The role of two interest rates in the intertemporal current account model*

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Abstract

The paper analyses the role of the lending-deposit interest rate spread in the dynamics of the current account in developing countries. For that purpose we extend the standard perfect-foresight intertemporal model of the current account for the existence of the interest rate spread and simulate the convergence path of developing economies. This model helps explain why in many cases it is optimal for a fast growing, low income countries to run balanced current account. Our theoretical considerations are confirmed by the panel data for 60 developing countries, which points to a significant relationship between the current account and the interest rate spread.

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1 Introduction

The literature on current account dynamics has evolved over time. Starting from the seminal articles by Buiter (1981) and Sachs (1981) the focus changed from intratemporal factors, such as relative prices and demand, to intertemporal factors, where expectations of the future influence savings and investment decisions. According to the latter perspective, the current account reflects the optimal transfer of consumption opportunities across time rather than indicating any economic disequilibrium implicit in intratemporal models.

As extensively discussed by Singh (2007), the early literature on the intertemporal approach to the current account (ICA) relied on perfect-foresight optimising models to conduct calibrated simulations examining the direction and magnitude of the current account response to structural monetary, fiscal or terms-of-trade shocks. The early literature, however, rarely tested the empirical fit of the ICA model to the data. Attempts to do so started in the early 1990s and along three main directions.

The first strand of the literature applied the "present value test", as developed by Campbell (1987), to examine whether the current account balance was equal to the present value of expected future declines in net output, defined as output less investment and government spending (see Sheffrin and Woo, 1990 or Otto, 1992). The framework was extended subsequently in several directions, in particular by emphasising the role of interest and exchange rates variability (Bergin and Sheffrin, 2000); by incorporating consumption habits (Gruber, 2004); or by adding an exogenous world real interest rate shock (Nason and Rogers, 2006). The above literature typically concluded that the ICA model is rejected by the data on account of higher volatility of the observed current account figures in comparison to the model-predicted series. As summarised by Bergin (2006), the current account dynamics of many countries have proven quite difficult to explain in terms of macroeconomic models using present value tests.

The second strand of the literature applied standard econometric techniques to establish if there is a long-term relationship between the current account and standard macroeconomic fundamentals affecting savings and investment, such as relative GDP *per capita*, the demographic structure or fiscal policy. The most relevant examples of this analytical approach are the studies by Faruqee and Debelle (1996), Chinn and Prasad (2003), Bussiere et al. (2004) or Zorzi et al. (2009). The associated panel data regressions generally confirm some of the ICA model implications, among other in particular, that there is a positive relationship between the current account and *per capita* GDP across countries. However, the estimated coefficients of the relationship between the relative income and the current account were substantially lower than what the permanent income hypothesis would imply, and in some cases occurred to be insignificant.

The third strand of the literature applied fully-fledged general equilibrium ICA models to explain the observed current account patterns in selected countries. Most notably, Blanchard and Giavazzi (2002) show that increased product and financial markets integration helps understanding the widening in the current account deficit in Greece and Portugal. Fagan and Gaspar (2007), within the ICA framework, explain why a group of converging economies, having seen a sizeable fall in their domestic interest rates after joining the euro area, experienced a rise in their current account deficit and a process of real exchange rate appreciation. In the same vein, Ca' Zorzi and Rubaszek (2008) show that current account patterns observed in the euro area can be explained by intertemporal optimisation considering the set of initial conditions (defined in terms of productivity, capital stock and net foreign assets) and expectations of a gradual process of convergence. Even though the above articles constitute some evidence in favour of the ICA model, forecasting tests are less encouraging. For example, Bergin (2003) shows that a dynamic stochastic ICA model is not able to beat a random walk in predicting movements in the current account for any of the three analysed countries: Australia, Canada and the United Kingdom. This result was later confirmed by Bergin (2006), who finds that a two-country ICA model for the US and the other G7 countries is not able to beat a standard vector autoregression in terms of one-step ahead in-sample predictions for the current account.

The above discussion shows that, despite their appeal, ICA models need to be refined to better characterise reality. This appears especially true for low-income converging economies, for which the standard ICA models predict high and persistent current account deficits, by an order of magnitude greater than what is observed in practice (see Obstfeld and Rogoff, 1996 for more extended discussion). In this article we put forward the hypothesis that the limited empirical performance of the standard ICA models is related to the fact that in most, if not all, cases they assume that there exists only one domestic interest rate, which is the same for deposits and loans. In practise, however, these rates tend to be substantially different. For example, the median difference between the lending and deposit rates in the panel of 60 developing countries in the years 1980-2006 amounted to 5.8 percentage points (see the Appendix for the detailed description of the data).

The problem of optimal consumption under a differential in the interest rates on deposits and loans was first introduced by Fisher (1930) in a two-period setup. He showed that for some income paths households would like to make deposits at the borrowing rate and loans when confronted with the deposit rate. As these rates are different, however, their consumption is equal to their current income. In other words, one more unit of consumption today is worth more than the discounted value of one plus the net deposit interest rate unit of consumption tomorrow, but less than the discounted value of repaying an extra unit plus the net lending interest rate in the next period. These results, which were subsequently extended to the multiperiod case by Watkins (1969) and Hassin and Lieber (1982), indicate that households might consume their entire income not because they are credit constrained, as in the model proposed by Galí et al. (2007), but because prevailing market conditions discourage them from both making a deposit and taking a loan. The existence of the interest rate spread means that the optimal growth rate of consumption for households with positive net financial liabilities is determined by the rate on loans, whereas for households with positive net financial assets by the rate on deposits. This should have dampening effects on the propensity of households to run high debt or keep excessive amount of assets.

At the country level, the existence of the interest rate spread can explain why low-income, converging economies are typically not running high current account deficits, leading to a sizeable build-up of foreign debt, as it is implied by the standard ICA model. Even though households would like to smooth their consumption on account of expected growth in income, the high intertemporal price of future consumption, which is given by the lending rate, constraints them from doing so and as a result their consumption follows closely their income.

So far these considerations have been ignored in the ICA literature. One reason might be of technical nature: in an environment with a different rate on assets and debt, the relation between net financial position of households and the interest rate is not continuous around the steady state. Consequently, the standard perturbation techniques of solving dynamic general equilibrium models cannot be applied in this setting. We tackle this problem by using numerical, direct optimisation methods. However, due to the fact that the perturbation techniques cannot be applied in our framework, we limit our analysis to the perfect-foresight framework, leaving for further research to relax the one-interest assumption in a stochastic ICA model.

The main contribution of this paper is twofold. First, we show that due to the existence of the interest rate spread it might be optimal for low-income, converging economies to run balanced current accounts. Moreover, we indicate that for small values of the spread its further narrowing can have very substantial effects on savings and investment decisions, hence on the level of the current account. Second, on the basis of the panel for 60 developing countries we provide empirical evidence of our theoretical model implications by showing that there is a significant relationship between the current account balance and the lending-deposit interest rate spread.

The article is structured as follows. The next two sections present the ICA model and the method of solving it. Section 4 presents simulation results, which show that in the environment of two interest rates the model implied current account deficits of low-income converging economies is substantially lower what the standard ICA model would imply. Finally, Section 5 presents empirical evidence on the relationship between the interest spread and the current account, where the data used for estimation are described in the Appendix. The last section concludes.

2 The model

The model economy is populated by representative households that are both consumers and producers. The following additional features are included. The model economy is small open and subject to a convergence process. There is a banking sector, which differentiates between a lending and a deposit rates. There are adjustment costs associated to the accumulation of capital. In the exposition of the model, which presented below, we use lower-case letters for individual variables, whereas capital letters stand for country aggregates.

2.1 Households

The model economy is populated by a continuum of identical household-producers maximising their utility from consumption c_t:

$$\max U_0 = \sum_{t=0}^{T} \beta^t u(c_t), \tag{1}$$

and producing output y_t according to the Cobb-Douglas technology:

$$y_t = k_t^{\alpha} Z_t^{1-\alpha}. \tag{2}$$

Here k_t is per household level of capital available at the beginning of period t and Z_t stands for the home country level of productivity. Produced output can be invested in capital, deposited in a bank or consumed. The capital stock evolves in line with the following equation:

$$k_{t+1} = (1-\delta)k_t + i_t(1-\psi\kappa_t), \tag{3}$$

where i_t is investment expenditures, δ the depreciation rate and ψ capital adjustment cost parameter. The variable κ_t is the individual investment-capital ratio relative to its steady-state value IK^*, $\kappa_t = \frac{i_t/k_t}{IK^*}$, where "*" stands for foreign economy that is assumed to be permanently in the steady state (a similar assumption was done by Ca' Zorzi and Rubaszek, 2008). The above specification means that the capital is accumulated subject to adjustment costs, introduced in vein of the framework proposed by Hayashi (1982), so that only a fraction of investment turns into capital.

Households can participate in financial markets through banks, which offer loans and deposits at gross rates R_t^L and R_t^A. Finally, consumption is taxed at rate τ. As a result, the representative household faces the following budget constraint:

$$a_{t+1} - l_{t+1} = R_t^A a_t - R_t^L l_t + y_t - i_t - (1+\tau)c_t, \tag{4}$$

where $a_t \geq 0$ and $l_t \geq 0$ are household assets and liabilities at the beginning of period t.

2.2 Banks

The banking sector consists of a continuum of identical banks that are maximising profits from loans and deposits. Profits are due to the fact that the deposit interest rate r_t^A set by the bank is lower than its borrowing rate r_t^L. The difference between collected deposits and granted loans is covered by the participation in the interbank market, where funds can be raised or deposited at rate R_t. As a result, profits equal to:

$$\pi_t = \left(r_t^L - R_t\right) l_t^b + (R_t - r_t^A) a_t^b, \tag{5}$$

where l_t^b and a_t^b stand for loans granted and deposits collected by the bank. For the sake of simplicity we abstract from any risk considerations or fixed costs incurred by banks. Instead, we assume that deposit and loan interest rates differ from the interbank rate due to the monopolistic power of each bank in the market. The implementation of the monopolistic competition framework proposed by Gerali et al. (2009) yields the following demand equations for loans and deposits:

$$l_t^{bank} = \left(\frac{r_t^L}{R_t^L}\right)^{-\theta_L} L_t \tag{6}$$

$$a_t^{bank} = \left(\frac{r_t^A}{R_t^A}\right)^{\theta_A} A_t, \tag{7}$$

where θ_L and θ_A are demand elasticities for loans and deposits, respectively. The maximisation of (5) subject to (6) and (7) sets the level of the interest rates at $r_t^L = \frac{\theta_L}{\theta_L - 1} R_t$ and $r_t^A = \frac{\theta_A}{\theta_A + 1} R_t$. As all banks are assumed to be identical, the country-wide level of the rates is $R_t^L = r_t^L$ and $R_t^A = r_t^A$.

2.3 Closing the model and the current account

To close the model we assume that the government is passive and runs a balanced budget, i.e. tax revenues are spent in the form of public expenditures (G_t):

$$G_t = \tau C_t. \tag{8}$$

Subsequently, we assume that the country's productivity is converging to its steady-state path Z_t^*, which is growing at a deterministic rate γ, at pace ρ:

$$Z_t = \rho Z_{t-1} + (1-\rho) Z_t^*. \tag{9}$$

Finally, we set the interbank interest rate at the level of global interest rate (R^*), which is assumed to be constant:

$$R_t = R^*. \tag{10}$$

The current account is calculated as the increment in the stock of net foreign assets, i.e.:

$$CA_t = (A_{t+1} - L_{t+1}) - (A_t - L_t), \tag{11}$$

where changes in aggregate assets and liabilities are given by:

$$A_{t+1} - L_{t+1} = R_t^A A_t - R_t^L L_t + Y_t - C_t - I_t - G_t. \tag{12}$$

It should be noted that in this setting we assume that banks are foreign owned and profits of the banking sector are transferred abroad. This assumption broadly reflects the situation in most developing countries, which are the main focus of this article.

3 Solving the model

We solve the model by using numerical techniques. For that purpose, we write the optimisation problem faced by households in a finite-horizon setting, where we set large values of the last period T,[1], which enables us to extrapolate our findings for infinite horizon. Households maximise their utility, given by (1), by choosing the sequence of c_t, i_t, a_{t+1}, l_{t+1} and implicitly k_{t+1} that satisfy equality constraints (2), (3) and (4), nonnegativity conditions $a_t \geq 0$ and $l_t \geq 0$, terminal conditions $a_{T+1} = 0$, $l_{T+1} = 0$ and $k_{T+1} = K^*_{T+1}$, given the initial values a_0, l_0 and k_0. As a result, the Lagrangean function takes the form:

$$
\begin{aligned}
\mathcal{L} \;=\; & \textstyle\sum_{t=0}^{T}\{\beta^t u(c_t) + \lambda_t[R^A_t a_t - R^L_t l_t + k^\alpha_t Z^{1-\alpha}_t - i_t - (1+\tau)c_t - a_{t+1} + l_{t+1}] \\
+ \; & q_t[(1-\delta)k_t + i_t(1-\psi\kappa_t) - k_{t+1}] + \mu^A_t a_{t+1} + \mu^L_t l_{t+1}\} \\
+ \; & \nu^A a_{T+1} + \nu^L l_{T+1} + \nu^K(k_{T+1} - K^*_{T+1}) + \omega^A a_0 + \omega^L l_0 + \omega^K k_0
\end{aligned}
\tag{13}
$$

The respective Karush-Kuhn-Tucker (KKT) first order conditions for this problem are given by:

$$
\begin{aligned}
c_t: \quad \lambda_t &= \frac{\beta^t}{1-\tau}u'(c_t) && (14)\\
a_{t+1}: \quad \lambda_t &= R^A_{t+1}\lambda_{t+1} + \mu^A_t && (15)\\
l_{t+1}: \quad \lambda_t &= R^L_{t+1}\lambda_{t+1} - \mu^L_t && (16)\\
i_t: \quad \lambda_t &= q_t(1-2\psi\kappa_t) && (17)\\
k_{t+1}: \quad q_t &= \lambda_{t+1}\alpha\left(k_{t+1}Z^{-1}_{t+1}\right)^{\alpha-1} + q_{t+1}\left[(1-\delta) + \psi\kappa^2_{t+1}IK^*\right] && (18)
\end{aligned}
$$

Equation (14) defines the present value of the marginal utility from consumption, which according to equations (15) and (16) is decreasing at a gross rate lying in the interval $[R^A_t; R^L_t]$. It can be noticed that if $a_{t+1} > 0$ then the decrease rate is equal to R^A_t and if $l_{t+1} > 0$ then it amounts to R^L_t as the KKT complementarily conditions state that $\mu^A_t a_{t+1} = 0$ and $\mu^L_t l_{t+1} = 0$. Equation (17) relates the market value of capital, i.e. q-Tobin ratio, to marginal utility of consumption. Finally, equation (18) determines the dynamics of the capital shadow price.

4 The results

This section presents the results of a number of simulations showing the convergence path of the model economy, focusing on the role of the initial conditions and the interest rate spread. We start by discussing the parameterisation of the model and the resulting

[1] We define large values of T as the values for which current account balance and net foreign assets in the last few periods of simulation are null.

steady-state path. Then, we elaborate on the relationship between GDP *per capita*, initial stock of capital, the interest rate spread and the current account. Finally, we perform sensitivity analysis with respect to model parameterisation.

4.1 Parameterisation

The model economy is calibrated at an annual frequency. Since the structure of the economy is assumed to be the same at home and abroad, the corresponding parameters are also the same. All parameters, but convergence pace, are chosen to reflect values for industrial countries and generally correspond to those by Ca' Zorzi and Rubaszek (2008), who provide a thorough discussion of their choice.

The utility function is chosen to be logarithmic, $u(c_t) = \ln c_t$, but the general findings presented below would still hold for a general class of concave and differentiable functions. The steady-state growth rate of productivity γ is set to 1.5 percent per year and the discount factor β to 0.975, which implies that steady-state real interest rate R^* is around 1.04. The coefficient ψ is fixed at 0.10, so that in the steady state 10% of investments covers installation costs (see Roeger and in 't Veld, 2004). The depreciation rate δ is chosen to be 0.08 and the share of capital α is 0.30, which implies the steady-state investment and capital-output ratios at 0.23 and 2.19, respectively.[2] The tax rate τ is fixed at 0.33, so that private consumption and government spending constitute 58 and 19 percent of GDP.

For the remaining parameters, determining the convergence path to the steady state, we fixed the convergence pace ρ at 0.95, so that the half-life of productivity gap amounts to around thirteen years. This assumption is clearly more optimistic than the literature consensus of around 0.98, but we decided to take this value to show that even high speed of convergence might not be sufficient to generate a current account deficit in the environment of high interest rate spread. The demand elasticity for deposits θ_A and loans θ_L is set to 50, so that the lending-deposit rates spread was around a reasonable value of 4 percentage points.

4.2 Simulating convergence path

The first simulation investigates the convergence path of the model economy for different assumptions concerning the initial level of GDP *per capita*. We analyse four cases in which the initial output is equal to one quarter, one third, one half and three quarters of its steady-state value. We assume that the starting value of the capital-output ratio is equal to its steady-state value, $KY_0 = KY^*$, and that net foreign assets are null, $B_0 = 0$. These additional assumptions are helpful in isolating the impact of the interest rate spread on the current account dynamics in converging economies. However, we will relax them later, considering that developing countries are generally characterised by

[2]The steady-state investment-capital ratio equals to $IK^* = \frac{\gamma+\delta}{1-\psi}$ and the capital-output ratio is $KY^* = \frac{\alpha(1-2\psi)}{R^*+\delta-1-\psi IK^*}$

lower capital-output ratios (see Nehru and Dhareshwar, 1993) than industrial countries and run positive net foreign debt (see Lane and Milesi-Ferretti, 2001).

Let us focus first on the results for a country that starts its convergence from very low GDP *per capita*, equal to one-fourth of its steady-state value, which is represented by the '$*$' marker on Figure 1. In the initial period the country is running a substantial current account deficit amounting to about 50% of GDP. The deficit to GDP ratio is subsequently declining and turn into surplus after 16 years from the initial period of the simulation. Net foreign assets, after reaching the trough of -160% of annual GDP in period 10, improve steadily reaching a balance after 40 years. As regards investments, the process of consumption smoothing in the environment of high lending rate is delaying new investment until the moment in which the rate of return on new projects reflects the borrowing rate. As a result, in the initial seven years the capital-output ratio is falling to below 80% of its steady-state value, where it fluctuates for another 20 years. It should be noted that these results confirm the above-mentioned trends in developing countries, namely that they tend to run positive net foreign debt and have relatively low capital-output ratios. The capital stock is subsequently rebuilt, so that the return on new investment reflects the dynamics of marginal utility from consumption λ_t. Finally, the growth rate of consumption is equal to βR_t^L until the moment debt starts being paid back (see equation 16). Afterwards, it converges to βR_t in line with the declining rate of return on new investment.

[Figure 1]

The results for a country that starts its convergence story from GDP *per capita* twice lower than in the steady state, which is represented by the 'o' marker on Figure 1, sheds some light on the importance of the interest rate spread for current account dynamics in developing countries. In the initial five years the country is running a current account deficit, which never exceeds 3% of GDP. The net foreign debt to GDP ratio peaks at the end of period 5 at about 5% of GDP and is subsequently repaid by the end of period 18. The process of consumption smoothing is reflected mainly in a decline of the capital-output ratio, which is falling because the intertemporal price of consumption in the initial periods is given by R_t^L. This, in turn, requires a high rate of return on new investment.

4.3 Comparison to the standard ICA model

The above results constitute a significant change in comparison to the standard ICA model with one interest rate. To illustrate this we compare convergence paths from our model to that from the standard ICA model, namely the model proposed by Ca' Zorzi and Rubaszek (2008). For that purpose, using standard perturbation techniques, we solve the model in which equations (5)-(7), describing the banking sector, and equation (10) for the domestic interbank rate are substituted by the standard equation of new open economy models with market imperfections (Benigno, 2009):[3]

$$R_t^L = R_t^A = R_t = R^* \exp(-\phi \frac{B_t}{Y_{t-1}}) \tag{19}$$

We compare the solution of the models for a country that starts its convergence from GDP *per capita* equal to a half of its steady-state value, whereas the capital-output ratio is given by the steady-state level and net foreign assets are null. We investigate convergence paths for three values of parameter ϕ, equal to 0.005, 0.02 and 0.04, which imply that a decrease in net foreign assets by 10% of GDP increases the domestic interest rate by 5, 20 and 40 basis points, respectively.

[Figure 2]

The results, which are presented on Figure 2, show that the current account deficit in the standard ICA model is substantially higher than in the two interest rate model. This is due to the fact that in the initial periods, before net foreign debt is accumulated, the difference between domestic and foreign interest rates in the standard ICA models not distant from zero. As a result consumption growth rate is lower, which translates into higher level of consumption in the first 40 years of the convergence process. Better opportunities to smooth consumption through financial markets participation in the standard ICA model are also reflected in shallower decline in the capital-output ratio than in the two interest rate model.

Convergence path and model parameterisation

We continue our investigation by simulating the convergence path of the model economy for different values of the interest rate spread $R_t^L - R^*$ and convergence pace ρ parameters. The existence of the interest rate spread is dampening the process of consumption smoothing as, in the case of developing economies, the present value of future consumption is relatively high. This is illustrated by the left-side panel of Figure 3, which presents the relationship between the interest rate spread and the current account deficit for the model economy with the initial GDP *per capita* equal to one half of its steady-state value. We simulated convergence path for four values of the lending-interbank interest rate spread. The results point that even small changes in the spread have large effects on the theoretical value of the current account deficit. For a relatively small interest rate spread, amounting to 0.5 percentage point, the current account deficit in the initial period amounts to over 32% of GDP, whereas for the spread equal to 1.0 and 2.0 percentage point the deficit falls to about 18% of GDP and 3% of GDP, respectively. When the spread is relatively large, equal to 4.0 percentage points, the current account balance is closed.

[Figure 3]

[3]Methods of introducing financial market imperfections in open economy general equilibrium models are reviewed in detail by Schmitt-Grohe and Uribe (2003)

In our model, the pace of convergence is also an important factor influencing the current account dynamics, which is in line with the panel data results of Chinn and Prasad (2003) or Bussiere et al. (2004). This is illustrated by the right-side panel of Figure 3, which shows that fast growing economies, with convergence pace $\rho = 0.90$, should run relatively high current account deficit of around 15% of GDP in the initial period. In the case of the country with identical initial conditions, but for which convergence pace is four times lower, $\rho = 0.975$, the current account is null. These results show that countries with a substantial income gap might avoid running a current account deficit, especially if the interest rate spread is high or the convergence pace is low.

4.4 Why current account deficits may not prevail in an intertemporal perspective

In the proposed model, the existence of the interest rate spread has significant effects on consumption and investment decisions of households. For many combinations of initial conditions or the convergence pace the current account balance is closed, which means that consumption and investment are constrained by the current income. The question might arise, for which starting values of relative GDP *per capita* and capital stock to output ratios, the current account is closed? We investigate this problem by simulating the convergence path for the grid of Y_0, ranging from $0.25Y_0^*$ to Y_0^*, and KY_0, ranging from $0.5KY^*$ to KY^*. The results of these simulations, which are presented by Figure 4, show that the current account deficit in countries with $KY_0 = KY^*$ exists if the initial GDP *per capita* is below 0.52 of its steady-state value, i.e. $Y_0 < 0.52Y_0^*$. On the other extreme, for countries with low initial capital stock, $KY_0 = 0.5KY^*$, current account deficit prevail if the initial GDP *per capita* is below 0.75 of its steady-state value, $Y_0 < 0.75Y_0^*$. The results also show that a double-digit current account deficit should be observed for low per-capita-income countries, with the initial output lower by 60% than its steady-state value, i.e. for $Y_0 \leq 0.4Y_0^*$. It should be noted that this finding is relevant for productivity convergence pace amounting to 5 percent per year and the spread between the borrowing and interbank rates at about 2 percentage points. In practise, financial conditions in poor countries tend to be much tougher and the convergence pace lower, which has a dampening effect on the current account deficit in our model.

[Figure 4]

We address the issue of convergence pace and financial conditions impact on the current account deficit in the next simulation. Towards that purpose we investigate for which pace of convergence ρ and interest rate spread $R^L - R^*$ a country with an initial GDP *per capita* equal to one-half of its steady-state value, $Y_0 = 0.5Y_0^*$, and $KY_0 = KY^*$ would run a current account deficit. In this case the convergence path is simulated for the grid of ρ, ranging from 0.90 to unity, and $R^L - R^*$, ranging from 0.5 to 5.0 percentage points. The results, which are given by Figure 5, show that the country under analysis converging at pace 2% per year, i.e. in line with the literature consensus, runs a current account deficit if the lending-interbank rate spread is relatively narrow and amounts to less than 1.0 percentage point. For the interest rate spread equal to 4 percentage points, which is a more typical description of emerging markets, as discussed in the next section, a current account deficit would be the outcome of an extremely rapid pace of convergence, amounting to 10% per year. Finally, it can be noted that the model implied current account deficit for a fast converging economy ($\rho = 0.90$) in the environment of low interest rate spread ($R^L - R^* = 0.5\%$) amounts to -46.6% of GDP, a value that is close to the implications of the standard ICA model. The standard ICA model can be thereby seen as a special case of our more general framework.

[Figure 5]

To summarise, we believe that the above simulations provide a new look on the ICA model, providing an intuition why emerging markets may not choose having a current account deficit even when decisions are taken with an intertemporal perspective. We have shown that if the interest rate spread is high, investment in low-income, converging economies is equal to savings, in line with Feldstein and Horioka (1980) findings. Moreover, the existence of the interest rate spread in developed countries might also partly explain the Lucas paradox, i.e. the observation that capital is not flowing from developed to developing countries despite the fact that developing countries have lower capital-output ratios, and thus higher rate of return on investment. Moreover, our results indicate that the interest rate spread, the GDP *per capita* gap and the convergence pace have a non-linear impact on the current account. In the case of a relatively narrow spread even small changes can have very substantial impact on the current account. Finally, in line with the earlier literature, our model implies that the current account deficit is a non-decreasing function of GDP *per capita*, the convergence pace and the financial markets development.

5 Empirical evidence

The empirical verification of the model outlined in section 2 is based on a set of panel regressions of the general form:

$$ca_{it} = \alpha_i + \rho ca_{it-1} + \beta_1 \ln(R^L_{it} - R^A_{it}) + \beta_2 \frac{Y^{PPP}_{it}}{Y^{PPP}_{US,t}} + \beta_3 \Delta \ln Y_{it} + \epsilon_{it} \qquad (20)$$

Here ca_{it} is the current account to GDP ratio, R^L_{it} and R^A_{it} are lending and deposit rates, Y^{PPP}_{it} is GDP *per capita* in PPP terms and Y_{it} denotes real GDP in constant prices for country i in period t.

The first explanatory variable is the logarithm of the interest rate spread, where we use the logarithm as the relationship between the current account and the spread should be nonlinear in line with our earlier discussion. The second independent variable is a proxy for the initial value of output, where GDP *per capita* in the US serves as a reference value. The third explanatory is GDP growth rate, which as in Bussiere et al. (2004) is a proxy for the pace of convergence. We also added lagged dependent variable to account for current account persistence (see Chinn and Wei, 2008 for evidence). Finally, we assume that the error term consists of a country fixed effect α_i and a residual error ϵ_{it}, where fixed effects account for country specific factors such as demographic structure, terms of trade volatility, openness and other factors which might be relevant for the current account (see Faruqee and Debelle, 1996 or Chinn and Prasad, 2003 for an extended discussion).[4]

Our main interest is in the relationship between the current account and the interest rate spread. In line with our earlier considerations we expect that an increase in the spread should limit consumption smoothing and capital accumulation and thereby lead to a lower current account deficit. As a result we expect the sign of parameter β_1 to be positive. As regards parameter β_2 our prior is that it should be positive or insignificant. If the interest rate spread is low or convergence pace fast, higher GDP *per capita* should increase the saving-investment balance. However, if financial markets conditions or growth expectations are not favourable, then our model implies that the current account is null and its level does not depend on the level of GDP *per capita*. Finally, for parameter β_3 we expect a negative sign, so that the current account balance in the periods of fast convergence is lower, or that the parameter is insignificant.

The regression (20) is estimated in four versions, depending on the inclusion of lagged dependent variable ca_{it-1} and the last two independent variables $\frac{Y_{it}^{PPP}}{Y_{US,t}^{PPP}}$ and $\Delta \ln Y_{it}$. In the case of specifications with restriction $\rho = 0$ we apply the two-stage least square instrumental variable estimator (IV), which controls for endogeneity, whereas for specifications without the restriction parameters are estimated using the GMM estimator proposed by Arellano and Bover (1995) and fully developed in Blundell and Bond (1998).

The models are estimated using annual data from the period 1980-2006 for a large number of developing countries. To be comparable with the earlier panel-data literature, we choose the sample of developing countries considered by Chinn and Prasad (2003), which we extend by central and eastern European countries that have joined the European Union in May 2004 and January 2007 (see Appendix for the detailed description of the dataset). The number of countries in the sample was constrained by two limitations. First, the data for the deposit and lending rates are not available for all countries of our initial choice. Second, we remove observations for high interest rate periods, which we define as periods in which the lending rate stood above 25% and could be viewed as periods of extreme instability, thus constituting clear outliers. As a result the final sample includes sixty developing countries.

[Table 1]

[4]We are not using random effects since formal tests with the null that country specific random effects are uncorrelated with the regressors were rejected by the data.

The results, which are reported in Table 1, confirm the main hypothesis of our theoretical model: the interest rate spread has positive and significant impact on the current account. The estimates show that doubling of the spread improves current account balance by around 3% of GDP. This result is generally robust with respect to model specification and estimation. As regards estimates for relative output parameter β_2, they are not significantly different from zero and in dynamic specification the estimate has the wrong sign, which is broadly in line with the estimates for developing countries of Chinn and Prasad (2003). We interpret this as partial support of our model, which indicates that if the interest rate spread is high there should be no relationship between the current account and relative output (see Figure 5). The estimates of output growth parameter β_3 are of expected sign and in the case of dynamic specification the coefficient is significantly different from zero. Finally, we find substantial persistence in the current account, where the estimate of ρ at 0.6 corresponds to estimates by Bussiere et al. (2004), who interpret this in terms of habit formation in the behaviour of households. Overall, we believe that the above results constitute some evidence in favour of the proposed model, showing in particular the importance of including the lending-borrowing spread to gauge the dynamics of the current account.

6 Conclusions

The standard intertemporal model of the current account assumes that the rates on deposits and loans are the same. One of the implications of this assumption is that fast-converging economies with initially low *per capita* output should run substantial current account deficits, which are however hardly observed in practise. Moreover, in empirical applications the standard ICA model is often rejected by the data if present-value tests are used or forecast accuracy comparison is performed (see Bergin, 2003 and 2006). In this paper we have argued that the poor performance of the standard ICA model might be to some degree explained by the existence of the lending-deposit interest rate spread. For that purpose we have developed a perfect-foresight general equilibrium model with two interest rates. Then we have performed a series of simulations to show that even a small change in the interest rate spread might have a tremendous effect on the current account balance, especially if the interest rate spread is close to zero. Moreover, we have indicated that the existence of the interest rate spread might prevent developing countries from running current account deficits, even in the case of economies experiencing rapid productivity growth. Finally, on the basis of the panel data for a large number of developing countries we have shown that the implications of the proposed model are to some degree confirmed by the data.

Further research related to the proposed framework can evolve in many directions. First, the specification of the model could be developed to embody other features that may be appropriate in explaining current account fluctuations. One could relax the one-good assumption and suppose an infinite number of goods sold at the monopolistically competitive market. This would have a dampening effect on the model's predictions for the current account deficits in converging economies as the future repayment of foreign liabilities would require a deterioration in the terms of trade (Blanchard and Giavazzi, 2002). The model could also be developed to include traded and non-traded goods to address the relative price implications of the convergence process, as it is done by Fagan and Gaspar (2007). Second, the proposed framework could be extended into a stochastic setup to analyse the implications of the lending-deposit interest rate spread on the shape of response of the current account to structural shocks, temporary productivity shock for instance. Finally, it might be interesting to introduce the two-interest rate setup to models other than those aimed at analysing current account developments. For instance, it might be interesting to see whether the existence of the interest rate spread has an effect on the response of the economy to a monetary shock. It should be noted that recently few authors proposed closed economy DSGE models with two interest rates (e.g. Gerali et al., 2009, or Cúrdia and Woodford, 2009). The proposed solutions, however, are based on very strong assumptions, which are introduced in a way that enables to use standard perturbation techniques of solving DSGE models: Gerali et al. (2009) assume a very specific form of heterogeneity in time preferences and (Cúrdia and Woodford, 2009) in the utility function.

To summarise, it is evident that the role of two interest rates is relatively unexplored field in microfunded optimising models, which dominate currently in the modern macroeconomics. These models assume that rates on deposits and loans are the same, which is strongly in opposition to what we observe in reality. In this paper we have shown that the existence of the interest rate spread can change significantly the implications of the standard ICA model for the current account dynamics. We put forward a hypothesis that the existence of the spread has an important impact on the dynamics of other macroeconomic variables, the verification of which we leave for further research.

Appendix

The data used in section 5 are taken from the World Economic Outlook 2009 (WEO) released by the International Monetary Fund, as well as the World Development Indicators (WDI) database of the World Bank. The relevant tickers for raw data are as follows: the current account to GDP ratio (WEO, bca_ngdpd), GDP *per capita* in PPP terms (WEO, ppppc), annual percent change of constant price GDP (WEO, ngdp_rpch), the lending rate (WDI, m4413244409) and the deposit rate (WDI, m1413519881).

Countries included are as follows: Algeria, Argentina, Bangladesh, Benin, Botswana, Bulgaria, Burkina Faso, Burundi, Cameroon, Chile, Colombia, Congo, Costa Rica, Cote D'Ivoire, Dominica, Ecuador, Egypt, El Salvador, Estonia, Gabon, Ghana, Gambia, Guatemala, Honduras, Hungary, Indonesia, Jamaica, Jordan, Kenya, Latvia, Lithuania, Malaysia, Malawi, Mali, Mauritius, Mexico, Morocco, Nepal, Niger, Nigeria, Panama, Papua New Guinea, Peru, Philippines, Poland, Rwanda, Senegal, Seychelles, Sierra Leone, South Africa, Sri Lanka, Swaziland, Syria, Thailand, Togo, Trinidad & Tobago, Uganda, Venezuela, Zambia, Zimbabwe.

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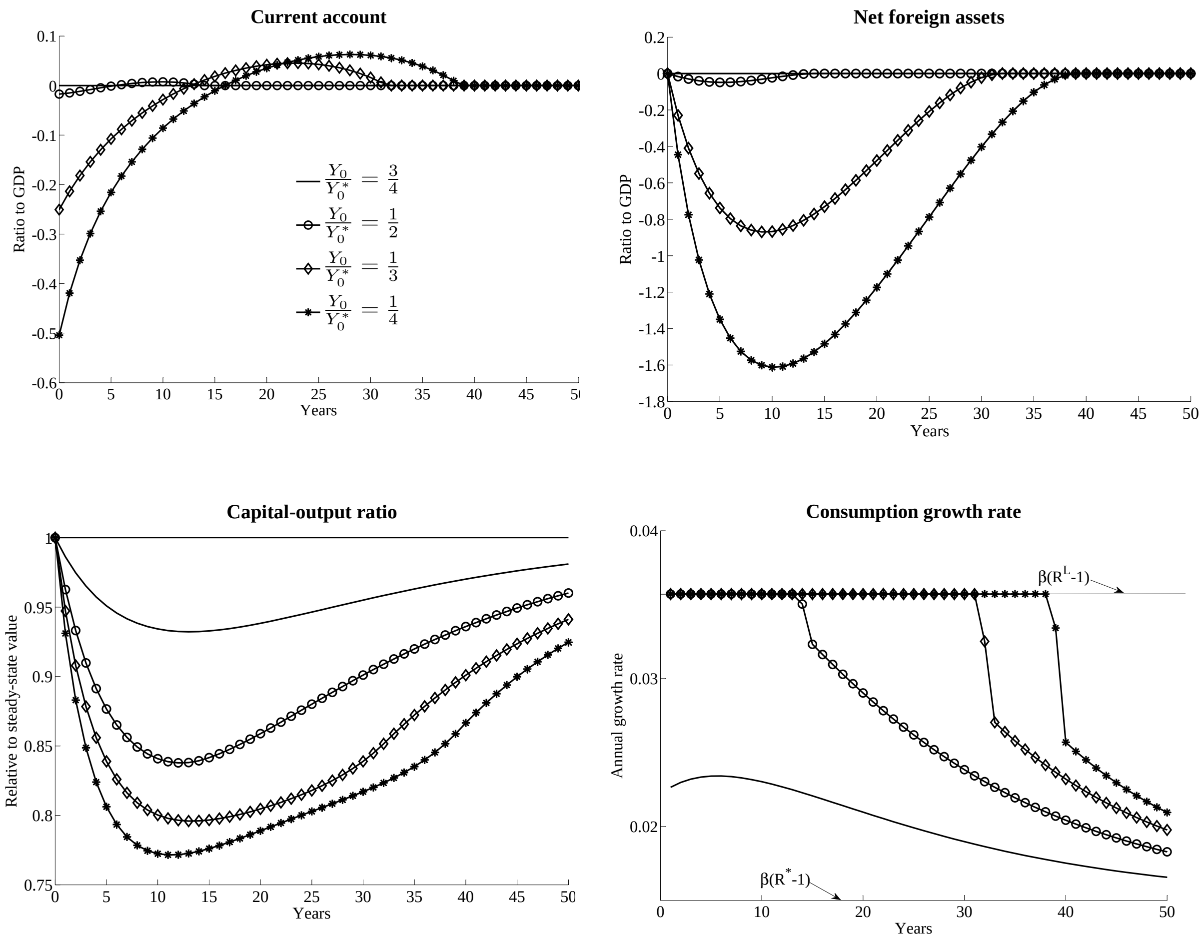
Table 1: Estimation results

Dependent variable	current account to GDP ratio			
Estimation method:	IV	GMM	IV	GMM
interest rate spread (β_1)	3.30***	1.33**	3.62***	1.32**
	(0.55)	(0.55)	(0.59)	(0.55)
relative output (β_2)			7.68	-7.90
			(9.11)	(5.11)
output growth (β_3)			-0.27	-0.08**
			(0.17)	(0.04)
lagged current account (ρ)		0.61***		0.61***
		(0.03)		(0.03)
observations	918	918	918	918

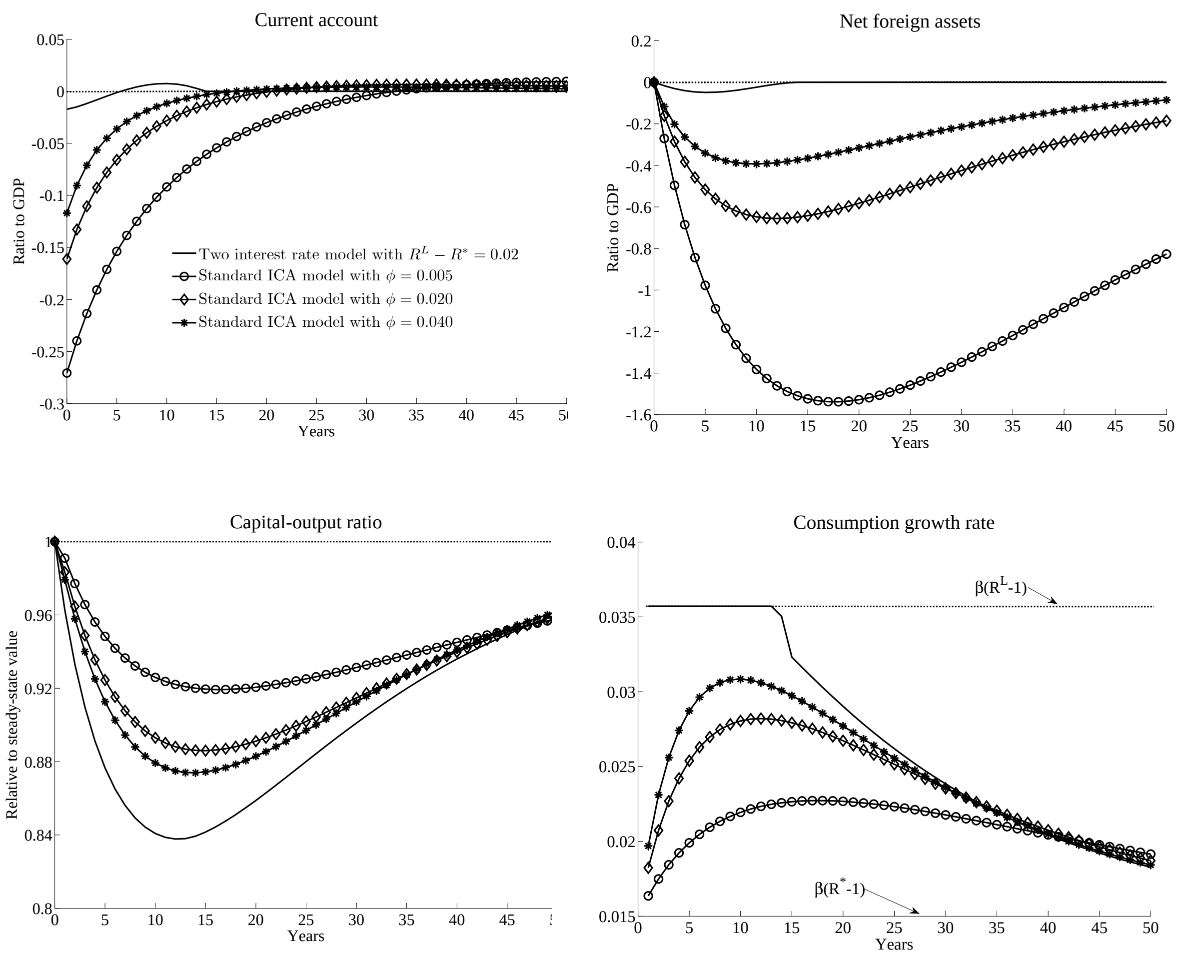
Notes: Standard errors in brackets; ***, ** and * indicate significance at 1%, 5% and 10% level, respectively

Figure 1: Convergence path and the initial value of GDP per capita



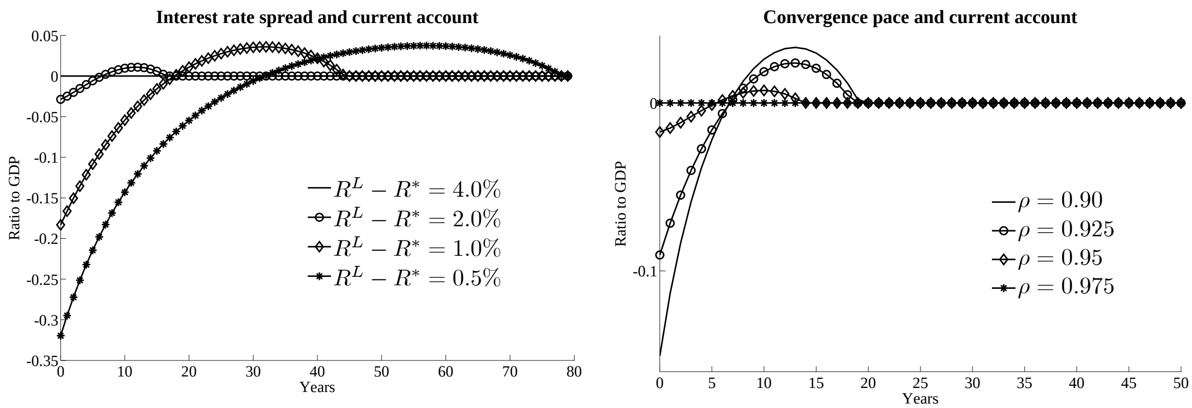
Notes: Simulations are performed for the basic parameterization of the model, assuming that $KY_0 = KY^*$ and $B_0 = 0$.

Figure 2: Comparison of convergence paths in two interest rate and standard ICA models



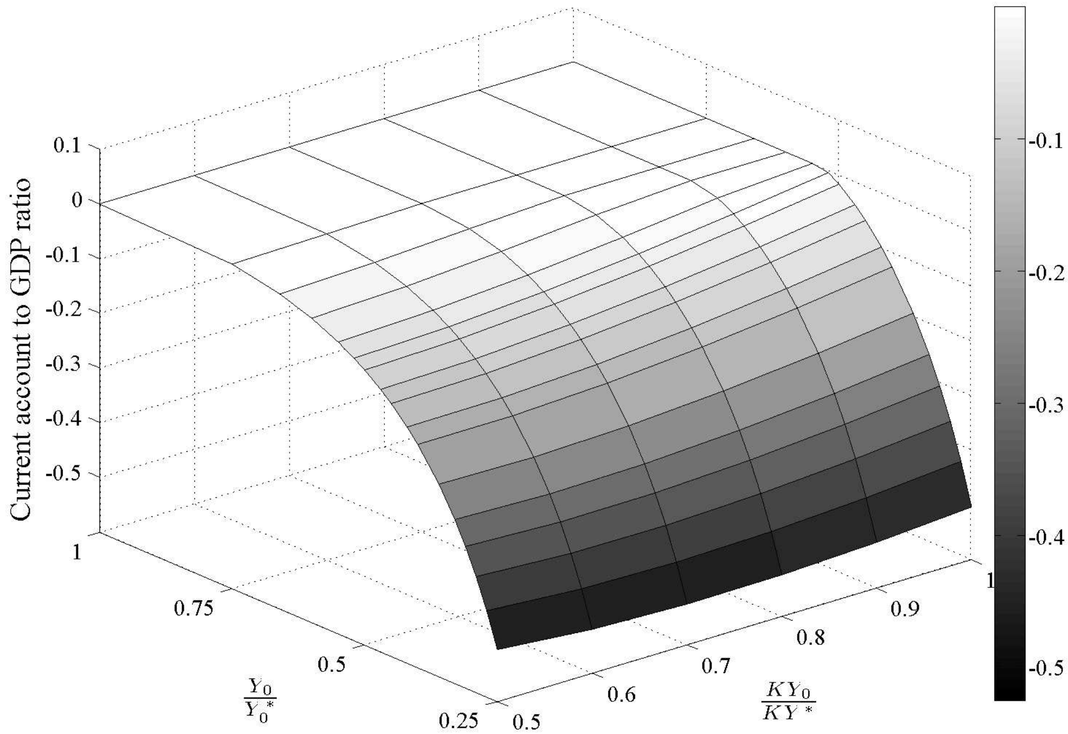
Notes: Simulations are performed for the basic parameterization of the model, assuming that $Y_0 = 0.5 \times Y_0^*$, $KY_0 = KY^*$ and $B_0 = 0$.

Figure 3: The current account paths for different structural parameters



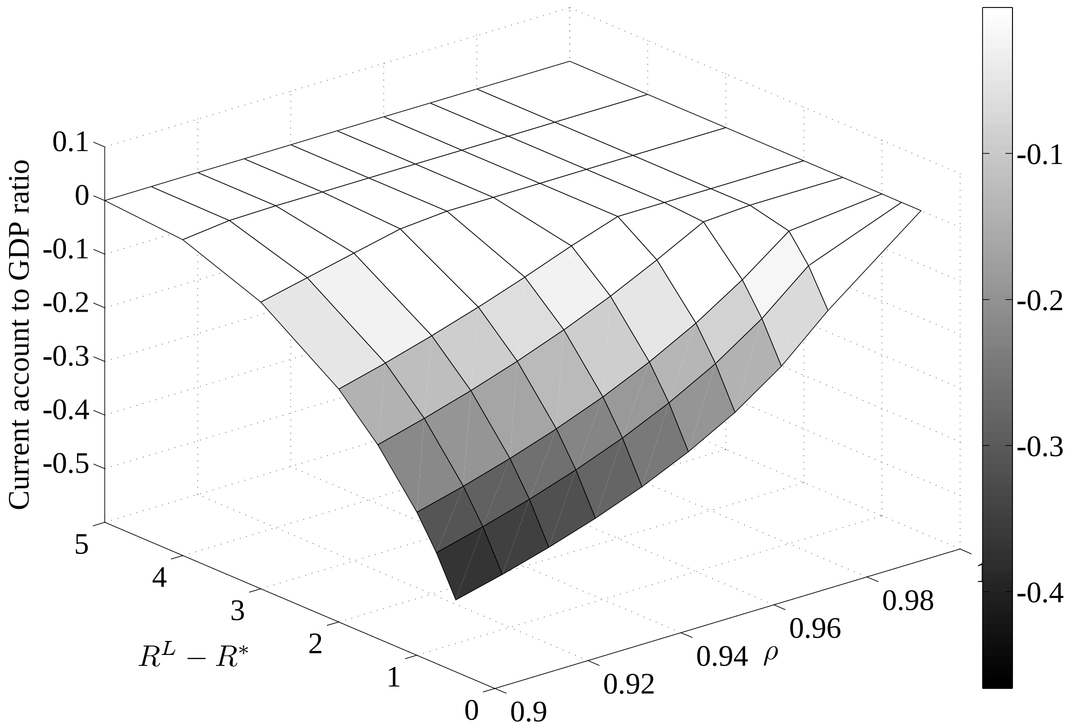
Notes: Simulations are performed for the basic parameterization of the model, assuming that $Y_0 = 0.5Y_0^*$, $KY_0 = KY^*$ and $B_0 = 0$

Figure 4: The current account and initial conditions



Notes: Simulations are performed for the basic parameterization of the model, assuming that $B_0 = 0$. The current account values refer to the first period of simulations.

Figure 5: The current account and model parameterization



Notes: Simulations are performed assuming that $Y_0 = 0.5Y_0^*$, $KY_0 = KY^*$ and $B_0 = 0$. The current account values refer to the first period of simulations