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Current Accounts in the Long and the Short Run

1. Introduction

Countries are subject to transitory income shocks such as changes in the terms of trade, fluctuations in production, policy reforms, natural disasters, and many others. There is ample evidence that countries use their assets to buffer or smooth the effects of these shocks on consumption, raising savings when income is high and vice versa.[1] The main goal of this paper is to improve our understanding of the combination of assets that countries use for this purpose. In particular, we ask: How do countries allocate the marginal unit of savings between domestic and foreign assets? Or, equivalently, what are the effects of fluctuations in savings on domestic investment and the current account?[2]

The traditional view is that countries invest the marginal unit of savings in foreign assets. Underlying this view are the assumptions that investment risk is weak and diminishing returns are strong. The first assumption ensures that countries invest their savings only in those assets that offer the highest expected return. The second assumption implies that

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1. For evidence on consumption smoothing, see Deaton (1992, pp. 133–134), who writes that "consumption is less volatile than income, it fluctuates less about its trend, the amplitude of its business cycle variation is less, and the variance of its growth rate is less than the variance of the growth rate of income."
2. Why do countries use assets to smooth consumption rather than simply buy insurance abroad? Implicit in this paragraph and basically in all that follows is the assumption that countries are unable or unwilling to sell their idiosyncratic risk. This assumption is a central tenet of the intertemporal approach to the current account (see Obstfeld and Rogoff, 1995), and it is widely thought to provide an accurate description of reality. The question of why this is so is one of the most intriguing puzzles in international finance. See Lewis (1999) for a survey of the literature on this topic.

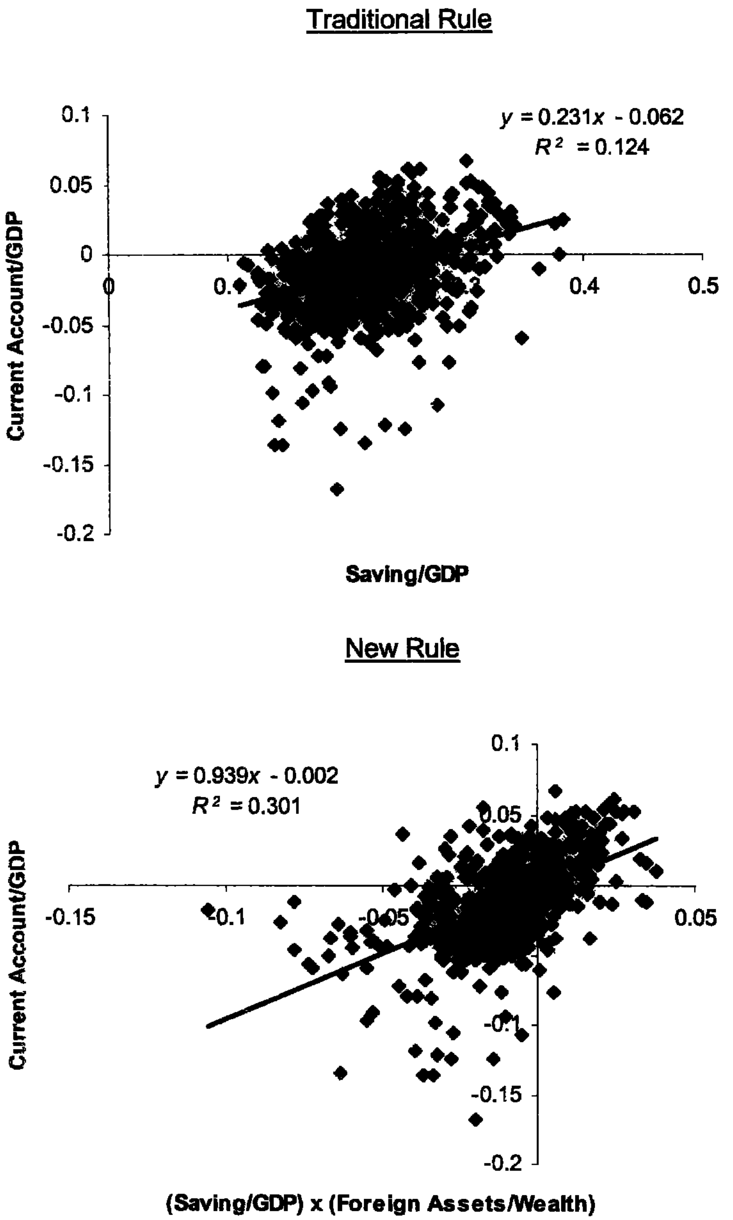
investing any fraction of the marginal unit of savings in domestic capital would lower its expected return below that of foreign assets. Hence the marginal unit of savings is invested in foreign assets, justifying the *traditional rule* that fluctuations in savings lead to fluctuations in the current account of roughly the same magnitude. While theoretically coherent, this rule has consistently been rejected by the data. The top panel of Figure 1 shows pooled annual observations of the current account and savings for 21 OECD countries over the past 30 years. A regression of the current account on savings delivers a slope coefficient that is positive but much lower than one. This is nothing but the famous result of Feldstein and Horioka (1980) that fluctuations in savings lead to parallel fluctuations in investment, with only minor effects on the current account.

In an earlier paper, we proposed a new view: that countries invest the marginal unit of savings like the average one (Kraay and Ventura, 2000). This is what one should expect if, in contrast to the traditional view, investment risk is strong and diminishing returns are weak. The first assumption implies that countries are unwilling to change the composition of their portfolios, unless shocks have large effects on the distribution of asset returns. The second assumption ensures that the distribution of asset returns is unaffected by the way countries invest the marginal unit of savings. Hence, the marginal unit of savings is invested like the average one, leading to the *new rule* that fluctuations in savings lead to fluctuations in the current account that are equal to savings times the share of foreign assets in the country portfolio. This rule not only is theoretically coherent, but it also provides a surprisingly good description of the data. The bottom panel of Figure 1 shows that a simple regression of the current account on the interaction between savings and the share of foreign assets delivers a slope coefficient close to one and a zero intercept. Moreover, this interaction term by itself explains around 30 percent of the observed variation in the current account.[3]

Hidden in the bottom panel of Figure 1 is a vast difference between the predictive power of the new rule in the long and the short run. Figure 2 illustrates this point. In the top panel, we have plotted the average current account over a thirty-year period against the average of savings times the

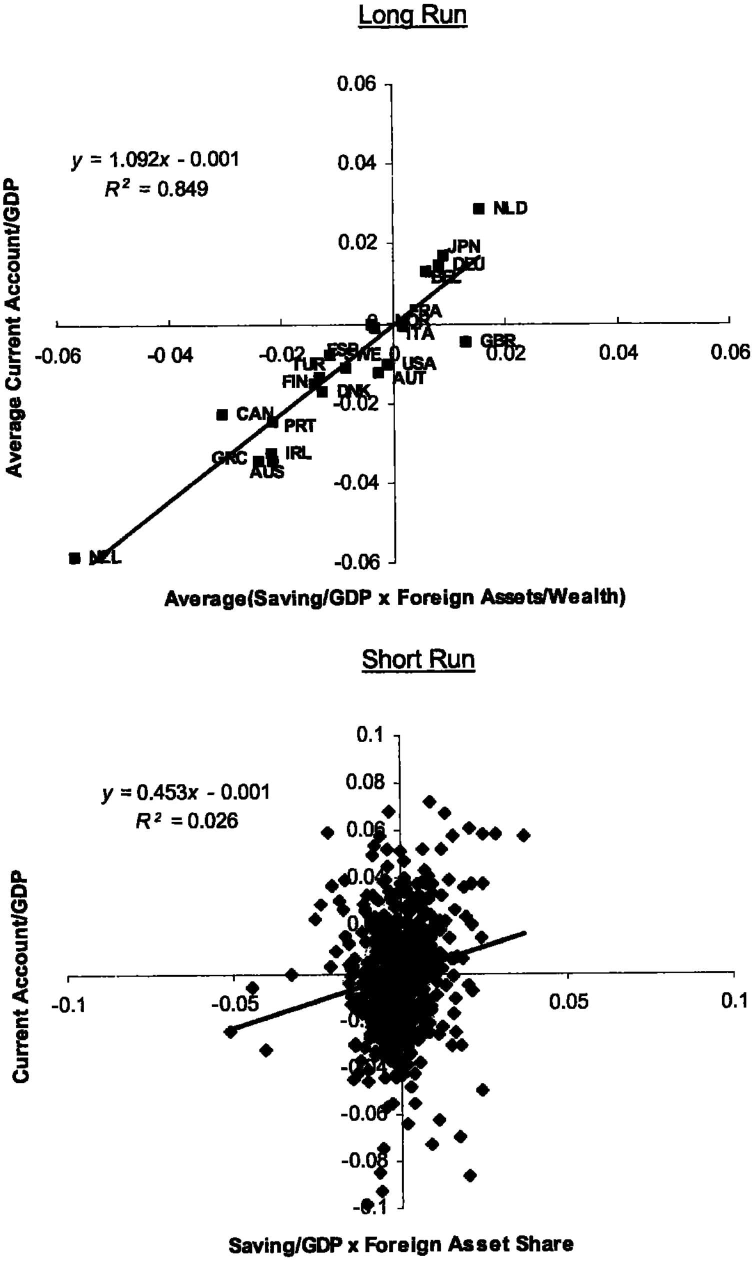
3. Since foreign assets constitute a small fraction of observed country portfolios, this view implies that fluctuations in savings should mostly lead to parallel fluctuations in investment, and is therefore consistent with Feldstein and Horioka's finding. What we found most surprising about this view in our earlier paper is that it has sharply different implications for the current account response to an increase in savings in debtor and creditor countries. Since debtors by definition hold more than their wealth in domestic capital, they invest at home more than the increase in savings, resulting in a current account deficit. In contrast, creditor countries invest at home less than the increase in savings, resulting in a current account surplus.

Figure 1 THE TRADITIONAL RULE AND THE NEW RULE



Note. The top (bottom) panel plots the current account balance as a share of GDP against gross national saving (gross national saving interacted with the foreign asset position), pooling all available annual observations for an unbalanced panel of 21 OECD countries over the period 1966–1997.

Figure 2 PORTFOLIO GROWTH AND THE CURRENT ACCOUNT



Notes: The top panel plots the period average of the current account as a share of GDP against the period average of gross national saving as a share of GDP interacted with the share of foreign assets in wealth for an unbalanced panel of 21 OECD countries over the period 1966–1997. The bottom panel plots the annual current account as a share of GDP against annual gross national saving as a share of GDP interacted with the annual foreign asset share, removing country means from both variables.

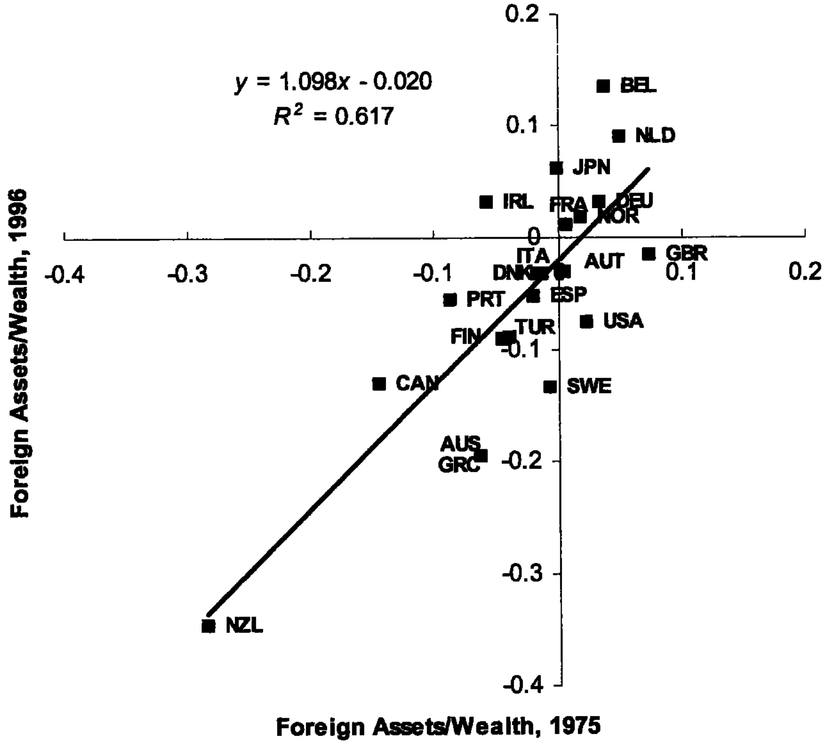
share of foreign assets during the same period. The new rule explains about 85 percent of the long-run or average cross-country differences in current accounts. In the bottom panel, we have plotted the (de-meaned) current account for each country and year against the (de-meaned) interaction of savings and the initial share of foreign assets in wealth for the same country and year. The new rule explains essentially none of the year-to-year within-country differences in current accounts. The contrast between the two panels indicates a discrepancy between the long- and the short-run behavior of the current account.[4]

How do we reconcile the apparently haphazard behavior of the current account in the short run with its neat behavior in the long run? Is the short-run relationship between savings and the current account just noise, or are there clear patterns behind this cloud of points? The main contribution of this paper, we think, is to provide clear answers to these questions. To do this, it is useful to start by pointing out that the new rule embodies the view that the current account primarily reflects *portfolio growth,* i.e. changes in the size of the country portfolio without systematic changes in its composition. The empirical success of the new rule in the top panel of Figure 2 simply reflects the observation that the composition of country portfolios has been remarkably stable in the long run. This is shown in Figure 3. If we want to understand why the new rule performs so poorly in the bottom panel of Figure 2, we must explain how and why in the short run increases in savings lead mostly to *portfolio rebalancing,* i.e. systematic changes in the composition of the country portfolio. If in addition we want to reconcile the two panels of Figure 2, we must go further and also explain why this short-run portfolio rebalancing is undone in the long run.

Our hypothesis is that this pattern is consistent with the view that adjustment costs to investment are important. If this is the case, an increase in savings that raises investment reduces the expected return to capital and induces countries to rebalance their portfolios towards foreign assets. Under these conditions, the short-run current account surplus is larger than the one predicted by the new rule. Once savings return to normal, investment declines, adjustment costs disappear, and the country portfolio returns gradually to its original composition. Throughout this adjustment process, the current account surplus is smaller than the one

4 We also noted this discrepancy in our earlier paper, although it was much less pronounced in the smaller sample of 13 countries and 23 years (1973–1995) that we used there. Here, we have been able to extend our sample to 21 countries and up to 32 years per country (1966–1997). All the results obtained in the previous paper are confirmed and, to some extent, reinforced when we use the larger sample.

Figure 3 PERSISTENCE OF COUNTRY PORTFOLIOS



Note: Throughout the paper, we use an unbalanced panel of 21 OECD countries over the period 1966–1997 Since we can construct a balanced panel of observations for this set of countries only over the period 1975–1996, we use 1975 here as the initial period.

predicted by the new rule. In the long run, the shock does not affect the composition of the country portfolio, and the new rule applies.

With this theoretical picture at hand, we go back to the data to search for patterns in the discrepancies between the observed current account and what the new rule would predict. When we do this, the picture that comes out from the data turns out to be clear and unambiguous: on impact, countries rebalance their portfolios towards foreign assets, and the new rule systematically underpredicts the short-run effects of increases in savings on the current account. In the years that follow, countries rebalance their portfolios back towards their original composition. During this period, the new rule systematically overpredicts the current account. We find that the whole adjustment process lasts about five years. Overall, the evidence is consistent with the view that adjustment costs to investment are important and, to avoid paying them, countries use foreign assets as a buffer stock to smooth fluctuations in investment.

The theory presented here can also reconcile two apparently contradictory observations about the relationship between the current account and investment. On the one hand, the long-run or cross-sectional correlation between investment and the current account is weak (Penati and Dooley, 1984; Tesar, 1991). On the other hand, the short-run or time-series correlation between investment and the current account is consistently negative (Glick and Rogoff, 1995). The theory presented here predicts that in the long run, portfolio rebalancing is small and the correlation between the current account and investment should be positive in creditor countries and negative in debtor ones. We show that the data are consistent with this prediction and that the weak cross-sectional correlation is the result of pooling data from debtor and creditor countries. The theory also predicts that in the short run portfolio rebalancing is important and this introduces a source of negative correlation between the current account and investment. This is true in all countries, regardless of whether they are debtors or creditors. We present a simple decomposition of the cross-sectional and time-series correlations between the current account and investment that illustrates this point.

The paper is organized as follows: Section 2 presents a stylized model that encapsulates the main elements of our portfolio-based theory of the current account. Section 3 uses the model to study how countries react to income shocks. Section 4 examines the empirical evidence and interprets it from the vantage point of the theory. Section 5 investigates the relationship between investment and the current account. Section 6 concludes.

2. *An Intertemporal Model of the Current Account*

In this section, we present a stylized model of how the current account responds to transitory income shocks. Since we stop short of modeling the world equilibrium and focus instead on a small open economy, these shocks should be interpreted as country-specific or idiosyncratic risk. Following the tradition of the intertemporal approach, we simply assume that countries are unable or unwilling to sell this risk in international markets. In particular, we adopt the starkest form of this view by assuming that the only asset that is traded internationally is a noncontingent bond.[5]

5 The intertemporal approach was developed by Sachs (1981, 1982), Obstfeld (1982), Dornbusch (1983), Svensson and Razin (1983), Persson and Svensson (1985), and Matsuyama (1987), among others. Obstfeld and Rogoff (1995) survey this research

The model captures what we think are the essential elements of a portfolio-based theory of the current account. This theory is built around the concept of country portfolio and a simple decomposition of the current account that relies on this concept. By the country portfolio, we refer to the sum of all productive assets located within the country plus its net foreign asset position. The latter consist of the sum of all claims on domestic assets held by foreigners minus the sum of all claims on foreign assets held by domestic residents. In our simple model, the only productive asset located within the country is the stock of capital, and the net foreign asset position is simply the stock of noncontingent bonds owned by the country. By the *composition* of the country portfolio, we refer to the share of the net foreign asset position in it. To interpret the evolution of the current account it is useful to break it down into two pieces: changes in the size of the country portfolio, which we call *portfolio growth;* and changes in the composition of the country portfolio, or *portfolio rebalancing.*[6]

We study a small country populated by a continuum of identical consumers. There is a single good that can be used for consumption and investment. Consumers have access to two investment opportunities: foreign loans and domestic capital. The interest rate on foreign loans is ρdt. To produce one unit of capital one unit of the single good is required. Since capital is reversible and does not depreciate, its price is equal to one and its return is equal to the flow of production minus operating costs. The flow of production generated by one unit of capital is $\pi dt + \sigma d\omega$, where π and σ are non-negative constants; and ω is a Wiener process, i.e., its changes are normally distributed with $E[d\omega] = 0$ and $E[d\omega^2] = dt$. That is, the flow of production is normally distributed with mean πdt and variance $\sigma^2 dt$. The operating costs αdt, are assumed to be proportional to the aggregate investment rate:

$$\alpha dt = \lambda \frac{dk}{k} \qquad (\lambda \geq 0), \tag{1}$$

where k is the aggregate stock of capital at the beginning of the (infinitesimal) period. Since capital does not depreciate, this is also the stock of capital that was used in production in the previous period. Note that we are treating the relationship between operating costs and investment as a congestion effect or negative externality. One set of assumptions that justifies this relationship would be that investment requires a public input

6 Implicit in this decomposition is the assumption that asset price revaluations are small. This might be a poor assumption in some episodes. See Ventura (2001) for an example that shows this.

that costs λ per unit of investment and the government finances this input by raising a tax α on capital. There might be alternative and more compelling sets of assumptions that deliver this relationship. The reason we adopt it here is simply that it provides a tractable and effective way to capture the notion of adjustment costs to investment.[7]

The representative consumer values consumption sequences with these preferences:

$$E\int_{c}^{\infty} \ln (c)/e^{-\delta t}\, dt \qquad (\delta > 0). \tag{2}$$

Given our assumptions about the flow of production and the operating costs, the return to capital is $(\pi - \alpha)dt + \sigma d\omega$; and the representative consumer's budget constraint can be written as follows:

$$da = \{[(\pi - \alpha)(1 - x) + \rho x]a - c\}dt + (1 - x)a\sigma d\omega, \tag{3}$$

where c, a, and x denote consumption, wealth, and the share of foreign loans in the portfolio of the representative consumer. The budget constraint illustrates the standard risk–return trade-off underlying investment decisions. Each extra unit of wealth invested in domestic capital rather than foreign loans increases the expected return to wealth by $(\pi - \alpha - \rho)dt$, at the cost of raising the variance of this return by $\sigma^2 dt$. Finally, we assume that it is not possible to short-sell the capital stock, i.e., $x \leq 1$.

The representative consumer solves (2) subject to (3), taking the path of α as given. Solving this problem, we find the optimal consumption and portfolio decision[8]:

$$c = \delta a, \tag{4}$$

$$x = 1 - \max\left\{\frac{\pi - \alpha - \rho}{\sigma^2}, 0\right\}. \tag{5}$$

7 The q-theory postulates that investment raises the price of investment goods relative to consumption goods, leaving the productivity of capital constant. We instead postulate that investment lowers the productivity of capital, leaving the relative price of investment and consumption goods constant. It is likely that in real economies, both sorts of adjustment costs to investment are important. See Lucas (1967) for an early model that considers both types of adjustment costs; and Caballero (1999) and Dixit and Pyndick (1994) for two excellent expositions of existing models of adjustment costs of investment.

8. Merton (1971) solved this problem first. See also the appendix in Kraay and Ventura (2000).

When deciding their consumption, consumers behave as in the permanent-income theory of Friedman. Equation (4) shows that consumption is a fixed fraction of wealth and is independent of the expected return and volatility of available assets. When deciding their portfolio, consumers behave as in the mean–variance theory of Markowitz and Tobin. Equation (5) shows that the shares of each asset in the portfolio depend only on the mean and variance of the different assets and not on the level of wealth. The kink in the demand for foreign assets is the result of the short-sale constraint on domestic capital, i.e. $x \leq 1$.

In equilibrium, the demand and supply of capital must be equal, and this implies that

$$(1 - x)a = k + dk. \tag{6}$$

The left-hand side of equation (6) is the demand for capital. Since we have assumed that only domestic consumers hold domestic capital, this demand is equal to the share of their wealth that these consumers want to hold in domestic capital, times wealth. The right-hand side of equation (6) is the supply of capital, and consists of the capital stock at the beginning of the period plus the investment made during the (infinitesimal) period.

This completes the description of the model. There are two state variables (k and a) and one shock ($d\omega$). The new-rule model of our previous paper obtains as the limiting case in which $\lambda \to 0$. In this case, there are no adjustment costs to investment and the only state variable is the level of wealth. Assume that $\pi > \rho + \lambda(\rho - \delta)$. This parameter restriction ensures that the economy is productive enough so that the short-selling constraint on capital is never binding. Then, it is straightforward to use equations (1)–(6) to obtain the dynamics for the capital stock and wealth[9]:

$$\frac{dk}{k} = \lambda^{-1}\left(\pi - \rho - \sigma^2 \frac{k}{a}\right)dt, \tag{7}$$

$$\frac{da}{a} = \left[\sigma^2\left(\frac{k}{a}\right)^2 + \rho - \delta\right]dt + \frac{k}{a}\,\sigma\, d\omega. \tag{8}$$

Equations (7)–(8) provide the law of motion of the system from any given initial condition and sequence of shocks. Our next goal is to use this

9. To derive equations (7)–(8), remember that in the limit of continuous time $dkdt \approx 0$.

dynamical system to study how the current account responds to income shocks.

3. Portfolio Growth and Portfolio Rebalancing

To illustrate the model's implications, we analyze the behavior of savings, investment and the current account after a transitory income shock. To do this, it is useful first to establish some notation. Let S and CA be savings and the current account, each as a share of wealth, i.e., $S = da/a$ and $CA = d(xa)/a$. It follows that, along any particular sample path that we consider, the current account can be written as

$$CA = xS + dx. \tag{9}$$

Equation (9) shows that it is possible to interpret the current account as the sum of two terms. The first one measures the change in the stock of foreign assets that would keep constant the composition of the country portfolio, and this is what we refer to as *portfolio growth*. The second term measures the change in the composition of the country portfolio, and this is what we refer to as *portfolio rebalancing*.

To develop intuitions about the interplay between these two components of the current account, we present next a series of examples. In all of them, we assume the following sample path for the production shock:

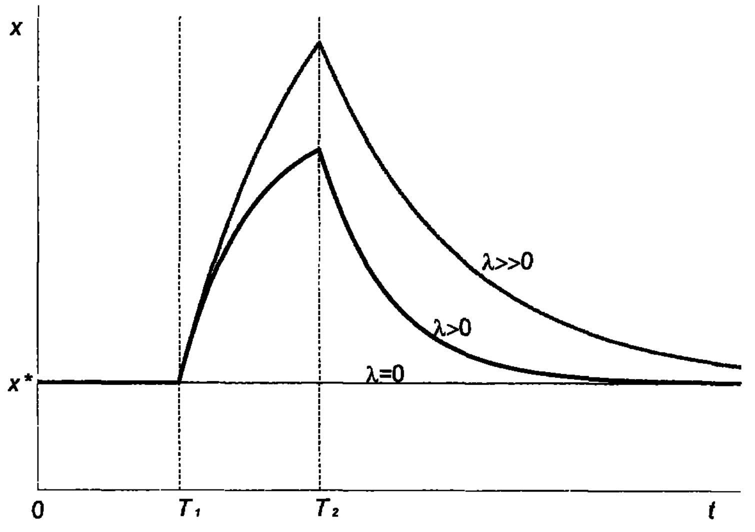
$$d\omega = \begin{cases} 0, & t \in (-\infty, T_1), \\ \frac{\varepsilon}{\sigma} dt, & t \in [T_1, T_2) \quad (\varepsilon > 0), \\ 0, & t \in [T_2, \infty). \end{cases} \tag{10}$$

That is, the country experiences a sequence of unexpected production shocks equal to εdt times the capital stock for a finite period and zero afterwards. We refer to the period $[T_1, T_2)$ as the *shock period* and to $(-\infty, T_1)$ and $[T_2, \infty)$ as the *pre-* and *postshock periods*, respectively.

Figure 4 shows the behavior of the foreign asset position along this sample path. Regardless of the initial condition, during the preshock period the share of foreign assets converges towards

$$x^* = 1 + \frac{1}{2\lambda} - \sqrt{\left(\frac{1}{2\lambda}\right)^2 + \frac{\lambda^{-1}(\pi - \rho) - \rho + \delta}{\sigma^2}}.$$

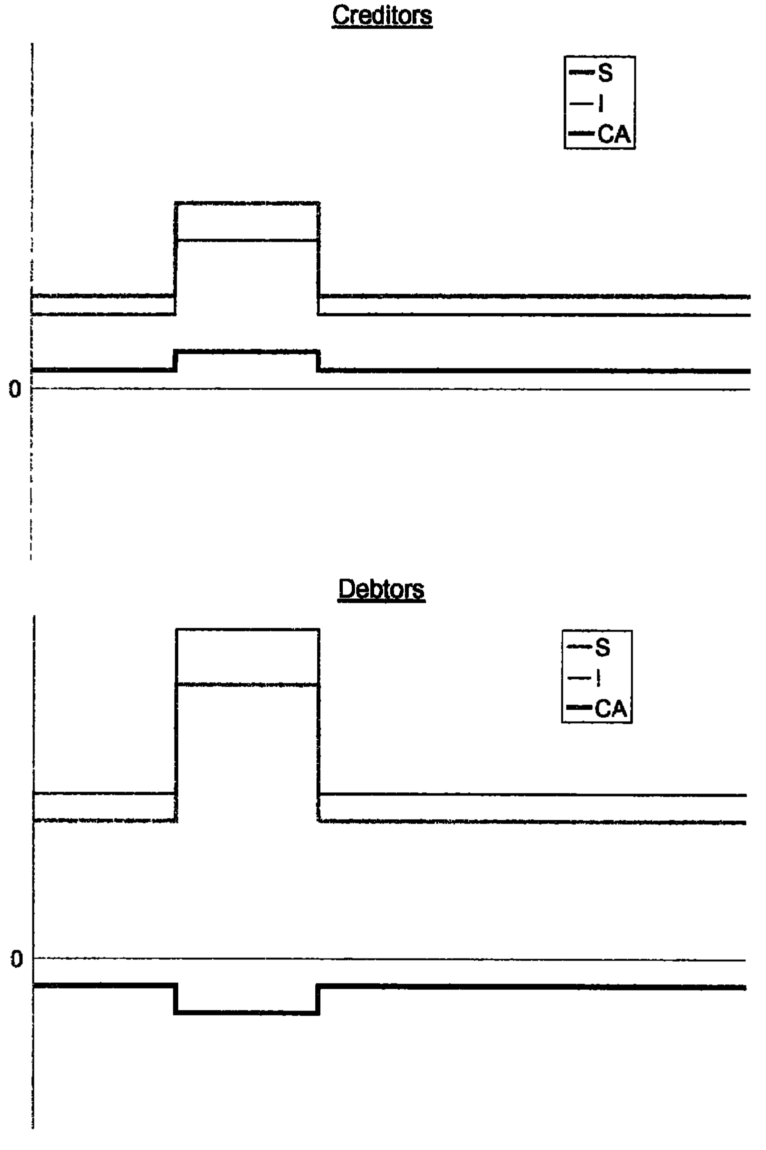
Figure 4 THE SHARE OF FOREIGN ASSETS IN WEALTH



The simulation behind Figure 4 assumes that this value has been reached by $t = 0$. During the shock period the share of foreign assets increases steadily, albeit at a declining rate. The magnitude of this increase depends on λ. High values of λ imply that the effects of increased investment on operating costs are large and provide a strong inducement for investors to rebalance their portfolios towards foreign assests. During the postshock period, investment and operating costs decline. As a result, the share of foreign assets slowly returns to its preshock level. We next study the implications of this behavior of the share of foreign assets for the current account.

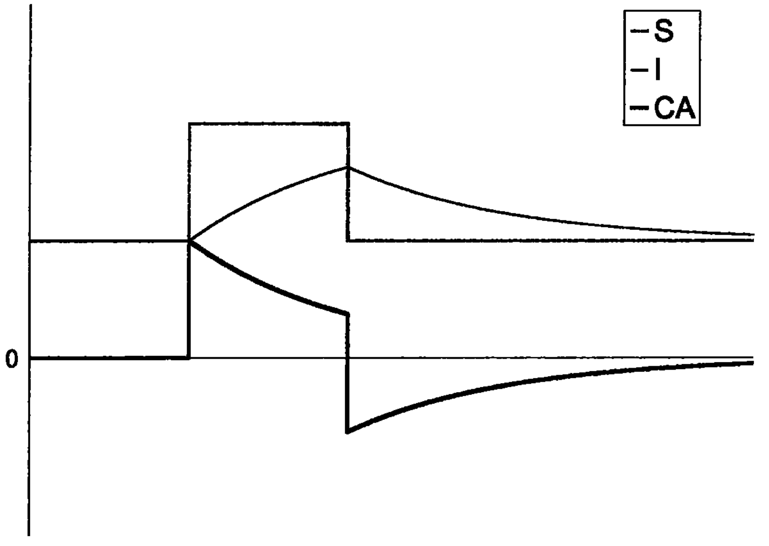
Consider first the case in which adjustment costs to investment are negligible, i.e, $\lambda \to 0$. Figure 4 shows that in this case the share of foreign assests is constant throughout. As a result, there is no portfolio rebalancing, i.e., $dx = 0$; and the current account is equal to portfolio growth, i.e., CA $= x$S. This is the new rule model that we analyzed in our previous paper, and its implications for a creditor and a debtor country are depicted in Figure 5. The top panel shows a creditor country, i.e. $x^* > 0$, while the bottom panel shows a debtor country, i.e. $x^* < 0$. Both countries raise their savings during the shock period as a result of the standard consumption-smoothing motive. Both countries also invest these marginal savings in domestic capital and foreign loans in the same proportions as their average portfolio. Since the foreign asset share is small in absolute value, we find that in both countries the increase in investment

Figure 5 PORTFOLIO GROWTH



Notes This figure shows saving (S), Investment (I), and the current account (CA), following a positive shock, in debtor and creditor countries, for the case $\lambda = 0$

Figure 6 PORTFOLIO REBALANCING



Notes: This figure shows saving (S), investment (I), and the current account (CA) following a positive shock, in a country with zero initial foreign assets, for the case $\lambda > 0$

is of the same order of magnitude as the increase in saving. But it is not exactly the same, and this leads to different current account responses in debtor and creditor countries. In the creditor country, investment increases somewhat less than savings and the current account registers a surplus. In the debtor country, investment increases somewhat more than savings and the current account registers a deficit. This is the main result of our previous paper.

Consider next the case in which adjustment costs to investment are no longer negligible, i.e., $\lambda > 0$. Figure 6 shows the case of a country that is neither a debtor nor a creditor. By choosing the case $x^* = 0$, we know that in the absence of adjustment costs, the current account would be zero before, during, and after the shock. The country raises its savings during the shock period for the same consumption-smoothing motive as before. But adjustment costs now discourage large swings in investment, and this affects how these savings are distributed between domestic capital and foreign loans. During the shock period, the country uses most of its increase in savings to purchase foreign loans, while investment increases only gradually. Consumers rebalance their portfolios towards foreign assets, because the increase in investment raises operating costs and this lowers the expected return to domestic capital. The portfolio-rebalancing component of the current account is positive, and as a result the new rule underpredicts the current account surplus in the short run. In the postshock period investment falls slowly, but remains higher than normal for a while. Since productivity has returned to its preshock level, savings return to normal and the higher than normal investment is now financed by sale of foreign loans. Consumers rebalance their portfolios back towards their original composition, because the decline in investment lowers operating costs and this raises the expected return to domestic capital. The portfolio-rebalancing component of the current account is therefore negative, and as a result the new rule overpredicts the current account surplus in the medium run. As time passes, the country portfolio returns to its original composition and the new rule applies again in the long run.

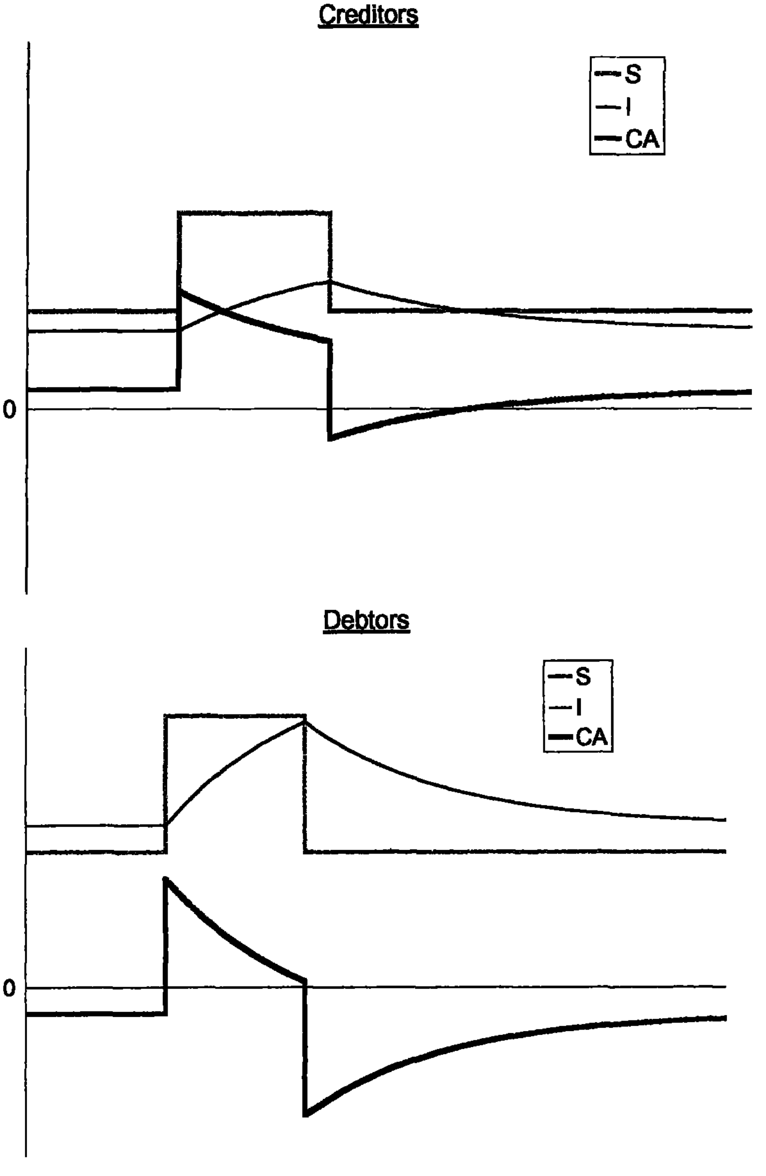
This example clearly shows the role of foreign loans as a buffer stock to smooth the fluctuations in investment. Without access to foreign loans, countries would be forced not only to invest all of their savings at home but also to do so contemporaneously. Access to foreign loans permits countries to spread their domestic investment over time and, in this way, avoid paying high adjustment costs. To do this, countries temporarily place their savings in foreign loans and slowly convert them into domestic investment.

It is possible to design more complicated examples in which the current account exhibits richer dynamics. For instance, Figure 7 shows the case of positive adjustment costs in a creditor and a debtor country. One can interpret these examples as a combination of portfolio growth and portfolio rebalancing along the lines of the explanations of Figures 5 and 6. The theory developed here therefore equips us with a clear picture of the factors that determine how the current account reacts to increases in savings. The next step is to go back to actual data and attempt to interpret them from the vantage point of the theory.

4. *The Process of Current Account Adjustment*

In the introduction, we argued that in the long run most of the variation in current accounts in OECD countries is due to portfolio growth effects, while in the short run, current account fluctuations primarily reflect changes in the composition of country portfolios or portfolio rebalancing. We based this point on the observation that the simple interaction of a country's foreign asset share with its saving, averaged over the past thirty years, proved to be a very good predictor of the country's average current account. However, the same interaction using annual data proved to be

Figure 7 PORTFOLIO GROWTH AND PORTFOLIO REBALANCING



Notes: This figure shows saving (S), investment (I), and the current account (CA), following a positive shock, in debtor and creditor countries, for the case $\lambda > 0$.

a very poor predictor of year-to-year fluctuations in current accounts. This was shown in the two panels of Figure 2.[10]

The theory presented above has the potential to explain these observations. In the presence of adjustment costs to investment, the theory predicts that in the short run countries react to transitory income shocks by raising savings and rebalancing their portfolios towards foreign assets. If these costs are sufficiently strong, the theory can therefore explain why the short-run variation in the current account is dominated by portfolio rebalancing and not portfolio growth. The theory also predicts that in the aftermath of the shock countries gradually rebalance their portfolios back to their original composition. Therefore the theory can also explain why the long-run variation in the current account is dominated by portfolio growth and not portfolio rebalancing.

The theory also has very clear predictions for the patterns of portfolio rebalancing that we should observe in the data. The new-rule (portfolio-growth) component of the current account underpredicts the actual current account during the shock period as countries rebalance their portfolios towards foreign assets, whereas it overpredicts the current account after the shock as countries rebalance their portfolios back towards its original composition. In other words, a contemporaneous increase in savings should be associated with a positive portfolio-rebalancing component of the current account, whereas past increases in savings should be associated with negative values in the same component. Moreover, for the new rule to apply in the long run, these positive and negative components should be roughly of the same magnitude. In this section, we show that the data are consistent with these predictions.

We begin by decomposing observed current accounts into portfolio-growth and portfolio-rebalancing components. As in the theory, let x_{ct} denote the share of foreign assets in the portfolio of country c at the beginning of period t, and let S_{ct} and CA_{ct} denote gross national saving and the current account balance as a fraction of GDP during period t. We measure

10. Of course, one could argue that this discrepancy between the between-country and within-country results is simply due to much greater measurement error in the within-country variation in current accounts and portfolio growth than in the between-country variation. While measurement error is certainly present, we think it is clearly not the whole story. One way to see this is to notice that (1) measurement error in the RHS variable in our regression will bias the slope coefficient downward by a factor equal to the signal-to-noise ratio, and (2) measurement error in both the LHS and RHS variables will bias the R^2 by a factor equal to the product of the signal-to-noise ratios in the two variables. Since we observe a slope coefficient of one-half and an R^2 that falls from 0.85 in the between regression to 0.03 in the within regression, this implies a signal-to-noise ratio of only 0.55 in the RHS variable and 0.06 in the LHS variable. While there are clearly various measurement issues in our data, we find it implausible that the data are as noisy as this calculation would suggest.

the portfolio-growth component of the current account as $PG_{ct} \equiv x_{ct}S_{ct}$, i.e. the net purchases of foreign assets that would be observed during period t if a country were to distribute its saving between domestic and foreign assets in the same proportion as in its existing portfolio at the beginning of the period. We measure the portfolio-rebalancing component of the current account residually as the difference between the actual current account and the portfolio-growth component, i.e., $PR_{ct} \equiv CA_{ct} - x_{ct}S_{ct}$.

To implement this decomposition, we require data on current accounts, saving, and the share of foreign assets in country portfolios. We obtain annual data on current accounts in current U.S. dollars from the International Monetary Fund's *International Financial Statistics*. We measure gross national saving as the sum of the current account and gross domestic investment in current U.S. dollars, and express both as a fraction of GDP in current U.S. dollars, obtaining investment and GDP from the World Bank's world development indicators. We obtain data on the share of foreign assets in wealth from Kraay et al. (2000). We restrict attention to the set of 21 industrial countries for which at least 20 annual observations on this variable are available over the period 1966–1997 covered by this dataset.

With data on saving and the portfolio-rebalancing component of the current account in hand, we estimate a series of dynamic linear regressions of the form

$$PR_{ct} = \alpha_c + \sum_{v=1}^{p} \phi_{cv} PR_{c,t-v} + \sum_{v=0}^{q} \gamma_{cv} S_{c,t-v} + \beta_c' Z_{ct} + u_{ct}, \tag{11}$$

where PR_{ct} and S_{ct} are the portfolio-rebalancing components of the current account and saving as described above, Z_{ct} is a vector of control variables, and u_{ct} is a well-behaved error term. We then use the point estimates of the coefficients to retrieve the implied impulse response function of portfolio rebalancing in period $t + k$ to an increase in saving in period t, i.e. $\partial PR_{c,t+k}/\partial S_{ct}$. These impulse responses provide us with a picture of how countries change the composition of their portfolios following an increase in saving. The results of four such regressions are summarized in Table 1. The top panel of Table 1 reports the estimated coefficients, while the bottom panel reports the corresponding impulse response functions using the 21-country sample of annual observations. The estimated impulse response functions are also plotted in the four panels of Figure 8.

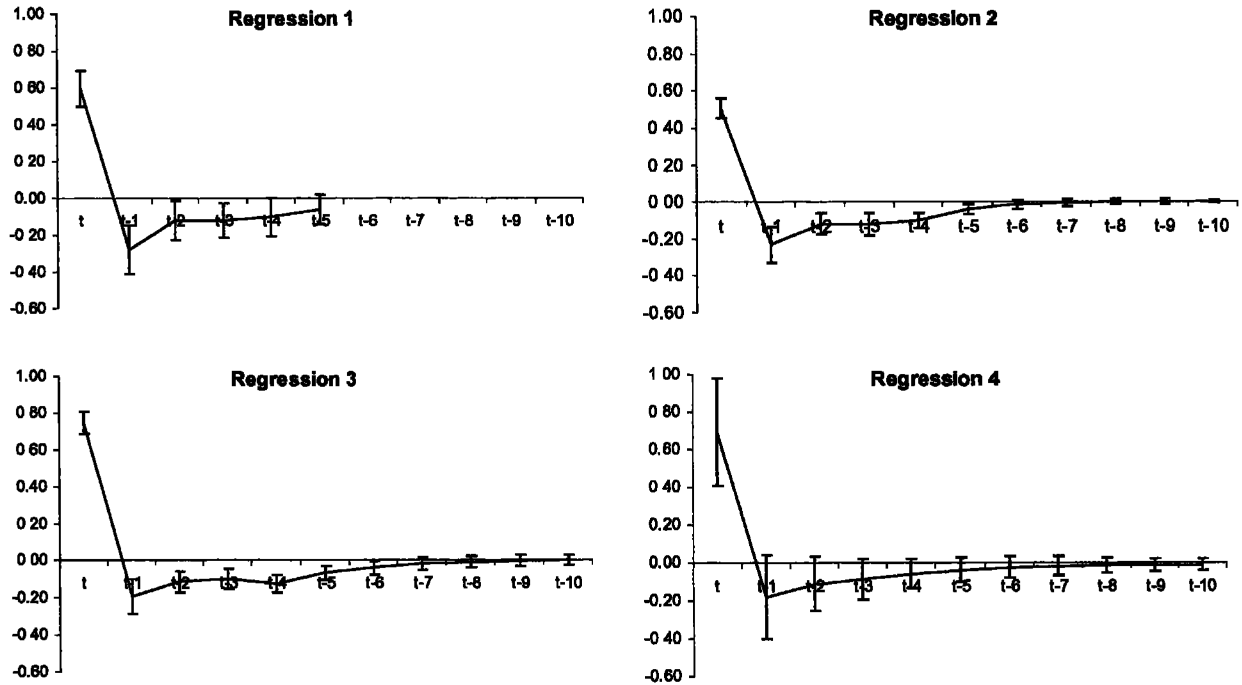
We begin by assuming that all of the slope coefficients are the same across countries. In our simplest specification, we also set $p = 0$ and intro-

Table 1 PORTFOLIO REBALANCING AND SAVING (ANNUAL DATA FOR 21 COUNTRIES)

	Regression 1		*Regression 2*		*Regression 3*		*Regression 4*	
	Coef.	*S.E.*	*Coef.*	*S.E.*	*Coef.*	*S.E.*	*Mean Coef.*	*SD of Coefs.*
Coefficient Estimates								
sy	0.598	0.096	0.504	0.080	0.746	0.079	0.691	0.286
sy(−1)	−0.281	0.133	−0.611	0.102	−0.824	0.104	−0.767	0.383
sy(−2)	−0.120	0.106	0.112	0.077	0.109	0.070	0.123	0.167
sy(−3)	−0.120	0.095	−0.043	0.073	0.040	0.067		
sy(−4)	−0.102	0.103	−0.031	0.065	−0.063	0.061		
sy(−5)	−0.060	0.078	0.020	0.058	0.019	0.057		
pr(−1)			0.754	0.056	0.845	0.057	0.837	0.216
pr(−2)			−0.114	0.069	−0.081	0.066	−0.152	0.186
pr(−3)			−0.031	0.049	−0.076	0.047		
dq					−0.375	0.050	−0.390	0.198
dpop					−0.684	0.188	−0.267	1.293
Country effects	Y		Y		Y			
Year effects	N		N		Y			
Impulse Responses								
t	0.598	0.096	0.504	0.054	0.746	0.059	0.691	0.286
$t-1$	−0.281	0.133	−0.231	0.096	−0.193	0.095	−0.179	0.222
$t-2$	−0.120	0.106	−0.119	0.058	−0.114	0.056	−0.111	0.142
$t-3$	−0.120	0.095	−0.122	0.060	−0.098	0.054	−0.088	0.106
$t-4$	−0.102	0.103	−0.102	0.042	−0.122	0.047	-0.059	0.076
$t-5$	−0.060	0.078	−0.039	0.028	−0.068	0.040	−0.038	0.063
$t-6$			−0.014	0.024	−0.040	0.037	−0.024	0.057
$t-7$			−0.003	0.020	−0.019	0.035	−0.018	0.048
$t-8$			0.000	0.016	−0.008	0.033	−0.014	0.041
$t-9$			0.001	0.012	−0.002	0.030	−0.013	0.036
$t-10$			0.001	0.009	0.001	0.027	−0.011	0.032

Note This table reports the results of estimating equation (11) in the paper The first three regressions assume slope coefficients are the same across countries. The last reports the mean and standard deviation across countries of country-by-country estimates. Standard errors for the impulse responses in regressions 2 and 3 are simulated using 500 draws from the estimated distribution of coefficients

Figure 8 PORTFOLIO REBALANCING IN RESPONSE TO UNIT INCREASE IN SAVING (ANNUAL DATA FOR 21 COUNTRIES)



Notes· This figure reports the impulse response of the portfolio-rebalancing component of the current account to a one-year unit increase in saving implied by our estimates (11) under the four different specifications discussed in the text. The vertical bars denote one-standard-deviation intervals around the estimated coefficients.

duce $q = 5$ lags of saving.[11] The results of this specification are reported in the first regression of Table 1. In this case, the impulse response function simply consists of the estimated coefficients on current and lagged saving. We find a strong positive contemporaneous correlation between saving and the current account. The point estimate of 0.6 can be interpreted as the fraction of an increase in saving that, on impact, would be invested in foreign assets by a country with zero initial foreign assets. This fraction would be slightly higher (lower) in creditor (debtor) countries because of the portfolio-growth component. Since the latter measures the current account balance that would keep the composition of their portfolios constant following an increase in saving, it is by construction positive in creditor countries and negative in debtor ones.

The subsequent lags of saving all enter with negative coefficients that are decreasing in absolute value and, with the exception of the first lag, are not significantly different from zero. These coefficients can be interpreted as the fraction of the initial increase in saving that is reallocated back towards domestic assets in each of the subsequent five years. Interestingly, the sum of the coefficients on current and lagged saving is -0.09, which is insignificantly different from zero. This suggests that the initial shift toward foreign assets is largely undone in the next five years, with the bulk of the readjustment occurring in the first year following the increase in saving. This pattern is consistent with the predictions of the theory.

The rest of Table 1 reports a variety of robustness checks on this basic result. We begin by introducing lagged values of the portfolio-rebalancing component of the current account, and find that the first and second lags are strongly significant, while third (and higher) lags are not.[12] Although this slightly alters the point estimates of the coefficients on current and lagged saving, we find that the shape of the impulse response function is very similar to that reported in the first regression. The main difference

11. In unreported results, we find that fifth and higher lags of saving are insignificantly different from zero in most specifications, and adding higher lags has little effect on the point estimates of the coefficients on the first five lags.

12. We are assuming here that the time dimension of our panel is sufficiently large that we can obtain consistent estimates of the coefficients on the lagged dependent variable in the presence of fixed effects relying on large-T asymptotics. Remember also that saving is constructed as investment plus the current account, and the latter is highly correlated with the dependent variable in equation (11). To the extent that the portfolio-rebalancing component of the current account is measured with errors that are persistent over time, this could introduce a correlation between the residuals and current and lagged saving In the specifications with lags of the dependent variable, we test for and do not reject the null of no serial dependence in the residuals, and so we can rule out this potential source of bias in our estimated impulse responses.

is that the initial shift toward foreign assets is slightly smaller than before, at 50% of the increase in saving.

In the next regression we augment the specification of the previous one with several additional control variables. To the extent that there are other shocks to returns that change the desired composition of country portfolios, and to the extent that these are correlated with saving, this will bias our results in directions which depend on the signs of these correlations. For example, if there are global shocks which raise saving and investment in all countries (such as changes in world interest rates), we will be underestimating the size of the initial shift toward foreign assets when saving increases. Similarly, if in countries and years in which saving is high, factors that increase the desired rate of investment (such as population or productivity growth) are also high, we may again be underestimating the shift toward foreign assets. To control for these factors, we introduce year dummies to capture global shocks, population growth, and Solow residuals as a proxy for productivity growth.[13] The third regression of Table 1 is this augmented specification. Population growth and Solow residuals enter significantly with the expected negative signs, and we find a larger shift toward foreign assets than before, with 75% of the initial increase in saving allocated toward foreign assets. However, the subsequent pattern of adjustment is the same as before, with the initial shift toward foreign assets being reversed in the next few years.

In the final regression, we relax the assumption that the slope coefficients in equation (11) are the same across countries, and instead estimate this equation separately for each country. Because of the fairly short time series available for each country, we adopt a more parsimonious lag structure, introducing only two lags of the dependent variable and of saving, as well as population growth and Solow residuals. We report the average and standard deviation across countries of the estimated coefficients in the last columns of Table 1.[14] Not surprisingly, we find that the country-by-country parameters are much less precisely estimated, and the dispersion across countries in the point estimates is large. Nevertheless, we find

13. We construct Solow residuals as the growth in GDP at constant prices less growth in employment times the period average share of labor in GDP, drawing the latter two variables from the OECD labor-force statistics and national accounts.

14. In the presence of parameter heterogeneity across countries, the pooled estimates reported in the previous two regressions will not deliver consistent estimates of the average (across countries) of these parameters when there is a lagged dependent variable (Pesaran and Smith, 1995). However, the average across countries of the estimated coefficients will provide a consistent estimate of the average response. We find results that are quantitatively quite similar across all specifications despite this potential source of bias in the estimates which impose parameter homogeneity across countries.

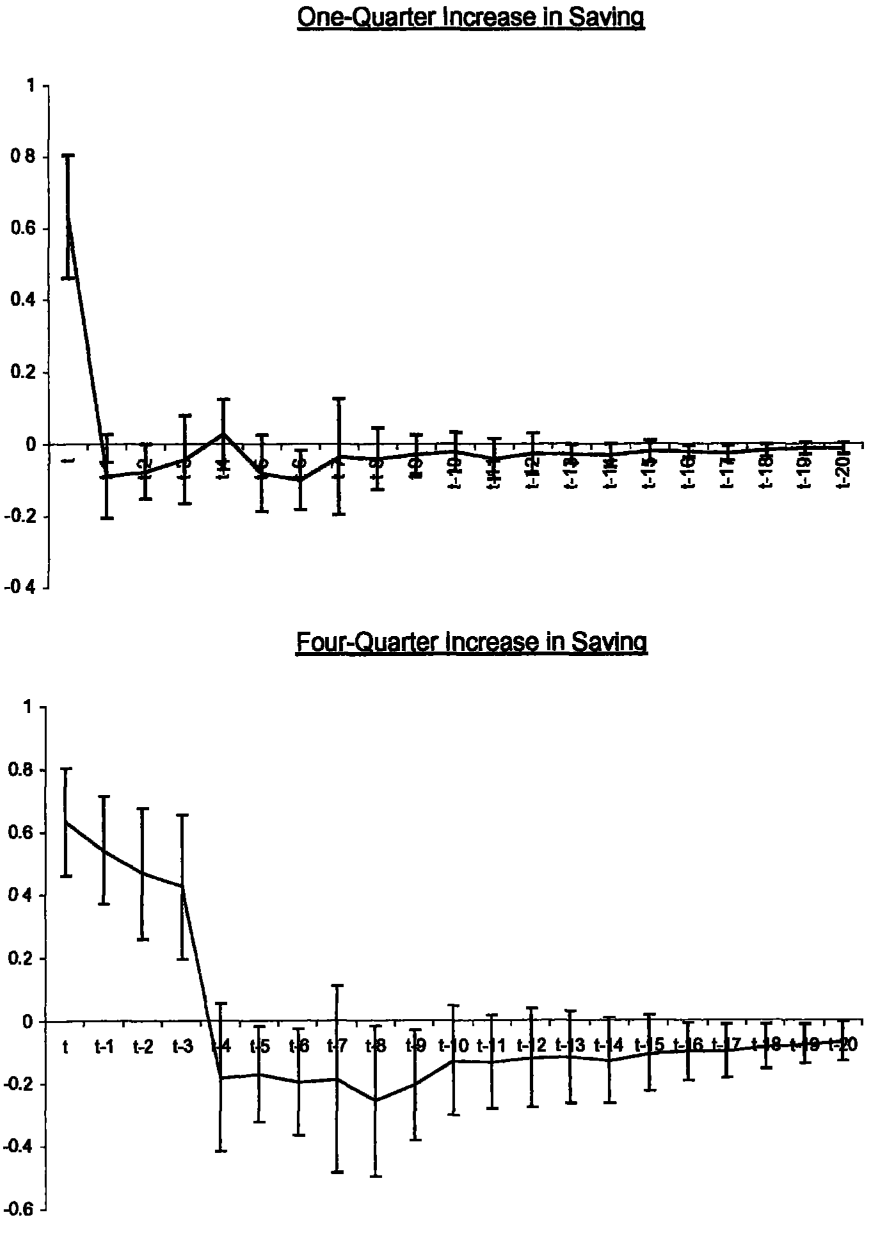
results that are qualitatively and quantitatively quite similar to those in the previous regressions. On average, the fraction of an increase in saving that is allocated to foreign assets is 0.7, and this initial shift toward foreign assets is quickly undone in subsequent periods.

One drawback of the annual data on which we have relied so far is that they are not informative about the intrayear dynamics of saving and the current account. For 12 of the countries in our sample, we were able to obtain quarterly observations on the current account, investment, and GDP beginning in 1980 or earlier from the *International Financial Statistics* and the OECD *Quarterly National Accounts*. For these countries, we linearly interpolate the annual data on the foreign asset share and use the result to construct quarterly portfolio growth and rebalancing components. We then re-estimate equation (11) using quarterly data, introducing eight lags of the portfolio-rebalancing component of the current account, and eight lags of saving. We do not have the quarterly data on population or employment growth required to introduce the same control variables as in the previous regressions with annual data (regressions 3 and 4 in Table 1). We therefore include only a set of period dummies and real GDP growth as controls.

As before, we summarize the results of these country-by-country regressions by computing the mean and standard deviation across countries of the estimated impulse responses. As shown in the top panel of Figure 9, we find that on impact, just over 60% of an increase in saving that lasts one quarter is invested abroad. Beginning immediately in the next quarter, this initial shift toward foreign assets begins to be reversed as countries run current account deficits. If we consider a shock to saving that lasts four quarters, the pattern that emerges is very similar to what we saw in the annual data. This is shown in the bottom panel of Figure 9. During the shock period, countries run positive but declining current account surpluses as they use foreign assets as a buffer stock to smooth investment. In subsequent years, countries run current account deficits in order to restore their original preshock portfolios.

To sum up, while portfolio growth explains much of the long-run variation in current accounts, portfolio rebalancing dominates in the short run. In all of our specifications, we find that the portfolio-rebalancing component of the current account follows a remarkably clear pattern. On impact, up to three-quarters of a shock to saving is invested abroad as countries use foreign assets as a buffer stock to smooth investment in the face of adjustment costs. In subsequent periods, the initial increase in saving produces current account deficits as countries shift their portfolios back to their original composition.

Figure 9 PORTFOLIO REBALANCING IN RESPONSE TO UNIT INCREASE IN SAVING (QUARTERLY DATA FOR 12 COUNTRIES)



Notes. This top (bottom) panel of this figure reports the impulse response of the portfolio-rebalancing component of the current account to a one-quarter (four-quarter) unit increase in saving implied by our estimates (11), using quarterly data for 12 OECD countries The vertical bars denote one-standard-deviation intervals around the estimated coefficients

5. The Current Account and Investment

Over the past 20 years considerable empirical effort has been devoted to documenting the correlations between investment and the current account. Two stylized facts have emerged. First, cross-country correlations between investment and the current account are weak (Penati and Dooley, 1984; Tesar, 1991). Second, within countries the time-series correlation between investment and the current account is consistently negative (Glick and Rogoff, 1995). We document that these two stylized facts hold in our sample of countries in Figure 10. In the top panel we plot long-run averages of the current account as a fraction of GDP (on the vertical axis) against long-run investment rates (on the horizontal axis) for the 21 industrial countries in our sample. Across countries, we find a very weak negative correlation between the two, with a coefficient of −0.036. In the bottom panel, we plot the same two variables expressed as deviations from country means, pooling all available annual observations. Within countries, the correlation between investment and the current account is strongly negative, with a coefficient of −0.329.[15]

This difference between the correlations between the current account and investment in the long and in the short run is consistent with the view of the current account proposed in this paper. To see this, it is useful to write the current account and investment as follows:

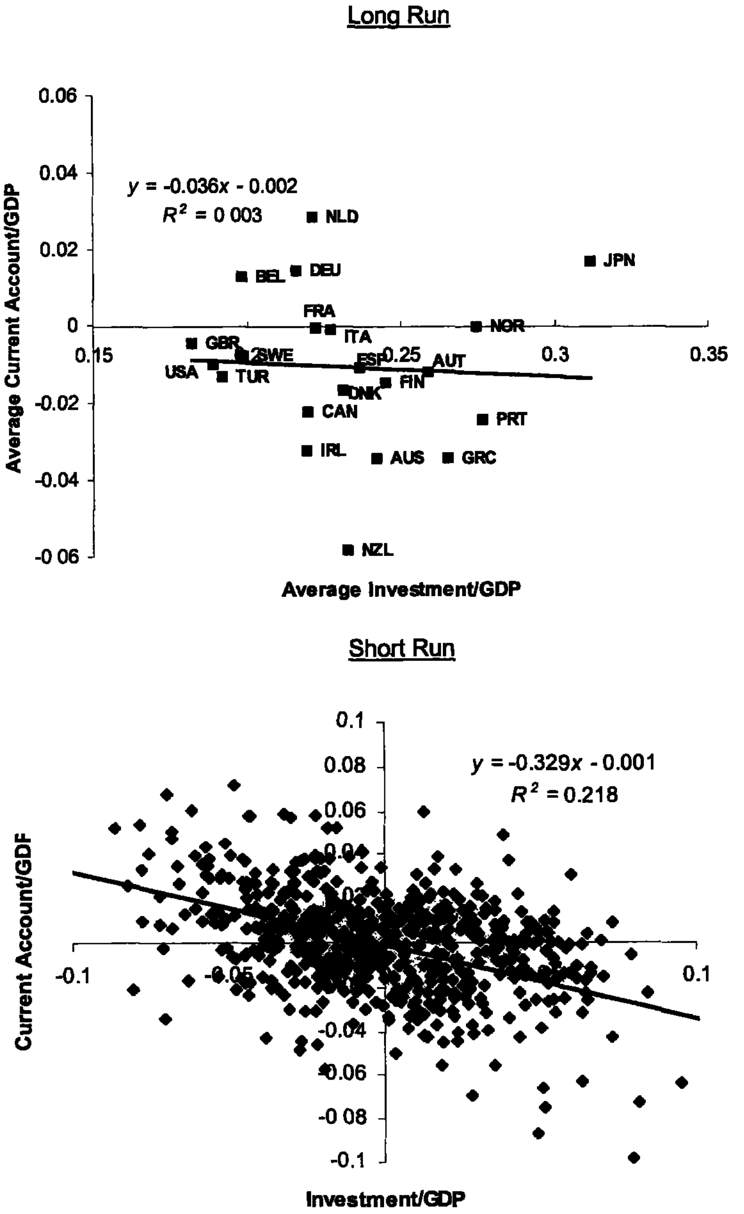
$$CA_{ct} = x_{ct}S_{ct} + PR_{ct}, \tag{12}$$

$$I_{ct} = (1 - x_{ct})S_{ct} - PR_{ct}. \tag{13}$$

These equations decompose the current account and investment into their portfolio-growth and portfolio-rebalancing components. The key observation to explain the pattern of correlations between the current account and investment is that the long-run relationship between these variables is dominated by their portfolio-growth components, while the short-run relationship is dominated by the portfolio-rebalancing components. To make this statement precise, we decompose the coefficient of a regression of the current account on investment into the contributions of portfolio growth and portfolio rebalancing. Let β be this regression coefficient, and define

15 This is almost exactly the same as the average of country-by-country estimates reported in Glick and Rogoff (1995)

Figure 10 INVESTMENT AND THE CURRENT ACCOUNT



Notes: This figure plots the current account as a share of GDP against gross domestic investment as a share of GDP, using an unbalanced panel of 21 OECD countries over the period 1966–1997. The top panel plots period averages, and the bottom panel plots deviations from country means.

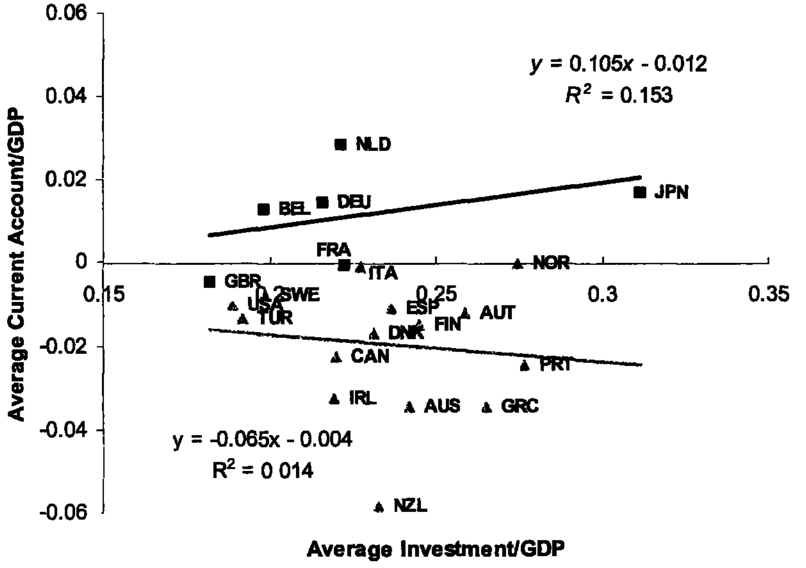
$$\beta^{PG} = \frac{\text{Cov}(xS, (1-x)I)}{\text{Var}(I)} \quad \text{and} \quad \beta^{PR} = \frac{\text{Cov}(CA, I)}{\text{Var}(I)} - \frac{\text{Cov}(xS, (1-x)\cdot I)}{\text{Var}(I)}.$$

Since $\beta = \beta^{PG} + \beta^{PR}$, we interpret β^{PG} and β^{PR} as the contributions of portfolio growth and portfolio rebalancing to the relationship between the current account and investment.

When we perform this decomposition on the between estimator in the top panel of Figure 10, we find that $\beta^{PG} = -0.041$ and $\beta^{PR} = 0.005$. Consistent with the theory, portfolio rebalancing plays no role in the long run, and the relationship between the current account and investment reflects only portfolio growth. Moreover, the theory predicts that the correlation between the current account and investment should be negative in debtor countries (where $x < 0$) and positive in creditor countries (where $x > 0$). The intuition is simple and follows immediately from the new rule: in debtor countries increases in saving generate even greater increases in investment, leading to current account deficits, while in creditor countries the increase in investment is less than that of saving, leading to current account surpluses. Since our sample of countries consists of a mixture of 15 debtor and 6 creditor countries, we should expect to find a negative but not especially strong correlation between investment and the current account in a cross section that pools all countries together. This is exactly what we found in the top panel of Figure 10. But when we divide our sample into debtors and creditors and compute the correlations separately in the two groups, we should find a negative correlation among debtors and a positive correlation among creditors. Figure 11 shows that this is the case. Of course, we have only a very small sample of creditors and debtors, and so these differences in slope should be taken with a grain of salt. Nevertheless, we note that they are consistent with the theory.

When we perform the same decomposition on the within estimator in the bottom panel of Figure 10, we find that $\beta^{PG} = -0.014$ and $\beta^{PR} = -0.315$. Consistent with the theory, portfolio rebalancing is important in the short run, and this introduces a source of negative correlation between the current account and investment. In the presence of adjustment costs, a shock to income in a given period triggers an adjustment process that lasts for many periods. In particular, a positive shock to income raises saving contemporaneously and is followed by several periods of portfolio rebalancing, as countries have higher than normal investment financed by current account deficits in order to restore their preshock portfolios. The opposite occurs when there is a negative shock. Thus positive shocks trigger a *ripple effect* of subsequent higher investment and lower current accounts, and vice versa for negative shocks. This effect is a source of negative correlation between investment and the current account within countries.

Figure 11 INVESTMENT AND THE CURRENT ACCOUNT IN THE LONG RUN IN DEBTORS AND CREDITORS



Notes: This figure plots the period average of the current account as a fraction of GDP against the period average of gross domestic investment as a fraction of GDP, using an unbalanced panel of 21 OECD countries over the period 1966–1997. The triangles (squares) correspond to countries with negative (positive) foreign assets averaged over the same period.

6. *Concluding Remarks*

By reconciling long- and short-run data, we further develop the view of the cyclical behavior of savings, investment, and the current account in industrial countries that we first proposed in Kraay and Ventura (2000). Faced with income shocks, countries smooth consumption by raising savings when income is high and vice versa. In the short run, countries invest most of their savings in foreign assets, only to rebalance their portfolios back to their original composition in the next four to five years. In the long run, country portfolios are remarkably stable, the new rule applies, and fluctuations in savings lead to fluctuations in the current account that are equal to savings times the share of foreign assets in the country portfolio. By using foreign assets as a buffer stock, countries smooth investment in order to save on adjustment costs.

An interesting implication of this view of international capital flows is that the stock of foreign assets and the current account are more volatile than consumption, investment, and the capital stock. But this does not mean that international capital flows are a factor that contributes to making macroeconomic aggregates more volatile or unstable. To the contrary, the view presented here suggests that the ability to purchase and sell foreign assets allows countries to smooth not only their consumption, but also their investment. Foreign assets and the current account absorb part of the volatility of these other macroeconomic aggregates.

Underlying the view proposed in this paper is the assumption that countries are unable or unwilling to use international financial markets to insure themselves against shocks. While few would question that this assumption is consistent with available evidence, it is certainly not consistent with existing theory. Until this inconsistency is resolved, we cannot claim a full understanding of international capital flows among industrial countries.

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Comment[1]

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1. *Introduction*

This is a very interesting paper, and it contributes to our understanding of the determination of the current account in developed countries. In a previous paper [Kraay and Ventura (2000), henceforth KV] the authors developed a theory of the current account based on portfolio theory. They considered a world in which domestic residents can save in two assets: risky domestic capital and riskless foreign bonds. If the processes governing the returns to assets do not change much over time and if there are no other frictions, the optimal share of wealth in foreign bonds is kept to a constant level that depends only on the preference parameters and on the relative risk of domestic capital. This implies that when domestic consumers accumulate an additional unit of wealth, they invest it just like their existing portfolio. Since the current account is the change in the foreign asset position of a country, their theory implies that the current account should be roughly equal to the product of domestic saving (the increase in wealth) and the current share of foreign assets in the existing country portfolio. In the previous paper the authors argued that this theory explains very well the long-run evolution of the current account.

In this paper they instead show that even though in the long run the

1 I thank Aart Kraay and Jaume Ventura for kindly providing me their data set, and Alessandra Fogli for useful comments.