The Role of Savings and Investment in Balancing the Current Account: Some Empirical Evidence from the United States

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Large and persistent external deficits often lead to calls for policy measures such as bilateral trade negotiations, tariffs, and import quotas, directed at restoring balance between exports and imports. However, current account deficits ultimately reflect a disparity between savings and investment: Fundamental national income accounting identities ensure that the current account is equal not only to the difference between exports and imports, broadly defined, but also to the difference between savings and investment (Krugman 1991). Therefore, the issue of how current account balance is achieved in practice can be viewed in terms of whether it is savings or investment that adjusts to an external imbalance.

To the extent that a country that borrows from abroad does not default on its debt obligations, high current account deficits must eventually be followed by higher national savings or lower investment. In a series of influential articles, Feldstein (1992) argued that while, in the short run, inflows of foreign capital can offset the difference between national investment and national savings, in the long run, the rebalancing of the current account occurs mainly through changes in investment. This is because a country's savings rate is, in the long run, predetermined by households' attitudes toward savings and borrowing, by the fiscal incentives for private savings, and by the public attitude toward budget deficits.[1] As such, a country's savings rate ultimately constrains the rate of investment: Low levels of national savings lead, in the long run, to low levels of investment, with potentially important implications for a country's future standards of living. Feldstein's preferred policy conclusion is that government measures aimed at raising a country's savings rate will generate an almost one-for-one increase in its long-run investment rate.

While the ability of government to permanently raise a country's savings rate remains highly controversial, it is still the case that solvency implies that permanent changes in savings or investment must lead to changes in the other variable of approximately the same amount. A change in savings or investment must be followed by future movements in savings and investment that equal the original change in present value. If the change is permanent, the only way to maintain solvency is for the other variable to adjust accordingly. Thus, the extent to which the original change in savings (investment) persists over time dictates what fraction of the adjustment to an external imbalance is borne by investment (savings).

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In this article, we examine empirically how savings and investment have responded to current account imbalances in the United States over the past 40 years. This is done by means of a simple procedure that imposes a solvency constraint at the estimation stage (see Bohn 1991). The main finding is that investment has been responsible, on average, for most of the adjustment to a current account imbalance. External deficits generated by unexpected declines in national savings were reduced in large part by subsequent declines in investment. In other words, innovations in savings exhibited a high degree of persistence. External deficits generated by unexpected increases in investment led to subsequent declines in investment that in net present value closely matched the original increase, with no long-run response in savings. Thus, innovations in investment were largely temporary.

The result that the largest fraction of the external adjustment was borne by investment is in accordance with Feldstein's view that changes in savings tend to be persistent and constrain investment in the long run. However, it should be noted that such a finding is not necessarily related to the Feldstein and Horioka (1980) claim that capital mobility is limited in the long run. The fact that permanent changes in savings lead to permanent changes in investment does not imply that the long-run level of savings must equal the long-run level of investment.

The rest of the article is structured as follows. Section I provides an overview of the relationship between savings, investment, and the current account in the United States. Section II illustrates the methodology used to empirically assess the response of future savings and investment to a change in a country's current external position. Section III applies the methodology to the United States over the past 40 years. Section IV offers concluding remarks.

I. Savings, Investment, and the Current Account

Simple national accounting identities help to shed light on the macroeconomic determinants of current account fluctuations. For this purpose, it is useful to start with the definition of a country's gross national product in period t:

$$GNP_t = Y_t + r_t B_t,$$

where Y_t is the country's gross domestic product and $r_t B_t$ denotes the country's net income from abroad, that is, the ex post return r_t earned on the stock B_t of net foreign assets entering period t. A negative value for B_t indicates that the amount of outstanding assets a country's domestic residents own abroad is less than the amount of outstanding assets foreigners own in the country, that is, the country is a net debtor vis-à-vis the rest of the world.[2] Equilibrium in the output market requires that gross domestic production equal the demand for private sector consumption, C, government spending, G, investment, I, and net demand from abroad, NX:

$$Y_t = C_t + G_t + I_t + NX_t.$$

Net demand from abroad is the excess of exports over imports, or the trade balance.

From the two previous identities it then follows that the current account, CA, conventionally defined as the sum of the trade balance and net income from

[1] See Feldstein (1992, p. 8).

[2] The stock of net foreign assets is given by the sum of net financial assets owned by the private sector (excluding the private sector's holdings of domestic capital) and of net financial assets owned by the public sector. This happens because the portion of net government debt owned by the private sector cancels out when private and public sector assets are consolidated, and the only outstanding assets remaining are those vis-à-vis the rest of the world. (See Obstfeld and Rogoff 1995.)

abroad, can also be written as the excess of gross national product over absorption:[3]

$$CA_t = NX_t + r_t B_t = GNP_t - (C_t + G_t + I_t). \quad (1)$$

In addition, note that the difference between a country's national product and private and government consumption is national savings, that is, the sum of private and government savings. As a result, the current account is also equal to the difference between national savings, S, and investment:

$$CA_t = S_t - I_t. \quad (2)$$

Viewing the current account as net exports (in a broad sense inclusive of net income from abroad) or as the difference between savings and investment is equivalent from an accounting perspective. Movements in interest rates, exchange rates, prices, and income will ensure that the decisions to export and import and to save and invest, made at a microeconomic level by a wide variety of heterogeneous economic agents, will match in the aggregate. Still, defining the current account as the difference between savings and investment is more appropriate when trying to explain enduring patterns in international capital flows.

The preceding identity also highlights the linkages between savings and investment and net international capital flows. Savings over a period of time t are in fact equal to the change in wealth from the beginning to the end of period t. Given that a nation's wealth at the beginning of period t is given by the sum of its stock of capital, K_t, and net assets from abroad, B_t, identity (2) can be rewritten as follows:[4]

$$CA_t = (B_{t+1} + K_{t+1} - B_t - K_t) - I_t = B_{t+1} - B_t, \quad (3)$$

where use has been made of the capital accumulation equation $K_{t+1} - K_t = I_t$. The identity says that the current account over a period of time t is the change in the value of net assets vis-à-vis the rest of the world. A net inflow occurs when the increase in domestic assets held by foreigners exceeds the increase in foreign assets held by domestic residents. In other terms, if domestic savings are insufficient to finance domestic investment, the excess of investment over savings will be financed by savings from abroad. Thus, the counterpart of a current account deficit is a net inflow of capital into the country that increases the country's net borrowing position vis-à-vis the rest of the world. Conversely, if domestic savings are greater than domestic investment, the excess will go to finance investment abroad. The current account surplus will result in a net outflow of capital from the country that will increase the country's net lending position vis-à-vis the rest of the world.

Both savings and investment have been lower on average during the last two decades than during the 1960s and 1970s, with the decline in savings being more pronounced.

Figure 1 highlights the evolution of savings, investment, and the current account as a percentage of GDP in the United States over the past 40 years, with savings and investment expressed in net terms.[5] The correlation between savings and investment has been extremely high, irrespective of the detrending method adopted.[6] Nonetheless, the current account has been in deficit over most of the past 20 years. As the figure shows, both savings and investment have been lower on average during the last two decades than during the 1960s and 1970s, with the decline in savings being more pronounced. The narrowing of the current account deficit in the early 1990s was achieved by a substantial decline in investment in the presence of stagnant savings, while the deterioration of the current account in more recent years was the result of a pickup in investment not matched by a comparable increase in national

[3] The sum of private consumption, government spending, and investment denotes absorption. The insight that the current account is the excess of GNP over absorption is credited to Alexander (1952).

[4] Without loss of generality, we abstract here from capital depreciation. Note that if foreigners own a portion of the country's domestic capital, domestic wealth is still equal to $B + K$ because the amount of capital owned by foreigners will enter negatively in B.

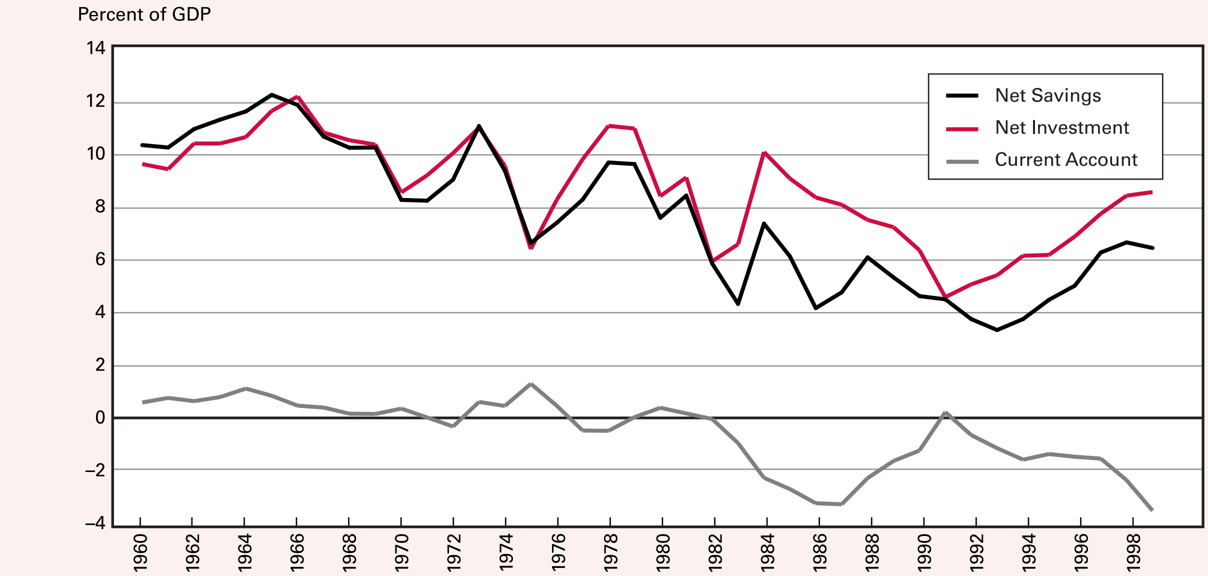
[5] Net additions to the capital stock depict a country's growth prospects better than gross additions, which include the consumption of fixed capital. Therefore, measures for investment and savings are net rather than gross.

[6] Over the full sample period considered, the correlation between savings and investment has been 0.90 in first-differences, and 0.80 after linear time detrending. The correlation drops somewhat when one considers the period from 1982 to 1998, but it still remains above 0.70.

Figure 1

U.S. Savings, Investment, and Current Account

1960 to 1999



savings.[7] Figure 2 provides a breakdown of net national savings into public and private savings, with the latter further decomposed into personal savings and retained corporate profits. The figure shows that while the current account deficits of the 1980s coincided with high budget deficits, in more recent years the external deficit has been associated with low personal savings and a resumption of budget surpluses.[8]

The U.S. experience of the 1980s and early 1990s was interpreted by Feldstein (1992) as a transition from a "short run" in which low national savings are offset by capital inflows from abroad, to a "long run" in which each dollar of persistent change in national savings "causes a nearly equal change in domestic investment" (p. 10). According to Feldstein, the national savings rate is, in the long run, the predetermined variable that constrains a country's rate of investment. Thus, absent spontaneous sustained changes in the national savings rate, current account balance is restored through changes in investment.

Since 1992, foreign investors have been financing a newly widening gap between investment and national savings. With the help of foreign capital inflows, U.S. financial markets have been able to lever a small pool of savings into a large effective increase in capital. As a result, the United States has experienced a period of sustained growth over the past eight years. Still, the remarkable output performance has been accompanied by a deterioration of the external position, and with net international indebtedness estimated to have reached almost 20 percent of GNP at

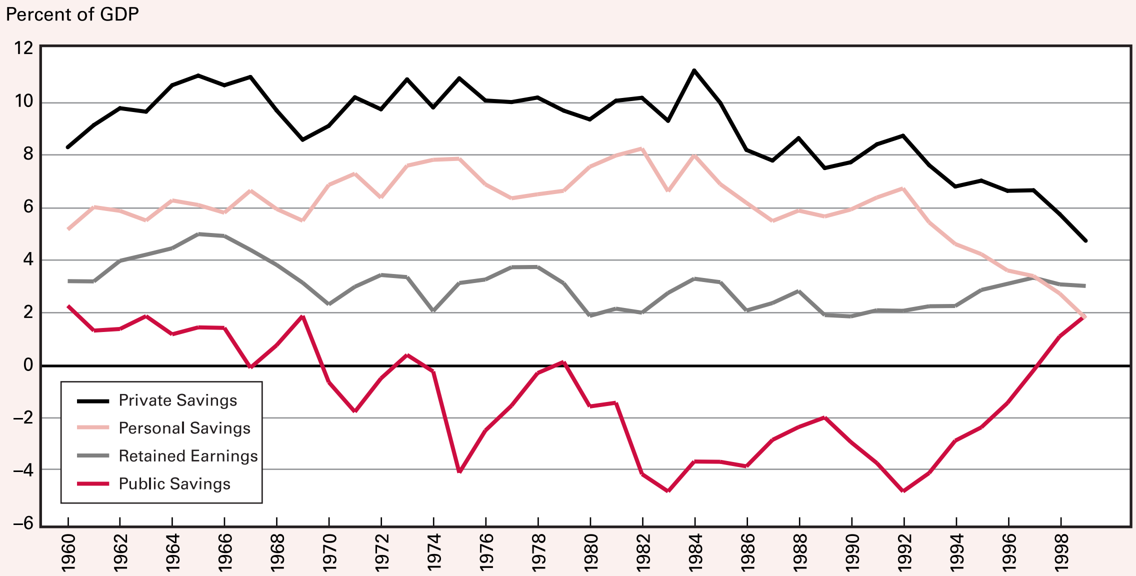
[7] Note that the current account depicted in Figure 1 is not precisely equal to the difference between savings and investment, as per equation (2). The discrepancy between the two measures is the difference between gross domestic product and gross domestic income. While these two quantities should be the same, they originate from different data sources, and as such they have, on some occasions, differed significantly. In addition, the current account measure shown in the figure is not necessarily a good approximation to the theoretically correct definition. In fact, the evolution of a country's net foreign assets position should record not only new inflows and outflows of capital, but also changes to the value of net foreign assets generated by capital gains and losses. Unfortunately, NIPA definitions of national income do not reflect such changes, and all the empirical work on current account fluctuations inevitably suffers from this shortcoming, especially when the period under consideration is characterized by high capital mobility. (See Mann 1999; Obstfeld and Rogoff 1995.)

[8] This recent development illustrates that it is difficult to argue for a simple causal relationship from budget to current account deficits.

Figure 2

U.S. Gross Private and Public Savings

1960 to 1999



the end of 1999,[9] the United States has turned from the world's largest creditor into the world's largest debtor.

As the next section will show, solvency requires that current account deficits eventually be followed by higher national savings or by lower investment. Of course, the way in which this adjustment will play out in the future crucially depends on the type of shocks that affect the U.S. economy. For example, if improvements in productivity are playing an important role, then the adjustment process entails both a decline in the rate of investment, once the new optimal level of capital has been reached, and an increase in the rate of personal savings.[10] However, if the current low level of personal savings depicted in Figure 2 is not the reflection of consumers learning about a high level of output in the future, but of a permanent shift in the preferences of the typical household, then the adjustment process will be different. Low personal savings in this scenario reflect a long-run tendency, and as such the brunt of the adjustment must be borne entirely by investment, absent further improvements in public savings. The rebalancing of the current account then entails, as Feldstein argued with respect to the experience of the 1980s and early 1990s, a drop in investment with no significant change in national savings.

While addressing the issue of which kind of adjustment process for the current account is more likely to occur is beyond the scope of the present article, the next section provides a framework for analyzing the average behavior of investment and national savings in balancing the current account over the past 40 years.

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[9] In terms of this section's notation, net international indebtedness is measured by a negative value for B.

[10] The decline in investment and the rise in national savings (through an increase in personal savings) are to be interpreted as ratios of GDP. The increase in personal savings does not require a decline in consumption levels, because higher future income allows people to save more. In the short run, an increase in productivity induces firms to invest more, and the increase in capital eventually translates into higher income for consumers. Still, because of the time required to build capital infrastructure, income can adjust only gradually to its new higher level. If consumers anticipate this higher future income, they will decrease their current savings and start to consume more. The gap between investment and national savings is then financed by an inflow of foreign funds. (See Glick and Rogoff 1995.)

II. Methodology[11]

From the identities (1) to (3) in the previous section, the current account can be written as follows:

$$B_{t+1} - B_t = rB_t + Y_t - C_t - G_t - I_t + \epsilon_t, \quad (4)$$

where ϵ is an error term that stems not only from approximating the rate of return on foreign assets by a constant number r, but also from the presence of measurement error. A country's ability to borrow from abroad is directly linked to the ability to repay its debt obligations. It is possible to show that solvency implies the following relationship between a country's outstanding level of external debt and its current and future resources:[12]

$$-(1+r)B_t = \sum_{s=t}^{\infty}\left(\frac{1}{1+r}\right)^{s-t} \mathrm{E}_t(Y_s - C_s - G_s - I_s + \epsilon_s), \quad (5)$$

where E_t denotes the expectation operator conditional on all information available at time t. The quantity $Y - C - G - I$ is the trade balance, NX. This is also equal to the difference between domestic savings less net income from abroad, $Y - C - G$, and investment. As such, it represents the net transfer of resources to foreigners each period.

The intertemporal budget constraint described by equation (5) then states that a country's initial external debt, the left-hand side of the equation, must equal the present discounted value of the country's resource transfers to foreigners. Thus, the intertemporal budget constraint holds when a country repays its external debt by having future national savings (less net income from abroad) exceed future investment by a sufficient amount in net present value. As the infinite sum on the right-hand side of equation (5) shows, solvency restricts the behavior of the external debt in the very long run only. While the constraint does not prevent a country from running external deficits for extended periods of time, it does not allow the country to continually borrow to meet the interest payments on its debt obligations without ever transferring real resources to its foreign creditors.

Note also that the intertemporal budget constraint (5) restricts the responses of savings and investment in the long run. Since the initial level of external debt is a predetermined quantity, an increase in current investment not matched by a change in current national savings must either be reversed, or eventually be followed by an increase in national savings. The future increase in national savings and the future decline in investment have to match, in net present value, the increase in current investment. Similarly, a decline in current savings not matched by a change in current investment must either be reversed or eventually be followed by a decline in investment, with such adjustments matching in net present value the decline in current savings.

This point can be illustrated more formally as follows.[13] For any variable X, denote the first-difference by $\Delta X_t = X_t - X_{t-1}$, and the present discounted value of future realizations by

$$PV(X)_t = \sum_{j=1}^{\infty}(1+r)^{-j}X_{t+j}.$$

The intertemporal budget constraint then becomes:

$$-CA_t = \mathrm{E}_t PV(\Delta S')_t - \mathrm{E}_t PV(\Delta I)_t + \mathrm{E}_t PV(\epsilon)_t, \quad (6)$$

where S' is national savings less net income from abroad.[14] In the remainder of this section and in the next, we will generically refer to savings but, unless otherwise noted, this should be interpreted as national savings less net income from abroad. Abstracting for now from the error term, the constraint says that high current account deficits today must ultimately be followed by future increases in savings and/or future declines in investment. In terms of *innovations* at time t in a variable and its present value, denoted by $\hat{X}_t = X_t - \mathrm{E}_{t-1}X_t$ and $P\hat{V}(X)_t = \mathrm{E}_t PV(X)_t - \mathrm{E}_{t-1}PV(X)_t$, respectively, equation (6) can be restated in the following way:

$$\Delta\hat{S}'_t + P\hat{V}(\Delta S')_t = \Delta\hat{I}_t + P\hat{V}(\Delta I)_t + r\Omega_t, \quad (7)$$

[11] Bohn (1991) first proposed the method described in this section to examine whether government budget balance in the United States was historically achieved through tax or spending adjustments.

[12] Equation (5) can be obtained by iterating equation (4) forward and imposing the solvency condition $lim_{t\to\infty}(1+r)^{-t}B_{t+1} = 0$. This condition ensures that net foreign debt grows over the long run at a rate that is strictly less than the rate of interest. For this reason, the requirement is often called the no-Ponzi-game condition.

[13] *Mutatis mutandis*, the discussion follows Bohn (1991, pp. 339–43), to which the reader is referred for a more detailed analysis.

[14] That is, $S' = S - rB = Y - C - G$.

where Ω_t is an error term that depends on ϵ_t and its expected present discounted value. Writing a country's intertemporal budget constraint as per equation (7) is particularly revealing, since one can show that a permanent innovation in a variable at time t is equal to $\Delta\hat{X}_t + P\hat{V}(\Delta X)_t$. (See Bohn 1991.) The constraint then indicates that, aside from movements in the error term, permanent changes in domestic savings and investment must be equal. Thus, an innovation in savings or investment, to the extent that it is permanent, must lead to an identical permanent change in the other variable.

Consider then an innovation in current savings, $\Delta\hat{S}'_t$, not matched by changes in current investment and the error term. If the innovation is permanent, it will generate later revisions in investment in the amount $\Delta\hat{S}'_t = P\hat{V}(\Delta I)_t$. If the innovation is instead temporary, later revisions in savings must be such that $\Delta\hat{S}'_t = -P\hat{V}(\Delta S')_t$. In intermediate cases in which the innovation is partly temporary and partly permanent, future changes in investment will match the permanent component of the innovation, that is, $\Delta\hat{S}'_t + P\hat{V}(\Delta S')_t = P\hat{V}(\Delta I)_t$.

The presence of the error term, Ω, in equation (7) has the consequence that future revisions in savings, $P\hat{V}(\Delta S')_t$, and investment, $P\hat{V}(\Delta I)_t$, will in general not add up exactly to the innovation in current savings, $\Delta\hat{S}'_t$. In the next section, it will be shown that, in practice, approximating the return on net foreign assets by a constant leads to fairly small discrepancies between future revisions in savings and investment and current innovations.

The Box details the way in which the responses of future savings and future investment to current innovations in savings or investment are computed in practice. This involves estimating a vector autoregression (VAR) that includes in the information set the first-difference of savings, the first-difference of investment, the current account, and possibly other variables. In the VAR, each variable in the information set (with the exclusion of the current account) is regressed on lagged values of all the other variables. It is then possible to compute impulse-response functions of savings and investment to unanticipated shocks in savings or investment. Such a procedure also generates estimates for $P\hat{V}(\Delta S')_t$ and $P\hat{V}(\Delta I)_t$, since these measures are discounted sums of the values taken by the impulse-response functions at different horizons.

Table 1
VAR Estimates

Panel A

Regressor variable	Equation 1 Dependent variable: ΔI Coefficient	t-statistic	Equation 2 Dependent variable: $\Delta S'$ Coefficient	t-statistic
ΔI (−1)	.200835	.644	.531705	2.003
$\Delta S'$ (−1)	−.356321	−.969	−.498323	−1.770
CA' (−2)	.156182	1.103	−.098347	−.572
R^2	.0977		.1234	

Panel B

Regressor variable	Equation 1 Dependent variable: ΔI Coefficient	t-statistic	Equation 2 Dependent variable: $\Delta S'$ Coefficient	t-statistic
ΔI (−1)	−.167444	−.552	.265804	.885
$\Delta S'$ (−1)	−.156555	−.420	−.354092	−1.262
ΔA^C (−1)	.264621	3.386	.191015	2.399
CA' (−2)	.324933	2.450	.023491	.138
R^2	.3368		.2581	

Note: All regressions include a constant, and the number of observations is 37. The variable ΔA^C denotes the percentage change in U.S.-specific manufacturing productivity (see Section III). All other variables are defined in the text.

Note that so far we have not specified whether the variables that enter the identities and constraints (1) to (7) are real or nominal, or are expressed as a ratio of GNP. In principle, any of these definitions would be appropriate. In the empirical section that follows, however, in order to mitigate potential heteroskedasticity problems, we will scale nominal savings, investment, and the current account by nominal GNP.

III. Empirical Results

We now examine the estimated response of future revisions in savings and investment to innovations in their current values. The goal is to assess the persistence of the innovations. As shown in the previous section, solvency implies that any permanent change in investment or savings must lead to a change of the same amount in the other variable. A temporary innovation will instead be reversed in subsequent periods.

The average response of future savings and investment to current innovations is estimated on annual data over the period 1960 to 1998. Table 1 provides estimation results for the VARs involving the first-differences of savings and investment on which

Estimating the Responses of Future Savings and Investment to Current Innovations

We here briefly describe the way in which innovations in current savings, investment, and their present values are computed. (See also Bohn 1991.) This is done by estimating a vector autoregression (VAR) where, for illustrative purposes, we assume that an autoregression of order 1 adequately captures the historical behavior of the first-difference of savings and investment. The VAR takes the following form:

$$\begin{bmatrix} \Delta S'_t \\ \Delta I_t \\ \mathbf{Z}_t \\ CA'_{t-1} \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{14} \\ a_{21} & a_{22} & a_{23} & a_{24} \\ \mathbf{a}_{31} & \mathbf{a}_{32} & \mathbf{a}_{33} & \mathbf{a}_{34} \\ 1 & -1 & 0 & -1 \end{bmatrix} \begin{bmatrix} \Delta S'_{t-1} \\ \Delta I_{t-1} \\ \mathbf{Z}_{t-1} \\ CA'_{t-2} \end{bmatrix} + \begin{bmatrix} u_{S',t} \\ u_{I,t} \\ \mathbf{u}_{Z,t} \\ 0 \end{bmatrix} \tag{A.1}$$

The last row of the system consists of the identity:

$$CA'_{t-1} = \Delta S'_{t-1} - \Delta I_{t-1} - CA'_{t-2},$$

where $CA' = S' - I$ is the current account less net income from abroad, or the trade balance. In what follows and in Section III we will generically refer to the current account but, unless otherwise noted, this should be interpreted as the trade balance. As written, the VAR assumes that S' and I are nonstationary in levels but stationary in first-differences. Such an assumption is borne out by the data when S' and I are expressed as a ratio of *GNP.*

In addition, the last row of the system implies that the linear combination of S' and I that gives rise to CA' is stationary, that is, S' and I are cointegrated with cointegrating vector (1, −1).[a] Over the period 1960 to 1998, the assumption of stationarity of CA' as a ratio of *GNP* cannot be rejected at standard confidence levels when one controls for changes in U.S.-specific manufacturing productivity (see Section III). Moreover, a regression of S' on I results in an estimated coefficient for investment that is not significantly different from the cointegrating restriction (1, −1) assumed in the last row of the system for the vector (S', I).

In the VAR, the sub-vector $\mathbf{Z}_t$ denotes additional variables pertaining to the time t information set that are useful for predicting the future path of savings and investment. The non-zero elements in the last column on the right-hand side of (A.1) are white-noise disturbances. Ordinary least squares are used separately for each row i of the system (except the last) to estimate the coefficients $a_{i\bullet}$. In compact form, the system (A.1) can be written as follows:

$$\mathbf{Y}_t = \mathbf{A}\mathbf{Y}_{t-1} + \mathbf{u}_t, \tag{A.2}$$

where $\mathbf{Y}_t = (\Delta S'_t, \Delta I_t, \mathbf{Z}_t, CA'_{t-1})$, $\mathbf{u}_t = (u_{S',t}, u_{I,t}, \mathbf{u}_Z, 0)$, and $\mathbf{A}$ is the square matrix of coefficients. Obviously, the time t innovation in S' (or I) is given by $u_{S',t}$ ($u_{I,t}$).

Moreover, if $\mathbf{h}_{S'}$ is the vector that selects $\Delta S'$ from $\mathbf{Y}$, the time t innovation in the present discounted value of $\Delta S'$ is given by the following expression:

$$P\hat{V}(\Delta S')_t = \mathbf{h}_{S't}(1 + r)^{-1}\mathbf{A}(\mathbf{I} - \mathbf{A}(1 + r)^{-1})^{-1}\mathbf{u}_t, \tag{A.3}$$

where $\mathbf{I}$ is an identity matrix of the same size as $\mathbf{A}$. Similarly, to obtain the time t innovation in the present discounted value of ΔI, it is necessary to replace, on the right-hand side of (A.3), $\mathbf{h}_{S'}$ with the vector $\mathbf{h}_I$ that selects ΔI from $\mathbf{Y}$. It then follows that the marginal effect of an innovation in I on the present discounted value of $\Delta S'$ is the element (1,2) of the matrix $(1 + r)^{-1}\mathbf{A}(\mathbf{I} - \mathbf{A}(1 + r)^{-1})^{-1}$. Conversely, the marginal effect of an innovation in S' on the present discounted value of ΔI is the element (2,1) of the same matrix.

[a] Note that the solvency constraint as written in equation (6) in the text requires the current account, CA, to be stationary, and the existence of a cointegrating relationship among S', I, and B, with cointegrating vector (1, −1, r). Here, on the grounds that B enters into the cointegrating vector with a small weight, we reduce the dimensionality of the system by approximating the current account CA by the trade balance, CA', and by excluding B from the system. Given the few observations available, such a shortcut also allows us to preserve degrees of freedom at the estimation stage.

the estimated impulse-responses are based. The minimal information set must include current and lagged values of the first-differences of savings and investment as ratios of GNP, and current and lagged values of the current account as a ratio of GNP. Panel A of the table reports estimates based on such a minimal information set. An autoregression of order 1 adequately describes the dynamics of savings and investment, in that the estimated residuals appear to be white noise.[15] Of particular interest for our purposes is the estimated coefficient for the lagged current account in both equations for savings and investment.

The solvency constraint as written in equation (6) in the previous section shows that high current account deficits must eventually be followed by higher savings and/or lower investment. Thus, one would expect to find an estimated negative coefficient for the lagged current account in the savings equation and an estimated positive coefficient in the investment equation. As panel A of the table shows, point estimates for the lagged current account conform to such a presumption, but estimated standard errors are very large and do not allow rejection of any interesting hypothesis.[16]

There are several potential explanations for this result. The intertemporal budget constraint restricts the behavior of savings and investment in the long run only, and it is possible that the sample period considered here is not long enough. In addition, short-run business cycle dynamics not accounted for in the regressions could obscure longer-term adjustments. As is well known, the current account varies systematically over the business cycle, and omitting a cyclical indicator could bias the estimated effect of the current account on future changes in savings and investment.

To investigate this last issue, we augment the previous regressions by including an indicator of the relative performance of the United States vis-à-vis the rest of the G-7 countries. The indicator is given by the (log of the) first-difference of U.S.-specific manufacturing productivity. Such a measure is constructed as the residual of a regression of U.S. manufacturing productivity on a weighted average of manufacturing productivity in the remaining G-7 countries. It is therefore the component of productivity that is specific to the United States, in the sense that it cannot be explained by contemporaneous productivity developments in the rest of the G-7 countries.

While the present analysis does not aim at distinguishing between alternative models of current account behavior, we here note that a broad class of theoretical frameworks predicts that country-specific changes in productivity should be negatively correlated with the current account, as is the case in actual practice. This is true, for example, in the context of a neoclassical setup with adjustment costs in the stock of capital (see Glick and Rogoff 1995).[17] To the extent that country-specific movements in manufacturing productivity provide a good proxy for a country's relative position in the business cycle vis-à-vis the rest of the world, the prediction of a negative correlation between country-specific productivity and current account fluctuations is also borne out in a standard Keynesian framework.[18]

Controlling for U.S.-specific variations in the business cycle, high current account deficits signal lower future investment. In contrast, high current account deficits do not signal future higher domestic savings.

[15] The lag-length is chosen optimally in accordance with the Akaike information criterion. Including an additional lag does not affect any of this section's results.

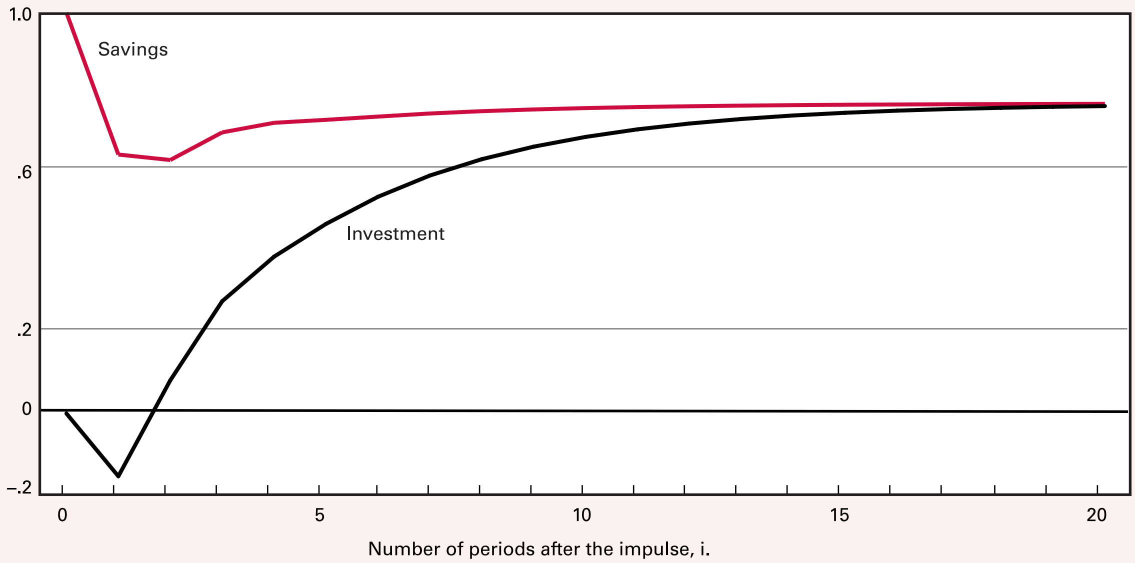
[16] Panel A in Table 1 also shows that the fit for the two equations is very poor.

[17] The intuition for why productivity changes influence the current account behavior in a neoclassical framework is given in footnote 10. Note, however, that only *country-specific* productivity shocks should exert a sizable impact on the current account. The reason is that if an increase in productivity is generalized to all the countries, then all consumers will simultaneously try to dissave. This entails an increase in the real interest rate that restores equilibrium between savings and investment, with no effect on each country's current account. Such a result holds precisely when all countries are symmetric. When this is not the case, a global productivity shock will affect each country's current account. However, the result that country-specific shocks should have a larger impact on the current account than global shocks still holds true on the grounds that the latter tend to move the world real interest rate in such a way as to restore equality between national savings and investment. (See Glick and Rogoff 1995.)

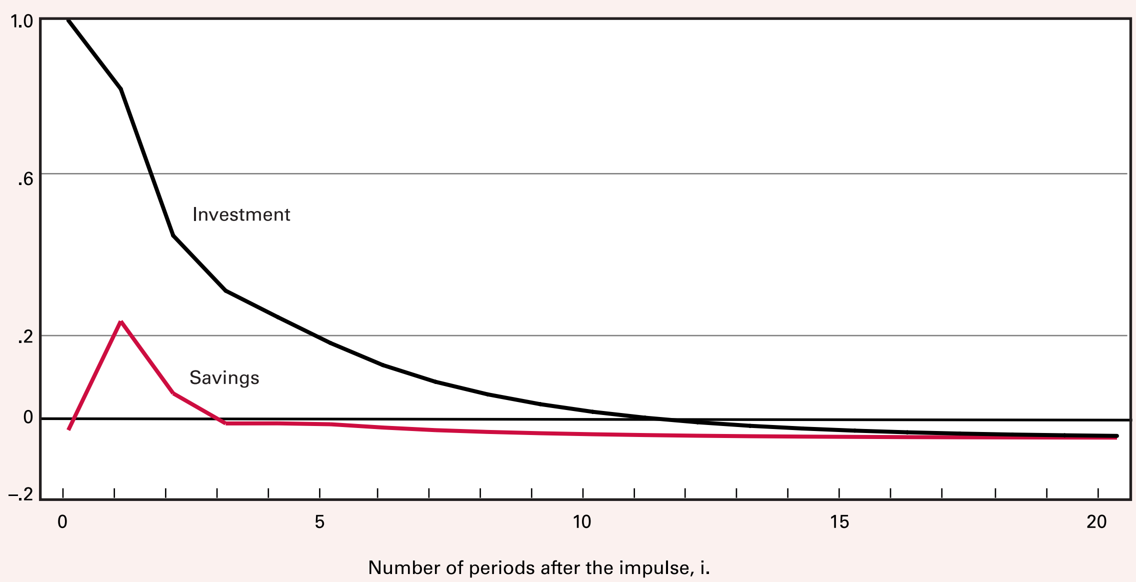
[18] This is true if one is willing to assume enough symmetry in import elasticities across countries. Then, a generalized increase in output across all countries should have little impact on a country's current account, since it would lead to an equal increase in both exports and imports. Instead, a country-specific increase in output should have first-order effects on the country's imports, thus leading to a deterioration in the country's external position.

Figure 3

A. Unit Shock to Savings: Responses of Savings and Investment after i *Periods*



B. Unit Shock to Investment: Responses of Savings and Investment after i *Periods*



Panel B of Table 1 provides estimation results when the minimal information set is augmented by including the (log of the) first-difference of U.S.-specific manufacturing productivity. Note that the estimated coefficient for the lagged current account in the equation for investment is now significant at standard confidence levels. Thus, when one controls for U.S.-specific variations in the business cycle, high current account deficits predict lower future investment. Still, the estimates indicate that the balancing of the current account is borne by investment only. The coefficient for the lagged current account in the savings equation is in fact insignificantly different from zero in both statistical and economic terms, implying that high current account deficits do not signal future higher domestic savings.

In sum, over the sample period considered, unexpected changes in savings tended to be persistent and generated persistent movements in investment.

Of course, the implications for current account adjustment stemming from the estimation in panel B of Table 1 are conditional on the information set we have chosen, and thus sensitive to a potential omitted variable bias. While such a possibility should be kept in mind when evaluating the results, controlling for other measures of cyclical variation and for the stance of fiscal policy does not lead to different estimation outcomes.[19]

Not surprisingly, the difference between the estimated average historical behavior of savings and investment outlined thus far foreshadows some of the results reported next. Panel A of Figure 3 shows the estimated impulse-responses of savings and investment following an unexpected unitary change in $\Delta\hat{S}'_t$.[20] The chart illustrates that the innovation in savings is only partially reversed in subsequent periods. In fact, over 70 percent of the original change appears to be persistent. This implies, as the figure shows, that investment must adjust to the innovation in savings. In the first period after the original unitary change, the sign of investment's response is opposite to the innovation in savings, but in subsequent periods the sign of the response is reversed, and investment moves toward rebalancing the current account. The response of the present discounted value of future changes in investment, $P\hat{V}(\Delta I)_t$, to a unitary change in savings is estimated at 0.73 when the real return on net foreign assets is set equal to 2 percent. For the same unitary shock, the estimated response of the present discounted value of future changes in savings, $P\hat{V}(\Delta S')_t$, is -0.23. As equation (7) in the previous section shows, this leaves a relatively small amount, 0.04, to the error term Ω_t.[21]

Panel B of Figure 3 reports the estimated impulse-responses of savings and investment following an unexpected unitary change in ΔI_t. In contrast to the innovation in savings, the innovation in investment is temporary, in that it is completely reversed in subsequent periods. The estimated response of the present discounted value of future changes in investment, $P\hat{V}(\Delta I)_t$, to the original unitary change is in fact equal to -0.97. As the estimated response for savings illustrates, no adjustment in savings is needed in the long run, and the hypothesis that an unexpected change in investment does not cause long-run changes in savings cannot be rejected at standard confidence levels. The error term Ω_t again plays a small role, in that it accounts for less than 0.04 of the adjustment process.

In sum, over the sample period we considered, innovations in savings tend to be persistent and generate persistent movements in investment. On average, a 1 percentage point decline in savings as a ratio of GNP signals a permanent decline in the ratio of investment to GNP of about 0.7 percentage point. Conversely, a 1 percentage point increase in investment signals a future decline in investment of approximately the same amount in net present value, with no long-run response in savings.

[19] Specifically, controlling for the change in GDP in both the United States and in the rest-of-G-7, or for U.S. government budget deficits and government expenditures, does not affect the results reported in panel B of Table 1. None of these variables enter the regressions significantly when one already controls for U.S.-specific changes in manufacturing productivity, nor do they affect in a sizable way the other estimated coefficients.

[20] The estimated impulse responses in Figure 3 are based on the VAR reported in Panel B of Table 1.

[21] In the experiment we are considering, $\Delta S'_t = 1$ and $\Delta I_t = 0$. For higher values of r, the error term becomes much more sizable. This might have to do with the fact that the United States, despite having an increasingly *negative* stock of net foreign assets since the mid 1980s, has until recently collected a *positive* stream of income from these assets.

IV. Conclusions

This article investigates the way in which investment and savings have responded, on average, to current account imbalances in the United States over the past 40 years. The exercise is conducted in the context of a simple and general framework that imposes a solvency constraint at the estimation stage. The constraint requires that current and future resource transfers to foreigners equal a country's initial debt vis-à-vis the rest of the world. Thus, any innovation in current savings and/or investment must be followed by future changes in savings and investment that match the current innovation in net present value. The issue addressed by the paper is the fractions of the adjustment that are, on average, borne by investment and by savings.

We find that investment was largely responsible for rebalancing the current account in the long run. Unexpected changes in national savings tended to be persistent, thus inducing long-run changes in investment in the same direction that restored external balance. Innovations in investment were instead mostly temporary and tended to be reversed in subsequent periods. No long-run adjustment in savings occurred.

The finding that investment has borne the largest fraction of the external adjustment accords with Feldstein's (1992) view that the savings rate is, in the long run, the predetermined variable that constrains domestic investment. As a result, in a situation with outstanding net external debt, low levels of national savings ultimately imply low levels of domestic investment to satisfy the solvency constraint. To the extent that one views net additions of capital as essential for future growth prospects, low savings may signify a reduction in future standards of living.

As with most empirical work, the evidence presented in this study comes with some caveats. In particular, the findings depend on the sample period we have chosen. Solvency constrains the behavior of savings and investment in the very long run only, and it does not prevent a country from running current account deficits for extended periods of time. Thus, one cannot rule out that, in a situation with high net foreign debt, an adjustment in domestic savings will occur at some time well into the future. Still, the econometrician may not have evidence of a savings adjustment in his limited sample period. For this reason, future research should be aimed at examining the robustness of the findings in longer data sets.

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