economy, due to inefficient and corrupt bureaucracies. Importantly, both interpretations yield the predictions that greater distortions lead to larger interest differential and foreign debt, and a smaller investment rate. These predictions accord with the theoretical negative relation between distortions and investment rate highlighted in previous studies (e.g. Chari, Kehoe, and McGratten 1996; Restucia and Urrutia 2001). The predictions also are in line with the empirical negative relation between distortions and investment rate prevailing for developing economies (e.g. Mauro 1995).

We confront the model’s predictions of the cyclical fluctuations of the current account and the interest differential to the empirical features of developed economies. For parsimony, we calibrate the model for Africa, the Americas, and Asia. Interestingly, the three regional-specific calibrations generate cyclical fluctuations that closely match those found for the developing countries. In accord with the data, some predictions differ across calibrations: the volatility of the current account and of the interest differential, as well as the contemporaneous correlations between the current account and output and between the interest differential and output display very wide ranges. As in the data, other predictions are common to all calibrations: the cross-correlation function for the current account and the interest differential exhibits an S-curve.
We also show that our modifications of the mainstream model play central roles to predict both the heterogenous and homogenous dimensions of the empirical features. In particular, a rise in the elasticity of the interest differential with respect to output reduces the volatility of the current account relative to that of the interest differential, and makes the current account and the interest differential more countercyclical. A rise in the distortionary bond tax yields an increase in the volatility of the current account relative to the interest differential, but also makes the current account and the interest differential more countercyclical. Finally, a rise in the distortionary capital tax raises the volatility of the current account relative to the interest differential, and makes the current account and the interest differential more procyclical. In contrast, most values for the interest differential elasticity as well as the bond and capital taxes produce a cross-correlation function for the current account and interest differential that displays a S-curve.

The rest of the paper is organized as follows. Section 2 documents the empirical cyclical fluctuations of the current account and interest differential for our sample of developing economies. Section 3 presents the small open economy model. Section 4 discusses the model’s steady state and the responses to the various shocks. Section 5 confronts the simulated cyclical fluctuations to the empirical fluctuations found in the data. Section 6 concludes.

2. Empirical Cyclical Features

We document the main features of the cyclical fluctuations of the current account and the interest differential for several developing countries. For completeness, we report the cyclical properties of other key macroeconomic aggregates, namely consumption, investment, and output. Our sample includes annual observations covering the 1975-2000 period for 13 countries in Africa, 8 countries in the Americas, and 7 countries in Asia. This sample is similar to that of Senhadji (1998), but contains a much wider variety of countries than those usually considered in previous studies. The frequency and time period are dictated by the availability of the data. The data are fully described in Appendix A.

In what follows, the current account \( x_t \) refers to the cyclical fluctuations of the ratio
of the real current account to real gross domestic product. The interest differential \((d_t)\) refers to the cyclical fluctuations of the difference between the ex-ante country-specific real gross return and the ex-ante world real gross return. The ex-ante real interest rate is the difference between the short-term nominal interest rate and the expected inflation rate. The world interest rate is a weighted average of the real interest rate for the G7 countries, where the weights reflect the country’s share of the overall real output of the G7 countries. Also, consumption \((c_t)\), investment \((i_t)\), and output \((y_t)\) refer to the cyclical fluctuations of the logarithms of the real private final consumption, real fixed capital formation, and real gross domestic product. As is standard practice, the cyclical fluctuations of a variable are measured by the deviations from the trend extracted by the Hodrick-Prescott filter with a smoothing parameter of 100.

We present the salient features of the cyclical fluctuations for each countries grouped by regions. Tables 1 to 3 report standard cyclical statistics. They are grouped under relative volatility and contemporaneous correlations. The relative volatility is the ratio of the sample standard deviation of the variable to the sample standard deviation of output. The correlation of a variable with output is simply the sample contemporaneous correlation between the variable and output. These statistics are useful to characterize the behavior of the variables through the business cycle. For example, a relative volatility smaller than one signifies that the variable is less volatile than output along the business cycle. Also, a negative correlation between a variable and output indicates that the variable is countercyclical, while a positive correlation indicates that the variable is procyclical.

Figures 1 to 3 display the cross-correlation function between the current account and the interest differential. The cross-correlation function is the sample dynamic correlations between the current account and the interest differential. These correlations are useful to summarize the joint behavior of our two variables of interest along the business cycle. In particular, the dynamic correlations capture comovements between leads and lags of the current account and the interest differential, and as such provide information about the shape of the relations between the variables taken at different points in time. In previous work, cross-correlation functions have proved to be useful to document the comovements between net exports and the term of trade.
The statistics reveal that the current account is less volatile than output for most developing countries. The range of relative volatility for the current account goes from a low of 0.13 in Ecuador to a high of 1.83 in Benin. Notably, the current account is more volatile than output in only three countries. On average, the relative volatility of the current account is 0.70 in Africa, 0.51 in the Americas, and 0.68 in Asia. The interest differential is much less volatile than output in some developing countries, but much more volatile than output in other countries. The wide range of relative volatility for the interest differential ranks from a low of 0.19 in Singapore to a high of 4.30 in Venezuela. The interest differential is more volatile than output in nine countries, of which five are in the Americas. On average, the relative volatility of the differential is 0.77 in Africa, 1.57 in the Americas, and 0.61 in Asia.

The statistics also indicate that the current account is sometimes procyclical and sometimes countercyclical. The range of correlation between the current account and output goes from -0.73 for Thailand to 0.79 for Ivory Coast. There is a lot of heterogeneity for this correlation. Interestingly, the current account is procyclical in 11 countries. Also, the current account is countercyclical in 6 out of 7 Asian countries. On average, the correlation between the current account and output is 0.10 in Africa, -0.06 in the Americas, and -0.30 in Asia. The interest differential is also sometimes procyclical and sometimes countercyclical. The range of correlation between the interest differential and output goes from -0.51 for Trinidad to 0.55 for Ecuador and Morocco. The interest differential is procyclical in 16 of the 28 countries, which includes most of the Asian countries. The correlation between the interest differential and output is 0.15 in Africa, -0.04 in the Americas, and 0.03 in Asia.

The cross-correlation function between the current account and the interest differential highlights that the relation between the current account and interest differential displays an asymmetric shape that resembles a horizontal S. That is, the correlations between lags of the current account and the interest differential tend to be negative, while the correlations between leads of the current account and the interest differential tend to be positive. For different turning points, the S-curve is observed for several countries. In Africa, it is observed for Benin, Gabon, Ivory Coast, Kenya, Morocco, Senegal, South Africa, Togo,
and Tunisia. In the Americas, it is observed for Costa Rica, Ecuador, Guatemala, Mexico, and Venezuela. Finally, in Asia, it is observed for all countries. On average, the asymmetric S shape holds with a contemporaneous turning point in Africa and with a one-period lead turning point for the Americas and Asia.

To complete the analysis, the statistics show that consumption is often more volatile than output. The relative volatility of consumption ranges from 0.50 in the Philippines to 1.73 in Benin. Interestingly, consumption is more volatile than output in 14 countries. On average, the relative volatility of consumption is 1.04 in Africa, 1.11 in the Americas, and 0.84 in Asia. In contrast, investment is systematically more volatile than output. The relative volatility of investment ranges from 1.01 in Ecuador to 5.94 in Benin. On average, the relative volatility of investment is 2.87 in Africa, 2.61 in the Americas, and 2.87 in Asia. Finally, consumption and investment are systematically procyclical. The correlation between consumption and output ranges from 0.20 in Gabon to 0.98 in Ecuador. On average, the correlation between consumption and output is 0.68 in Africa, 0.86 in the Americas, and 0.77 in Asia. The correlation between investment and output ranges from 0.09 in Benin to 0.94 in Thailand and Ecuador. On average, the correlation between investment and output is 0.62 in Africa, 0.75 in the Americas, and 0.77 in Asia.

In sum, the empirical features of the current account and the interest differential display a fair amount of heterogeneity in some dimensions, but homogeneity in other dimension. This contrasts with the strong homogeneity reported in earlier work for both developing and industrialized economies. Also, the empirical features of consumption and investment exhibit a fair amount of homogeneity and are similar to those reported for industrialized countries. One exception is that consumption is often more volatile than output, as frequently found for developing economies (e.g. Mendoza 1995) but unlike that found for industrialized economies (e.g. Backus, Kehoe, Kydland 1992).

3. A Small Open Economy Model

We model a small country open to world financial markets. The access to world financial markets, however, is imperfect. Consumers face a country-specific interest rate on their
net holdings of world bonds. In addition, consumers face important distortions in their access to financial and capital markets. The distortions create a loss of resources to the consumers.

The small country is populated by a representative consumer, whose expected lifetime utility is given by

\[
E_t \left[ \sum_{t=0}^{\infty} \beta^t U(C_t, N_t) \right],
\]

where \(E_t\) is the conditional expectation operator, \(C_t\) is consumption, \(N_t\) is hours worked, and \(0 < \beta < 1\). We employ the (GHH) preferences of Greenwood, Hercowitz, and Huffman (1988):

\[
U(C_t, N_t) = \left[ C_t - \left( \theta / \eta \right) N_t^\eta \right]^{\gamma} / \gamma,
\]

where \(\gamma \geq 1\), \(\theta > 0\), and \(\eta > 1\). GHH preferences have been shown to help explain many features of the business cycle of small open economies (e.g. Correia, Neves, and Rebelo 1995; Mendoza 1991).

The consumer’s budget constraint is given by

\[
C_t + I_t + X_t + T_t = W_t N_t + (r^k_t - \tau_k) K_t + (R_t - 1 - \tau_b) B_t + \Pi_t,
\]

where \(I_t\) is investment, \(X_t\) is the changes in the net holdings of bonds, \(T_t\) is lump-sum taxes, \(W_t\) is the wage rate, \(r^k_t\) is the rental rate of capital, \(K_t\) is the stock of capital, \(R_t\) is the country-specific gross return on bonds, \(B_t\) is the net holdings of bonds, and \(\Pi_t\) are the home firm’s profits. The parameters \(\tau_b\) and \(\tau_k\) generate intertemporal distortions on both the bonds and capital markets. We explicitly assume that the distortions create a loss of resources to the consumers that is transferred to the government, so that the parameters \(\tau_b\) and \(\tau_k\) can be interpreted as tax rates. Alternatively, we could also assume that the distortions generate a resource drain on the economy. In this case, the parameters \(\tau_b\) and \(\tau_k\) can be interpreted as indices of non-tax impediments created by inefficient and corrupt bureaucracies. Both interpretations lead to similar predictions.

Capital accumulation follows

\[
K_{t+1} = \Phi(I_t / K_t) K_t + (1 - \delta) K_t,
\]
where \(0 < \delta < 1\). The term \(\Phi_t = \Phi(I_t/K_t)\) denotes adjustment costs:

\[
\Phi_t = \left[\omega_1/(1 - 1/\phi)\right](I_t/K_t)^{1-1/\phi} + \omega_2,
\]

(5)

where \(\phi\) is the elasticity of investment with respect to Tobin’s \(q\). The standard no-adjustment cost version is obtained when the elasticity is large (\(\phi \to \infty\)). Adjustment costs limit the volatility of investment in open economies (e.g. Baxter and Crucini 1993).

The evolution of the net holdings of bonds is described by

\[
B_{t+1} = X_t + B_t.
\]

(6)

The consumer chooses consumption, hours worked, and capital and bond holdings to maximize expected lifetime utility (1) subject to the budget constraint (53 and the accumulation equations (4) and (6). The first-order conditions of the consumer’s problem are

\[
\lambda_t = U_{ct},
\]

(7.1)

\[
U_{nt} = -\lambda_t W_t,
\]

(7.2)

\[
\lambda_{kt} = \lambda_t/\Phi_{\delta t},
\]

(7.3)

\[
\lambda_t = \beta E_t \left[\lambda_{t+1} (R_{t+1} - \tau_b)\right],
\]

(7.4)

\[
\lambda_{kt} = \beta E_t \left[\lambda_{t+1} (r_{t+1}^k - \tau_k) + \lambda_{kt+1} \left(\Phi_{t+1} - \Phi_{\delta t+1} (I_{t+1}/K_{t+1}) + (1 - \delta)\right)\right],
\]

(7.5)

where \(\lambda_t\) and \(\lambda_{kt}\) are multipliers associated with the constraint (3) and the accumulation equation (4). Also, \(U_{ct}\) and \(U_{nt}\) are the partial derivatives of \(U(C_t, N_t)\) with respect to its arguments \(C_t\) and \(N_t\), while \(\Phi_{\delta t}\) is the partial derivative of \(\Phi_t\) with respect to its argument \(I_t/K_t\):

\[
U_{ct} = \left[C_t - (\theta/\eta) N_t^{\eta}\right]^{\gamma-1},
\]

(8.1)

\[
U_{nt} = -\left[C_t - (\theta/\eta) N_t^{\eta}\right]^{\gamma-1} \theta N_t^{\eta-1},
\]

(8.2)

\[
\Phi_{\delta t} = \omega_1 (I_t/K_t)^{-1/\phi}.
\]

(8.3)

Equation (7.1) equates the shadow price of consumption to its marginal benefit, where the marginal benefit is the rise in utility following an increase in consumption. Equation (7.2)
equates the marginal cost of working an extra unit of time to the wage rate. Equation (7.3) translates the shadow price of new capital into its output price. Equation (7.4) equates the marginal cost of purchasing an extra unit of bonds to its discounted expected marginal benefit. Note that the expected benefit is reduced by the presence of the distortionary tax $\tau_b$. Equation (7.5) equates the marginal cost of purchasing an extra unit of capital to its discounted expected marginal benefit, where the expected marginal benefit is reduced by the presence of the distortionary tax $\tau_k$.

The firm’s profits are given by

$$\Pi_t = Y_t - W_t N_t - r^k_t K_t,$$

where $Y_t$ is output. Goods are produced using the constant return to scale production technology

$$Y_t = Z_t K_t^\alpha N_t^{1-\alpha},$$

where $Z_t$ is the level of stochastic total factor productivity and $0 < \alpha < 1$.

The firm chooses labor and capital inputs to maximize profits (9) subject to the production function (10). The first-order conditions of the firm’s problem are

$$W_t = (1 - \alpha) Y_t / N_t,$$

$$r^k_t = \alpha Y_t / K_t.$$  

Equation (11.1) equates the wage rate to the marginal product of labor. Equation (11.2) equates the rental rate of capital to the marginal product of capital. Note that these conditions imply that $\Pi_t = 0$.

For simplicity, the government runs a balanced budget:

$$G_t = T_t + \tau_b B_t + \tau_k K_t,$$

where $G_t$ is stochastic government expenditures.

To close this economy, we assume that the country-specific return differs from the world return by

$$R_t = R^w_t + D_t,$$
where $D_t$ is the interest differential and $R^w_t$ is the stochastic world return on bonds. The interest differential is given by

$$D_t = -\varphi B_t / Y_t^{\xi}, \quad (14)$$

where $\varphi \geq 0$ and $\xi \geq 0$. There is no differential when $\varphi = 0$. Also, the interest differential is only a function of the net foreign asset position when the output elasticity is $\xi = 0$. The specification in (14) is a reduced form formulation used to obtain an upward sloping supply of foreign funds. That is, a rise in foreign borrowing worsens the net foreign asset position, which raises the borrowing rate above the world interest rate. As in Senhadji (1997), this may occur because of a risk premium. As in Boileau and Normandin (2004), it may also occur because international financial markets are costly.

The current account is given by changes in the net holdings of foreign assets $X_t$. Using this definition, the economy’s aggregate resource constraint is

$$X_t = Y_t + (R_t - 1)B_t - C_t - I_t - G_t. \quad (15)$$

Finally, the model has three exogenous stochastic variables: productivity $Z_t$, government expenditures $G_t$, and the world return $R^w_t$. The variables are generated by

$$z_t = \rho_z z_{t-1} + \epsilon_{zt}, \quad (16.1)$$
$$g_t = \rho_g g_{t-1} + \epsilon_{gt}, \quad (16.2)$$
$$r^w_t = \rho_r r^w_{t-1} + \epsilon_{rt}, \quad (16.3)$$

where $z_t = \ln(Z_t/Z)$, $g_t = \ln(G_t/G)$, $r^w_t = \ln(R^w_t/R^w)$. The variables $Z$, $G$, and $R^w$ are the steady state levels of productivity, government expenditures, and world return. The innovations $\epsilon_{zt}$, $\epsilon_{gt}$, and $\epsilon_{rt}$ are uncorrelated zero-mean random shocks with variances $\sigma^2_z$, $\sigma^2_g$, and $\sigma^2_r$.

The dynamic system that characterizes the equilibrium for this model includes the consumer’s problem first-order conditions (7), the partial derivatives (8), and the firm’s first-order conditions (11). The system is completed by the production function (10), the accumulation equation (4), the definition of the adjustment cost (5), the definition of the current account (6), the aggregate resource constraint (17), the interest differential described by (13) and (14), and the laws of motion for exogenous stochastic variables (16).
4. Steady State and Dynamic Responses

We study the deterministic steady state of the model and the dynamic responses of key variables to the various shocks. We do so for two main reasons. First, the simulated cyclical features of the model depend in part on the effects of some key parameters on the steady state equilibrium. Second, the simulated cyclical features also depend on how the various shocks affect the equilibrium. In addition, the dynamic system that characterizes the equilibrium does not yield an analytical solution. For our analysis, we approximate the equilibrium using the log-linear approximation method described in King, Plosser, and Rebelo (2002). This method, requires that we solve the model’s deterministic steady state and that we assign values to all parameters.

4.1 The Deterministic Steady State

The equations that characterize the deterministic steady state are

\[ K = \Phi(I/K)K + (1 - \delta)K, \quad (17.1) \]
\[ 1 = \beta\left[(\alpha Y/K - \tau_k) + (1 - \delta)\right], \quad (17.2) \]
\[ Y = ZK^\alpha N^{1-\alpha}, \quad (17.3) \]
\[ \theta N^{\eta-1} = (1 - \alpha)Y/N, \quad (17.4) \]
\[ 1 = \beta(R - \tau_b), \quad (17.5) \]
\[ R = R^\omega + D, \quad (17.6) \]
\[ D = -\varphi B/Y^\xi, \quad (17.7) \]
\[ C + I + G = Y + (R - 1)B. \quad (17.8) \]

The distortionary capital tax \( \tau_k \) lowers the investment rate. To see this, we use equation (17.1) and values for \( \delta \) and \( \phi \). We set the parameters \( \omega_1 \) and \( \omega_2 \) to ensure that \( I = \delta K, \Phi(\delta) = \delta, \) and \( \Phi_\delta(\delta) = 1 \). Then, using equation (17.2) and values for \( \alpha \) and \( \beta \), the investment rate is

\[ I/Y = \alpha\beta\delta/[1 - \beta(1 - \delta) + \beta \tau_k]. \quad (18) \]
The implications are that countries with a large tax $\tau_k$ have low investment rates, low capital to output ratio, and low output. Using equations (17.3) and (17.4) as well as values for $Z$, $\theta$, and $\eta$, output is

$$Y = \Upsilon^{(1-\alpha)/(1-\alpha\zeta)}Z^{\zeta\zeta/1-\alpha\zeta}(K/Y)^{\alpha\zeta/(1-\alpha\zeta)},$$  \hspace{1cm} (19) 

where $\Upsilon = [(1-\alpha)/\theta] > 0$ and $\zeta = \eta/(\eta + \alpha - 1) > 1$.

The distortionary bonds tax $\tau_b$ raises the interest differential. Using equation (17.5) and (17.6), the interest differential is

$$D = 1/\beta - R^w + \tau_b.$$  \hspace{1cm} (20) 

The implication is that countries with a large tax $\tau_b$ have high steady state interest differentials. In what follows, we assume that there are no distortions in the rest of the world, so that the subjective discount factor is $\beta = 1/R^w$ and the interest differential depends solely on $\tau_b$. As a consequence, the distortionary tax $\tau_b$ also lowers the net foreign asset position. Using equation (17.7) and values for $\phi$ and $\xi$, the net foreign asset to output ratio is

$$B/Y = -(1/\phi)DY^{\xi-1}.$$  \hspace{1cm} (20) 

The implication is that countries with a large tax $\tau_b$ have high debt to output ratio ($B/Y < 0$), and spend a large fraction of their output servicing the foreign debt (($R - 1)B/Y$).

Finally, the distortions $\tau_b$ and $\tau_k$ also affect the share of output devoted to consumption. Using equation (17.8) and a value for $G/Y$, the output share of consumption is

$$C/Y = 1 + (R - 1)B/Y - G/Y - I/Y.$$  \hspace{1cm} (21) 

Large values of $\tau_k$ lower the investment rate, which serves to raise the output share of consumption. At the same time, the reduction in output raises the debt to output ratio of net debtor countries and raises the fraction of output devoted to servicing the foreign debt, which serves to lower the output share of consumption. Large values of $\tau_b$ raise the interest differential, the debt to output ratio, and the fraction of output devoted to servicing the foreign debt. The result is that the output share of consumption is low.
4.2 The Region-Specific Calibration

To pursue our analysis, we calibrate the model to mimic the (empirical) region-specific features of the data. Admittedly, each region displays a lot of heterogeneity, but the regional averages are rich enough to capture the heterogeneity of the cyclical features observed for individual countries.

Table 4 presents the calibration. We set a number of parameters to common values for all regions. We set the subjective discount factor to match the average level of the world discount factor $\beta = 1/R^w = 0.973$. We set a number of parameters to annual versions of the values discussed in Backus, Kehoe, and Kydland (1992). These include the coefficient of relative risk aversion $1 - \gamma = 2$, the depreciation rate $\delta = 0.10$, and the capital share $\alpha = 0.36$. We set the elasticity of labor supply to the value discussed in Greenwood, Hercowitz, and Huffman (1988): $1/(\eta - 1) = 1.7$. We also set the steady state value of the level of productivity to $Z = 1$. Lane and Milesi-Ferretti (2001) estimate the sensitivity of the interest differential to changes in the ratio of net foreign assets to net exports for industrialized countries over the 1970 to 1998 period. Their estimates roughly translate into values between $\varphi = 0.001$ and $\varphi = 0.003$. Devereux and Smith (2004) study the Franco-Prussian war indemnity of 1871-1873. They argue that for this period, international financial markets involved more frictions than implied by recent estimates. For this reason, they use a value of $\varphi = 0.01$, which is 10 times larger than the lower estimate of Lane and Milesi-Ferretti (2001). We argue that the access to financial markets of developing countries also involves more frictions than suggested by the recent estimates. For our purpose, we set $\varphi = 0.02$, which is 10 times the average estimate of Lane and Milesi-Ferretti (2001). Finally, we set the parameters of the world return shock process to their ordinary least squares estimates of $\rho_r = 0.315$ and $\sigma_r = 0.010$.

The remaining parameters are set to region-specific values. As is standard, we set the elasticity of investment with respect to Tobin’s $q$ to match the regional averages of the relative volatility of investment. With our overall calibration, the required values are $\phi = 48.75$ in Africa, $\phi = 18.10$ in the Americas, and $\phi = 45.60$ in Asia. We set the capital tax to match the regional averages of the investment rate. The required values are of $\tau_k = 0.050$ in Africa, $\tau_k = 0.065$ in the Americas, and $\tau_k = -0.005$ in Asia. We
set the bonds tax to match the regional averages of the interest differential. The average interest differentials are $D = 0.034$ in Africa, $D = 0.005$ in the Americas, and $D = 0.018$ in Asia. The implied values of the tax rate are $\tau_b = 0.034$ in Africa, $\tau_b = 0.005$ in the Americas, and $\tau_b = 0.018$ in Asia. We set the output share of government expenditures to their regional averages of $G/Y = 0.147$ in Africa, $G/Y = 0.116$ in the Americas, and $G/Y = 0.107$ in Asia. We also set $\theta$ to ensure that hours worked are 30 percent of the time endowment in the steady state: $N = 0.30$. This requires value of $\theta = 1.930$ in Africa, $\theta = 1.848$ in the Americas, and $\theta = 2.374$ in Asia. We set the elasticity of output in the interest differential to match the regional averages of the correlation between the interest differential and output. With our overall calibration, the required values are $\xi = 0.044$ in Africa, $\xi = 0.615$ in the Americas, and $\xi = 0.165$ in Asia. Finally, we set the parameters of the productivity and government expenditures shock processes to their ordinary least squares estimates. The estimates of the productivity shock process are $\rho_z = 0.410$ and $\sigma_z = 0.057$ in Africa, $\rho_z = 0.598$ and $\sigma_z = 0.066$ in the Americas, and $\rho_z = 0.541$ and $\sigma_z = 0.041$ in Asia. The estimates of the government expenditures shock process are $\rho_g = 0.446$ and $\sigma_g = 0.097$ in Africa, $\rho_g = 0.549$ and $\sigma_g = 0.010$ in the Americas, and $\rho_g = 0.494$ and $\sigma_g = 0.059$ in Asia.

For this calibration, the steady state debt to output ratio is $B/Y = -3.68$ in Africa, $B/Y = -0.35$ in the Americas, and $B/Y = -1.49$ in Asia. The result is that the steady state share of output devoted to consumption is $C/Y = 0.42$ in Africa, $C/Y = 0.69$ in the Americas, and $C/Y = 0.53$ in Asia.

4.3 Simulated Dynamic Responses

Before confronting the simulated features of the region-specific calibrations of the model, we study the dynamic responses of key variables to the various shocks. Figure 4 displays the simulated dynamic responses. The shocks come from positive one-standard deviation innovations to productivity, government expenditures, and the world return. The key variables are output, the current account (to output ratio) and its decomposition into the national saving rate and the investment rate, and the interest differential.

Overall, the responses show that the model is driven almost entirely by productivity
shocks. For all regions, the responses are by far the largest after the productivity shock, small after the government expenditures shock, and almost inexistent after the world return shock.

An increase in productivity raises output for all three regions. The impact increase in output is smallest in Asia, larger in Africa, and largest in the Americas. In part, this occurs because the standard deviation of productivity shocks is smallest in Asia ($\sigma_z = 0.041$), larger in Africa ($\sigma_z = 0.057$), and largest in the Americas ($\sigma_z = 0.066$).

For all regions, the higher productivity stimulates both national saving and investment. The higher productivity raises individual wealth. The higher wealth stimulates national saving, because consumers wish to intertemporally smooth consumption. Clearly, the rise in national saving promotes a procyclical current account. The higher productivity also raises the marginal product of capital. The higher marginal product stimulates investment to ensure an increase in the capital stock. The rise in investment promotes a countercyclical current account. The relative magnitudes of the national saving and investment responses dictate the behavior of the current account. In Africa and Asia national saving does not rise enough at impact to fully fund the investment boom, and the current account initially deteriorates. In the Americas, national saving rises by more than investment at impact, and the current account initially improves.

These impact responses highlight two important features. First, the magnitudes of the responses of the current account are smaller than those of output for all three regions, which translates in a current account that is less volatile than output. Second, the direction of the responses suggests that the current account is procyclical in the Americas, almost acyclical in Africa, and countercyclical in Asia.

The higher productivity lowers the interest differential on impact, but subsequently improves it. The interest differential responds to both changes in the current account and output. At impact, the higher productivity raises output, but has no effect on the (predetermined) net foreign asset position. Thus, for all three regions, the impact increase in output generates an impact reduction in the interest differential. The relative magnitude of the impact response depends on the output elasticity of the interest differential $\xi$. The impact response is small in Africa, larger in Asia, and largest in the Americas because the
elasticity is smallest in Africa ($\xi = 0.044$), larger in Asia ($\xi = 0.165$), and largest in the Americas ($\xi = 0.615$). At impact, the higher productivity also affects the current account, which subsequently changes the net foreign asset position. The impact effect of the current account improves the subsequent net foreign asset position in the Americas and worsens the net foreign asset position in Africa, but the effects are small compared to the effects of output. In Asia, however, the large deterioration of the current account worsens the net foreign asset position sufficiently to subsequently push the interest differential above its steady state.

These responses hint at three important features. First, the magnitudes of the responses of the interest differential are not as large as those of output for all three regions, so that the interest differential is less volatile than output. Second, the direction of the response suggests that the differential be close to acyclical for Africa, countercyclical for the Americas, and acyclical for Asia. Finally, the impact responses suggests that the contemporaneous correlation between the current account and the interest differential be positive for Africa, slightly negative for the Americas, and positive for Asia. It is however difficult to deduce the entire shape of the cross-correlation functions from the responses.

An increase in government expenditures generates an eventual small reduction in output in all three regions. The government expenditures shock does not immediately affect output because GHH preferences eliminate the responses of employment to changes in lifetime wealth. More specifically, output depends only on productivity and the (predetermined) capital stock. Thus, output does not react at impact because neither productivity nor the capital stock respond to the increase in government expenditures at impact. The higher government expenditures reduce both national saving and investment, but the effect is larger on national saving. The result is a deterioration of the current account for all three regions. The current account deterioration eventually worsens the net foreign asset position. The interest differential does not react on impact, because neither output nor the net foreign asset position changes on impact. Eventually, both the reduction in output and the worsening of the net foreign asset position raise the interest differential. Finally, the rise in the interest differential raises home interest rates. In response, firms reduce investment to lower the capital stock, and the lower capital stock reduces output.
Finally, an increase in the world return eventually lowers output. The increase in world return raises home interest rates. This lowers investment and eventually reduces output in all three regions. Overall, the shock stimulates saving in the Americas and Asia, but reduces saving in Africa. The result is that the current account improves in the Americas and Asia, but deteriorates in Africa. Finally, these effects eventually reduce the interest differential in the Americas and Asia, but raise the interest differential in Africa.

5. Simulation Results

In this section, we first confront the simulated properties of the model to those of the region-specific averages for Africa, the Americas, and Asia. We then further study the sensitivity of the simulated properties to changes in key parameters.

5.1 Simulated Cyclical Features

Table 5 reports the simulated cyclical statistics as well as the region-specific empirical cyclical statistics. Figure 4 presents the simulated and empirical cross-correlation functions between the current account and the interest differential.

The simulated statistics reveal that the current account is less volatile than output for the three region-specific calibrations of the model. The simulated relative volatility of the current account is 0.60 for Africa, 0.41 for the Americas, and 0.76 for Asia. Also, the interest differential is less volatile than output for all three region-specific calibrations of the model. The simulated relative volatility of the interest differential is 0.10 for Africa, 0.86 for the Americas, and 0.31 for Asia. Note that the interest differential is less volatile than the current account for the region-specific calibration of Africa and Asia, but much more volatile than the current account in the region-specific calibration of the Americas.

The simulated statistics indicate that the current account is sometimes procyclical and sometimes countercyclical. The simulated correlation between the current account and output is 0.04 for Africa, 0.31 in the Americas, and -0.48 in Asia. That is, the current account is slightly procyclical for the region-specific calibration of Africa, strongly procyclical for the region-specific calibration of the Americas, and strongly countercyclical.
for the region-specific calibration of Asia. The simulated statistics also indicate that the
interest differential is sometimes procyclical and sometimes countercyclical. Of course,
the output elasticity of the interest differential is calibrated to ensure that the simulated
correlation between the interest differential and output matches the data.

The simulated cross-correlation function between the current account and the interest
differential displays the horizontal S shape. That is, the simulated correlations between
lags of the current account and the interest differential are negative, while the simulated
correlations between leads of the current account and the interest differential are positive.
The simulated turning point occurs contemporaneously for the region-specific calibration
of Africa, and contemporaneously for the region specific calibrations of the Americas and
Asia.

For completeness, the simulated statistics show that consumption can be more volatile
than output. The simulated relative volatility of consumption is 1.11 for Africa, 0.72 in the
Americas, and 0.86 in Asia. The range of the simulated relative volatility of consumption
is thus wide: consumption is more volatile than output in the region specific calibration
of Africa, but less volatile than output in the region-specific calibration of the Americas
and Asia. The simulated relative volatility of investment is high. That is, investment is
more volatile than output for the three region-specific calibration. Of course, the elasticity
of investment to Tobin’s $q$ ($\phi$) is calibrated to ensure that the relative volatility invest-
ment matches the data. Finally, the simulated statistics suggest that consumption and
investment are procyclical. The simulated correlation between consumption and output is
0.99 in Africa, 0.99 in the Americas, and 0.99 in Asia. The simulated correlation between
investment and output is 0.87 in Africa, 0.92 in the Americas, and 0.88 in Asia.

Overall, the simulated statistics display magnitudes and signs that often numerically
accord with the data. In this context, the region-specific calibrations of the model capture
well the heterogeneous and homogenous empirical cyclical features of the current account
and the interest differential documented for developing economies. In particular, the model
produces a fair amount of heterogeneity in the volatility of the current account relative
to the volatility of the interest differential. In addition, both the current account and the
interest differentials are sometimes procyclical and sometimes countercyclical.
5.2 Simulated Cyclical Features: Sensitivity

The heterogeneity of the simulated features of the business cycle for our region-specific calibration of the model highlight the importance of some key parameters. In this section, we further study the importance of these key parameters, and verify the sensitivity of the simulated business cycle features to changes in them.

For this purpose, we construct a baseline parametrization of the model, and use it to conduct several experiments about the key parameters of the model. The key parameters are those that differ between the three region-specific calibration. The parameters are the elasticity of the interest differential to changes in output, the elasticity of investment to changes in Tobin’s \( q \), as well as the distortionary taxes to bond holdings and capital holdings.

The results of the different experiments are reported in Table 6 and Figure 6. The results of additional experiments on the common parameters appear in the Appendix Table B and Appendix Figure B. The baseline parametrization is based on an average of the region-specific calibrations. We set the common parameters to the values shown in Table 4: \( \beta = 0.973 \), \( \gamma = -1.00 \), \( \eta = 1.59 \), \( \delta = 0.10 \), \( \alpha = 0.36 \), \( Z = 1 \), \( \varphi = 0.02 \), \( \rho_r = 0.315 \), and \( \sigma_v = 0.010 \). Second, we set a number of parameters to match the three region averages of some key moments. The average moments are \( \sigma_i / \sigma_y = 2.78 \), \( D = 0.019 \), \( I/Y = 0.226 \), \( N = 0.30 \), \( \rho(d, y) = 0.05 \). The required parameter values are \( \phi = 34.5 \), \( \tau_b = 0.019 \), \( \tau_k = 0.031 \), \( \theta = 2.057 \), \( \xi = 0.105 \). Finally, we set a number of parameters to their three region averages: \( \rho_z = 0.516 \), \( \sigma_z = 0.055 \), \( G/Y = 0.123 \), \( \rho_g = 0.496 \), \( \sigma_g = 0.055 \).

The first experiment verifies the effects of changing the output elasticity of the interest differential. We lower the elasticity to \( \xi = 0 \) and raise it to \( \xi = 1.00 \). The lower bound is consistent with Boileau and Normandin (2004) and Uribe and Yue (2005), while the upper bound is consistent with Nason and Rogers (2005). First, an increase in the elasticity it lowers the steady state level of the net foreign asset position and raises the output share of consumption to \( C/Y = 0.61 \). Second, the increase in the elasticity makes the interest differential more volatile and countercyclical. This occurs because the interest differential reacts more to changes in output. Third, the increase in the elasticity makes the current account more volatile and countercyclical. This occurs because the increase in
the elasticity raises the volatility of investment, and the larger fluctuations of investment must be financed by larger current account deficits.

The second experiment verifies the effects of changing the elasticity of investment to changes in Tobin’s $q$. We raise the elasticity by setting $\phi = 1000$ and lowers it by setting $\phi = 17.25$. Effectively, a higher elasticity lowers (almost eliminates) the adjustment cost to investment, while a lower elasticity greatly raises the adjustment cost. First, the reduction of the adjustment cost does not affect the steady state. Second, the reduction of the adjustment cost makes the interest differential more volatile and procyclical. This occurs because of the large effects of the adjustment costs on investment and the current account. Third, as expected, the reduction in the adjustment cost makes the current account more volatile. This occurs because of the large increase in the volatility of investment.

The third experiment verifies the effects of changing the distortionary tax on bond holdings. We lower the tax to $\tau_b = 0.001$ and raise it to $\tau_b = 0.038$. The lower bound almost eliminates the interest differential while the upper bound is twice that of the baseline parametrization. First, an increase in the distortionary tax raises the steady state level of the interest differential, and lowers the net foreign asset position. This then raises the share of output devoted to servicing the foreign debt and reduces the share devoted to consumption to $C/Y = 0.41$. Second, the increase in the tax makes the interest differential less volatile and countercyclical. Inversely, the reduction in the tax greatly reduces the steady state level of the interest differential, and makes it extremely volatile. Third, the increase in the tax only slightly affects the current account.

The last experiment verifies the effects of changing the distortionary tax on capital. We lower the tax to $\tau_k = 0.00$ and raise it to $\tau_k = 0.10$. The changes in the tax effectively raises the output share of investment to $I/Y = 0.28$ and lowers it to $I/Y = 0.16$. First, the increase in the capital tax lowers the output share of investment and raises the output share of consumption to $C/Y = 0.61$. Second, the rise in the capital tax has almost no effect on the cyclical features of the interest differential. Third, the rise in the tax makes the current account more volatile and procyclical. This occur because of the reduction in the investment rate and rise in the output share of consumption magnifies the effects of productivity shocks on national saving relative to investment.
5.3 Discussion

To come.

6. Conclusion

Overall, the modified small open economy model appears to provide an explanation of the joint behavior of the current account and the interest rate differential for developing economies. Importantly, the model appears to account for the heterogeneity observed for the volatility of the current account relative to that of the interest differential, as well as for the correlations between the current account and output and between the interest differential and output.

In large part, our explanation is based on distortions $\tau_k$ and $\tau_b$ that create a loss of resources. These distortions can be interpreted as taxes or as indices of distortions generated by inefficient and corrupt bureaucracies. Interestingly, the available empirical evidence suggests that tax rate and corruption have similar impacts on the economy. Wei (1997) documents that a rise in either the tax rate on multinational firms or the corruption level in a host country reduces inward direct investment. More concretely, an increase in the corruption level from that of Singapore to that of Mexico is equivalent to raising the tax rate by over twenty percentage points.

Our model suggests that greater distortions lead to larger interest differentials and smaller investment rates. This is consistent with the available empirical evidence for developing economies. Mauro (1995) documents a strong negative correlation between the investment rate and the level of corruption for developing economies.
Appendix A: Data

The yearly measures are constructed for 28 emerging countries for the 1975 to 2000 period. The measures are computed from the International Financial Statistics (IFS) released by the International Monetary Funds, as well as the World Development Indicators (WDI) published by the World Bank. The countries in Africa are Benin, Gabon, Ghana, Ivory Coast, Kenya, Mali, Mauritius, Morocco, Nigeria, Senegal, South Africa, Togo, and Tunisia. The countries in the Americas are Chile, Costa Rica, Ecuador, Guatemala, Mexico, Trinidad, Uruguay, and Venezuela. The countries in Asia are Indonesia, Malaysia, Philippines, Singapore, South Korea, Sri Lanka, and Thailand.

In addition, the measure of world real gross return is constructed from the G7 countries (Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States) for the 1975 to 2000 period. Germany refers to West Germany and Unified Germany for the pre- and post-1990 periods.

A.1 Output

For each emerging and G7 country, output is measured by the weighted nominal gross domestic product (GDP) in national currency (sources: WDI for emerging countries and IFS for G7 countries), deflated by the consumer price index (CPI) (sources: WDI for emerging countries and IFS for G7 countries). The output weights are country-specific constants that convert the values of output into comparable units. Following Backus, Kehoe, and Kydland (1992), the constants are chosen to match our yearly values of output in 1985 to the yearly data on real GDP obtained from the international prices for 1985, reported by Summers and Heston (1988) (source: variables 1 and 2 in their Table 3).

A.2 Interest Differential

For each emerging and G7 country, the real gross return is the nominal gross interest rate minus the expected gross inflation rate. The nominal gross interest rate is the yearly gross interbank rate (source: IFS) for most countries, and the mean of the yearly lending and borrowing gross interest rates for Chile, Gabon, Guatemala, Ecuador, Morocco, Nigeria, Uruguay, and Venezuela. The expected yearly gross inflation rate is the one-year ahead forecast formed from a univariate ARMA(1,1) process. The world real gross return is the sum of the real gross return for the G7 countries, weighted by the country’s share of the total output of the G7 countries. The interest differential is the difference between the real gross return for each emerging country and the real gross world return.

A.3 Current Account

For each emerging country, the current account is the product of the output weight, the nominal current account in US dollars (source: WDI), and the nominal exchange rate of national currency units per US dollar (source: WDI), divided by the CPI.

A.4 Consumption, Investment, and Government Expenditures

For each emerging country, consumption is the output weight times nominal private final consumption expenditures in national currency (source: WDI), deflated by the CPI.
Investment is the output weight times nominal gross fixed capital formation in national currency (source: WDI), deflated by the CPI. Government expenditures are the output weight times nominal government final consumption expenditures in national currency (source: WDI), normalized by the CPI.

A.5 Technology

For each emerging country, technology is constructed from the production function (8) using the calibrated capital share $\alpha = 0.36$, and measures of output, capital, and employment. Capital is computed from the capital accumulation equation (5), the calibrated depreciation rate $\delta = 0.10$ and adjustment costs parameter $\phi = 48.75$ for Africa, $\phi = 18.10$ for the Americas, and $\phi = 45.60$ for Asia, as well as the steady state value of capital (for the initial period) and investment (for the other periods). Employment corresponds to the labor force (source: WDI).
References


Arellano, C., 2005, Default risk, the exchange rate, and income fluctuations in emerging economies, mimeo University of Minnesota.


Devereux, M.B. and G.W. Smith, 2004, Transfer problem dynamics: Macroeconomics of the Franco-Prussian war indemnity, mimeo Queen’s University.


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Note: Entries under relative volatility and correlation refer to the sample standard deviation of the variable relative to the sample standard deviation of $y$ and the sample contemporaneous correlation between variables. The variables are the detrended logarithms of output ($y$), consumption ($c$), and investment ($i$), as well as the detrended current account to output ratio ($x$), and the detrended interest differential ($d$). The detrending method is the Hodrick-Prescott filter.
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Note: Entries under relative volatility and correlation refer to the sample standard deviation of the variable relative to the sample standard deviation of $y$ and the sample contemporaneous correlation between variables. The variables are the detrended logarithms of output ($y$), consumption ($c$), and investment ($i$), as well as the detrended current account to output ratio ($x$), and the detrended interest differential ($d$). The detrending method is the Hodrick-Prescott filter.
Table 3. Empirical Cyclical Statistics: Asia

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<tr>
<td>Thailand</td>
<td>0.53</td>
<td>0.36</td>
</tr>
<tr>
<td>Mean</td>
<td>0.68</td>
<td>0.61</td>
</tr>
</tbody>
</table>

Note: Entries under relative volatility and correlation refer to the sample standard deviation of the variable relative to the sample standard deviation of $y$ and the sample contemporaneous correlation between variables. The variables are the detrended logarithms of output ($y$), consumption ($c$), and investment ($i$), as well as the detrended current account to output ratio ($x$), and the detrended interest differential ($d$). The detrending method is the Hodrick-Prescott filter.
<table>
<thead>
<tr>
<th>Common Values</th>
<th>Africa Values</th>
<th>America Values</th>
<th>Asia Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data: (R^w = 1.028, N = 0.30;)</td>
<td>Data: (\sigma_i/\sigma_y = 2.87, D = 0.034, I/Y = 0.202, G/Y = 0.147;) (\rho(d, y) = 0.15;)</td>
<td>Data: (\sigma_i/\sigma_y = 2.61, D = 0.005, I/Y = 0.187, G/Y = 0.116;) (\rho(d, y) = -0.04;)</td>
<td>Data: (\sigma_i/\sigma_y = 2.87, D = 0.018, I/Y = 0.292, G/Y = 0.107;) (\rho(d, y) = 0.03;)</td>
</tr>
<tr>
<td>Consumers: (\beta = 0.973, \gamma = -1.00, \eta = 1.59, \delta = 0.10;)</td>
<td>Consumers: (\phi = 48.75, \theta = 1.930;)</td>
<td>Consumers: (\phi = 18.1, \theta = 1.848;)</td>
<td>Consumers: (\phi = 45.6; \theta = 2.374;)</td>
</tr>
<tr>
<td>Producers: (\alpha = 0.36, Z = 1;)</td>
<td>Producers: (\rho_z = 0.410, \sigma_z = 0.057;)</td>
<td>Producers: (\rho_z = 0.598, \sigma_z = 0.066;)</td>
<td>Producers: (\rho_z = 0.541, \sigma_z = 0.041;)</td>
</tr>
<tr>
<td>Asset Market: (\varphi = 0.02, \rho_r = 0.315, \sigma_r = 0.010;)</td>
<td>Government: (\tau_b = 0.034, \tau_k = 0.050, \rho_g = 0.446, \sigma_g = 0.097;)</td>
<td>Government: (\tau_b = 0.005, \tau_k = 0.065, \rho_g = 0.549, \sigma_g = 0.010;)</td>
<td>Government: (\tau_b = 0.018, \tau_k = -0.005, \rho_g = 0.494, \sigma_g = 0.059;)</td>
</tr>
<tr>
<td>Asset Market: (\xi = 0.044;)</td>
<td>Asset Market: (\xi = 0.065;)</td>
<td>Asset Market: (\xi = 0.615;)</td>
<td>Asset Market: (\xi = 0.165;)</td>
</tr>
</tbody>
</table>
Table 5. Simulated Cyclical Statistics

<table>
<thead>
<tr>
<th></th>
<th>Relative Volatility</th>
<th>Correlation</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>x</td>
<td>d</td>
<td>c</td>
<td>i</td>
<td>(x, y)</td>
<td>(d, y)</td>
</tr>
<tr>
<td>Africa</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simulated</td>
<td>0.60</td>
<td>0.10</td>
<td>1.11</td>
<td>2.87</td>
<td>0.04</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.07)</td>
<td>(0.07)</td>
<td>(0.07)</td>
</tr>
<tr>
<td>Empirical</td>
<td>0.70</td>
<td>0.77</td>
<td>1.04</td>
<td>2.87</td>
<td>0.10</td>
<td>0.15</td>
</tr>
<tr>
<td>America</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simulated</td>
<td>0.41</td>
<td>0.86</td>
<td>0.72</td>
<td>2.61</td>
<td>0.31</td>
<td>-0.04</td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
<td>(0.08)</td>
<td>(0.01)</td>
<td>(0.05)</td>
<td>(0.06)</td>
<td>(0.07)</td>
</tr>
<tr>
<td>Empirical</td>
<td>0.51</td>
<td>1.57</td>
<td>1.11</td>
<td>2.61</td>
<td>-0.06</td>
<td>-0.04</td>
</tr>
<tr>
<td>Asia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simulated</td>
<td>0.76</td>
<td>0.31</td>
<td>0.86</td>
<td>2.87</td>
<td>-0.48</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.08)</td>
<td>(0.05)</td>
<td>(0.09)</td>
</tr>
<tr>
<td>Empirical</td>
<td>0.68</td>
<td>0.61</td>
<td>0.84</td>
<td>2.87</td>
<td>-0.30</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Note: Entries under relative volatility and correlation refer to the standard deviation of the variable relative to the standard deviation of $y$ and the contemporaneous correlation between variables. The variables are the detrended logarithms of output ($y$), consumption ($c$), and investment ($i$), as well as the detrended current account to output ratio ($x$), and the detrended interest differential ($d$). The detrending method is the Hodrick-Prescott filter. Numbers associated with simulated correspond to the average (standard deviation) statistics generated from 1000 replications of 200-period samples using the region-specific calibrated model. Numbers associated with empirical refer to the average region-specific statistics of the data.
### Table 6. Simulated Cyclical Statistics: Sensitivity

<table>
<thead>
<tr>
<th></th>
<th>Relative Volatility</th>
<th>Correlation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(x)</td>
<td>(d)</td>
<td>(c)</td>
</tr>
<tr>
<td>Baseline</td>
<td>0.54</td>
<td>0.19</td>
<td>0.84</td>
</tr>
<tr>
<td>Interest Differential: Output</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low((\xi = 0.0))</td>
<td>0.53</td>
<td>0.20</td>
<td>0.84</td>
</tr>
<tr>
<td>High((\xi = 1.0))</td>
<td>0.63</td>
<td>0.88</td>
<td>0.80</td>
</tr>
<tr>
<td>Investment: Adjustment Costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low((\phi = 1000))</td>
<td>3.58</td>
<td>0.72</td>
<td>0.81</td>
</tr>
<tr>
<td>High((\phi = 17.25))</td>
<td>0.35</td>
<td>0.16</td>
<td>0.84</td>
</tr>
<tr>
<td>Tax: Bonds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low((\tau_b = 0.001))</td>
<td>0.54</td>
<td>4.37</td>
<td>0.71</td>
</tr>
<tr>
<td>High((\tau_b = 0.038))</td>
<td>0.53</td>
<td>0.10</td>
<td>1.19</td>
</tr>
<tr>
<td>Tax: Capital Stock</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low((\tau_k = 0.0))</td>
<td>0.46</td>
<td>0.19</td>
<td>0.88</td>
</tr>
<tr>
<td>High((\tau_k = 0.1))</td>
<td>0.72</td>
<td>0.19</td>
<td>0.80</td>
</tr>
</tbody>
</table>

Note: Entries under relative volatility and correlation refer to the standard deviation of the variable relative to the standard deviation of \(y\) and the contemporaneous correlation between variables simulated by various parametrizations of the model. The variables are the detrended logarithms of output \((y)\), consumption \((c)\), and investment \((i)\), as well as the detrended current account to output ratio \((x)\), and the detrended interest differential \((d)\). The detrending method is the Hodrick-Prescott filter. Numbers correspond to the average statistics generated from 1000 replications of 200-period samples.
Table B. Simulated Cyclical Statistics: Extensions

<table>
<thead>
<tr>
<th>Relative Volatility</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$x$</td>
</tr>
<tr>
<td>Baseline</td>
<td>0.54</td>
</tr>
<tr>
<td>Discount Factor</td>
<td></td>
</tr>
<tr>
<td>Low ($\beta = 0.96$)</td>
<td>0.57</td>
</tr>
<tr>
<td>High ($\beta = 0.98$)</td>
<td>0.52</td>
</tr>
<tr>
<td>Risk Aversion</td>
<td></td>
</tr>
<tr>
<td>Low ($1 - \gamma = 1$)</td>
<td>0.54</td>
</tr>
<tr>
<td>High ($1 - \gamma = 10$)</td>
<td>0.54</td>
</tr>
<tr>
<td>Labor Supply Elasticity</td>
<td></td>
</tr>
<tr>
<td>Low ($\frac{1}{\eta - 1} = 0.2$)</td>
<td>0.66</td>
</tr>
<tr>
<td>High ($\frac{1}{\eta - 1} = 2.5$)</td>
<td>0.61</td>
</tr>
<tr>
<td>Differential Responsiveness to Bonds</td>
<td></td>
</tr>
<tr>
<td>Low ($\varphi = 0.01$)</td>
<td>0.57</td>
</tr>
<tr>
<td>High ($\varphi = 0.10$)</td>
<td>0.42</td>
</tr>
<tr>
<td>Depreciation Rate</td>
<td></td>
</tr>
<tr>
<td>Low ($\delta = 0.05$)</td>
<td>0.19</td>
</tr>
<tr>
<td>High ($\delta = 0.15$)</td>
<td>0.92</td>
</tr>
<tr>
<td>Capital Share</td>
<td></td>
</tr>
<tr>
<td>Low ($\alpha = 0.30$)</td>
<td>0.53</td>
</tr>
<tr>
<td>High ($\alpha = 0.40$)</td>
<td>0.54</td>
</tr>
</tbody>
</table>

Note: Entries under relative volatility and correlation refer to the standard deviation of the variable relative to the standard deviation of $y$ and the contemporaneous correlation between variables predicted by various parametrizations of the model. The variables are the detrended logarithms of output ($y$), consumption ($c$), and investment ($i$), as well as the detrended current account to output ratio ($x$), and the detrended interest differential ($d$). The detrending method is the Hodrick-Prescott filter. Numbers correspond to the average statistics generated from 1000 replications of 200-period samples.
Figure 1. Empirical Cross-Correlation Functions: Africa

Note: The solid lines correspond to sample cross-correlation functions between the variables. The variables are the detrended current account to output ratio ($x$) and the detrended interest differential ($d$). The detrending method is the Hodrick-Prescott filter.
Figure 2. Empirical Cross-Correlation Functions: America

Note: The solid lines correspond to sample cross-correlation functions between the variables. The variables are the detrended current account to output ratio ($x$) and the detrended interest differential ($d$). The detrending method is the Hodrick-Prescott filter.
Figure 3. Empirical Cross-Correlation Functions: Asia

Note: The solid lines correspond to sample cross-correlation functions between the variables. The variables are the detrended current account to output ratio \((x)\) and the detrended interest differential \((d)\). The detrending method is the Hodrick-Prescott filter.
Figure 4. Simulated Dynamic Responses

Note: The solid lines correspond to the dynamic responses computed from the calibration for Africa. The dashed lines represent the dynamic responses associated with the calibration for America. The dotted lines are the dynamic responses related to the calibration for Asia. The variables are the logarithm of output ($y$), the ratio of the current account to output ($x$), the national saving rate ($S/Y$), the investment rate ($I/Y$), and the interest differential ($d$).
Figure 5. Simulated Cross-Correlation Functions

Note: The solid (dashed) lines correspond to the average (95 percent confidence interval of the) cross-correlation functions generated from 1000 replications of 200-period samples using the region-specific calibrated model. The dotted lines are the average region-specific cross-correlation functions of the data. The variables are the detrended current account to output ratio ($x$) and the detrended interest differential ($d$). The detrending method is the Hodrick-Prescott filter.
Figure 6. Simulated Cross-Correlation Functions: Sensitivity

Note: The lines correspond to the average cross-correlation functions generated by 1000 replications of 200-period samples. The solid lines is generated from the baseline parametrization of the model. The dashed (dotted) lines are generated by the alternative parametrizations involving low (high) values of key parameters. The variables are the detrended current account to output ratio ($x$) and the detrended interest differential ($d$). The detrending method is the Hodrick-Prescott filter.
Figure B. Simulated Cross-Correlation Functions: Extensions

Note: The lines correspond to the average cross-correlation functions generated by 1000 replications of 200-period samples. The solid lines is generated from the baseline parametrization of the model. The dashed (dotted) lines are generated by the alternative parametrizations involving low (high) values of key parameters. The variables are the detrended current account to output ratio ($x$) and the detrended interest differential ($d$). The detrending method is the Hodrick-Prescott filter.