

Investment-Saving Comovement under Endogenous Fiscal Policy

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Key words: investment, saving, capital mobility, endogenous fiscal policy

Abstract

I expand Feldstein's (1983) model by including flexible exchange rate and by introducing endogenous fiscal policy. Using this model, I demonstrate how a positive investment-saving correlation can arise in a world with endogenous fiscal policy. I show that this correlation does not depend on capital mobility and therefore is compatible with any degree of capital mobility. This implies that the observed investment-saving comovement is not necessarily due to imperfect capital mobility. The model has a testable implication: it predicts a lack of Granger causality from private saving to private investment. Empirical examination of this prediction indicates that U.S. time series data is compatible with the hypothesis of endogenous fiscal policy during a flexible exchange rate period, but not during a fixed exchange rate period.

In a closed economy, private investment can only be financed by domestic saving and therefore investment and saving will be correlated. However, in an open economy, at least part of the investment can be financed by foreign saving. Therefore, in an open economy, national saving and investment may in principle diverge and move independently of each other. However, the empirical findings by Feldstein and Horioka (1980) and Feldstein (1983) indicate that investment and saving are highly correlated across countries. They interpret these findings as evidence of a lack of perfect capital mobility.¹ This interpretation of the investment-saving comovement has been very controversial and a significant number of studies disagree with it since it is in contrast with the general deregulation of capital markets and increased integration of world financial markets that took place over the last 20-30 years.²

Several authors, like Tobin (1983), Westphal (1983), Roubini (1988), and Summers (1988), have offered an alternative explanation for the investment-saving comovement. If the government is concerned about balancing a current account deficit, it can set the size of its spending (or its budget deficit) endogenously by reacting to the gap between private saving and investment. If the government uses such an endogenous fiscal policy, then private investment and national saving will also be correlated; that is, this will be true regardless of the degree of capital mobility.

From a theoretical point of view, standard Keynesian macroeconomic theory assigns the government budget an exogenous policy role. However, its discretionary use by governments for stabilization purposes implies that policy makers actually

react to events and situations occurring in the economy. This makes Keynesian fiscal policy endogenous. In the new classical framework fiscal policy is treated in a similar manner except that the emphasis is on unanticipated implementation of the policy.³

Whether the government's budget policy is exogenous or endogenous is important because of its policy implications in the context of investment-saving correlation: Feldstein and Horioka's (1980) finding that variations in saving are associated with variations in investment, implies that under exogenous fiscal policy a reduction in the U.S. budget deficit will not improve external balance; rather it will increase investments. This conclusion, however, is not necessarily correct if fiscal policy is endogenous in the sense described above.⁴

In this paper I present a variant of a standard neoclassical model modified for a large open economy with flexible exchange rates. Using the model, I analyze the implications of perfect capital mobility and immobility for the investment-saving relationship and the crowding out effects of expansionary fiscal policy on investment and trade balance.

The model presented here is an extension of the model discussed in Feldstein (1983). The present model expands beyond Feldstein's model by explicitly introducing the market for foreign exchange as well as by addressing the role of fiscal policy in the context of investment-saving comovement. Unlike Feldstein (1983), who implicitly assumes that fiscal policy is exogenous, I allow for the possibility of endogeneity in the conduct of fiscal policy.

The model demonstrates how a positive investment-saving correlation can arise in a world with endogenous fiscal policy. Since this correlation does not depend on capital mobility and is therefore compatible with any degree of capital mobility, I conclude that tests of long-term capital mobility that are based on investment-saving correlation are not likely to be informative about the true degree of international capital mobility.

I also discuss testable implications of the model. In particular, I show that an endogenous fiscal policy hypothesis of the type considered in this paper predicts a lack of Granger causality from private saving to private investment. Empirical examination of this prediction indicates that the U.S. time series data is compatible with the hypothesis of endogenous fiscal policy during a flexible exchange rate period, but not during a fixed exchange rate period. The implication is that the observed investment-saving correlation in the U.S. time series may indeed be a result of an endogenous fiscal policy.

The paper is organized as follows. Section 1 describes the structure of the model. In section 2 the implications of the model are analyzed under the assumption of exogenous fiscal policy. In section 3, the implications of the model are analyzed under the assumption of endogenous fiscal policy. In section 4, testable implications of the model are empirically examined using the U.S. time series data. The paper ends with conclusions.

1. The model

Following Feldstein (1983), assume that the demand for gross domestic investment, I , is a decreasing function of real interest rate, r :

$$I = I(r) + \xi_I \quad I' < 0 \quad (1)$$

where ξ_I is a zero mean random term with constant variance. Supply of private saving, PS , is an increasing function of the real interest rate:

$$PS = S(r) + \xi_S \quad S' > 0 \quad (2)$$

where ξ_S is a zero mean random term with constant variance. I assume that the correlation between ξ_I and ξ_S is zero. I make this assumption in order to focus on the role of fiscal policy in generating investment-saving comovement. Otherwise we need to address a possibility of a "common cause" mechanism, which is beyond the scope of this paper. For a discussion and empirical analysis of the common cause theory, see Levy (1991).

Exports, X , and imports, M , depend on the real exchange rate, R , and are given by (3) and (4):

$$X = X(R) + \xi_X \quad X' > 0 \quad (3)$$

$$M = M(R) + \xi_M \quad M' < 0 \quad (4)$$

where ξ_X and ξ_M are random shocks with zero mean and constant variance.

From national income accounting, net exports, NX , equal net capital outflow (net foreign investment), F , which in turn is defined as capital outflow, F_o , minus capital inflow, F_i , and is a decreasing function of the real interest rate. Thus,

$$F = F_o - F_i = F(r) + \xi_F \quad F' \leq 0 \quad (5)$$

where ξ_F is a zero mean random term with constant variance. In case of perfect capital mobility, $F' = -\infty$, and if capital is completely immobile, then $F' = 0$.

2. Exogenous fiscal policy

Now assume that the government's receipts are fixed at T_0 , and that the expenditures, G , are set exogenously. The budget deficit is given by

$$G - T = G_0 + \xi_G - T_0 \quad (6)$$

where ξ_G is a random fiscal policy shock with zero mean and constant variance. The model is closed by the national income identity

$$[PS - (G - T)] - I = X - M \quad (7)$$

which states that the excess of national saving over investment must match the trade balance. Since $F = X - M$, (3), (4), and (5) imply that

$$F(r) + \xi_F = X(R) + \xi_X - M(R) - \xi_M \quad (8)$$

which after total differentiation and rearrangement, yields

$$dR = \frac{F' dr - d\xi_X + d\xi_M + d\xi_F}{X' - M'} \quad (9)$$

Since $X' > 0$, and $M' < 0$, the denominator in (9) is always positive. Therefore, equation (9) implies that

$$\frac{dR}{dr} = \frac{F'}{X' - M'} \leq 0.$$

That is, unless capital is completely immobile, an increase in interest rate ($dr > 0$) will lead to a lower exchange rate since the resulting capital inflow will cause an appreciation of the domestic currency. It also implies that a positive (negative) shock to imports (exports) devalues domestic currency since it results in higher (lower) demand for (supply of) foreign currency.

Now substitute (1), (2), (3), (4), and (6) into (7) to get

$$S(r) + \xi_S - G_0 - \xi_G + T_0 - I(r) - \xi_I = X(R) + \xi_X - M(R) - \xi_M \quad (10)$$

Taking the total differential of (10), and using (9) for dR , yields

$$dr = \frac{d\xi_I + d\xi_G - d\xi_S + d\xi_F}{S' - I' - F'} \quad (11)$$

Since $S' > 0$, $I' < 0$, and $F' \leq 0$, the denominator in (11) is always positive. The equation states that as long as capital is not perfectly mobile (i.e., $F' > -\infty$), the interest rate rises when there is a positive shock to either investment ($d\xi_I > 0$), government expenditures ($d\xi_G > 0$), or demand for net foreign investment ($d\xi_F > 0$). However, if capital is perfectly mobile (i.e., $F' = -\infty$), then either shock will instantaneously result in capital inflow, completely satisfying the excess demand for resources, and thus leaving the interest rate unchanged.

Substituting (11) into (9), gives dR in terms of all the possible shocks of the model:

$$dR = F' \left[\frac{d\xi_I + d\xi_G - d\xi_S + d\xi_F}{(X' - M')(S' - I' - F')} \right] + \frac{d\xi_M - d\xi_X + d\xi_F}{X' - M'} \quad (12)$$

Note that both denominators in equation (12) are positive. Taking the total differential of (5) and combining it with (11) yields

$$dF = F' dr + d\xi_F = F' \left[\frac{d\xi_I + d\xi_G - d\xi_S + d\xi_F}{S' - I' - F'} \right] + d\xi_F \quad (13)$$

which shows the response of net capital outflow (or net foreign investment), and thus of trade balance, to various shocks. Equations (12) and (13) can be used jointly for comparative statics under alternative hypotheses about capital mobility. For example, with perfect capital mobility (i.e., $F' = -\infty$), an increase in government spending ($d\xi_G > 0$) causes a decrease in net foreign investment (F) "one for one" and therefore results in capital inflow since

$$\lim_{F' \rightarrow -\infty} \frac{dF}{d\xi_G} = -1.$$

Simultaneously,

$$\lim_{F' \rightarrow -\infty} \frac{dR}{d\xi_G} = -\frac{1}{X' - M'} < 0,$$

which means that domestic currency appreciates, reducing the external balance. In other words, an expansionary fiscal policy completely crowds out net exports, but has no effect on the interest rate as

$$\lim_{F' \rightarrow -\infty} \frac{dr}{d\xi_G} = 0.$$

At the other extreme, if capital is completely immobile ($F' = 0$), then the increased government demand must be satisfied by domestic resources. The first term on the right hand side of (12) and (13) vanishes when $F' = 0$. Therefore, an expansionary fiscal policy leaves the current account and the exchange rate unchanged and instead increases the interest rate since

$$\lim_{F' \rightarrow 0} \frac{dr}{d\xi_G} = \frac{1}{S' - I'} > 0.$$

This leads to a crowding out of investment because

$$\lim_{F' \rightarrow 0} \frac{dI}{d\xi_G} = \frac{I'}{S' - I'} < 0,$$

as can be seen from equation (14) below. Using a similar argument, it follows that under partial capital mobility, (i.e., $0 > F' > -\infty$), a higher budget deficit will crowd out both investment as well as net export.

In order to see the relationship between investment and national saving, take the total derivative of (1) and use (11) to get

$$dI = I' dr + d\xi_I = I' \left[\frac{d\xi_I + d\xi_G - d\xi_S + d\xi_F}{S' - I' - F'} \right] + d\xi_I \quad (14)$$

which means that

$$\frac{dI}{d\xi_S} = - \frac{I'}{S' - I' - F'} \quad (15)$$

Under perfect capital mobility,

$$\lim_{F' \rightarrow -\infty} \frac{dI}{d\xi_S} = 0,$$

and so any change in domestic private saving (which changes national saving by an equal amount since government saving is exogenous) is matched by a corresponding change in capital flow, leaving investment unchanged. Thus under perfect capital mobility, investment and national saving will not be correlated. If capital is immobile, that is, if $F' = 0$, then

$$\lim_{F' \rightarrow 0} \frac{dI}{d\xi_S} = - \frac{I'}{S' - I'}$$

and therefore $0 < dI/d\xi_S \leq 1$. That is, higher national saving will lead to higher investment. It is this result that led Feldstein and Horioka (1980) to interpret the positive investment-saving relationship they found as an indicator of a lack of perfect capital mobility.

3. Endogenous fiscal policy

Now consider a situation where the government has a reaction function through which it responds to current account imbalances by adjusting its spending according to the gap between private saving and investment. In particular, suppose that fiscal policy reaction function is given by

$$G - T = [\alpha(PS - I) + \xi_G] - T_0 \quad (16)$$

where $0 < \alpha \leq 1$. In (16) it is assumed that fiscal policy changes are implemented by changing G rather than T . Substituting (1), (2), (3), (4), and (16) into (7), taking its total derivative, and using (9) for dR yields

$$dr = \frac{(1 - \alpha)(d\xi_S - d\xi_I) - d\xi_F - d\xi_G}{(1 - \alpha)(I' - S') + F'} \quad (17)$$

Here, if the government follows an endogenous fiscal policy of the type assumed in (16), then investment and national saving will be correlated even if capital is perfectly mobile. Therefore, the observed positive correlation between investment and private saving is not necessarily an indicator of a lack of perfect capital mobility.

To see this, suppose that there is a positive change in private saving. That is, $d\xi_S > 0$. Such a change will be followed by an adjustment of the government's budget deficit according to (16). To get the exact expression, take the total derivative of (16), replace dr by (17), and find $d(G - T)$. This yields

$$\begin{aligned} d(G - T) &= \alpha(S' - I')dr + \alpha d\xi_S - \alpha d\xi_I + d\xi_G \\ &= \alpha(S' - I') \left[\frac{(1 - \alpha)(d\xi_S - d\xi_I) - d\xi_F - d\xi_G}{(1 - \alpha)(I' - S') + F'} \right] + \alpha d\xi_S - \alpha d\xi_I + d\xi_G. \end{aligned} \quad (18)$$

When capital is perfectly mobile, that is, $F' = -\infty$, the first term on the right hand side of (18) vanishes and

$$\lim_{F' \rightarrow -\infty} \frac{(G - T)}{d\xi_S} = \alpha.$$

The total differential of national saving is given by

$$dNS = [(1 - \alpha)S' + \alpha I']dr + (1 - \alpha)d\xi_S + \alpha d\xi_I - d\xi_G, \quad (19)$$

and since $dr = 0$ under perfect capital mobility, national saving will respond to the change in private saving by $dNS/d\xi_S = (1 - \alpha)$.

Note that in such an environment, private investment does not respond to changes in private saving. To see this, derive $dI/d\xi_S$ by taking the total differential of (1) and substituting (17) for dr :

$$\frac{dI}{d\xi_S} = \frac{I'(1 - \alpha)}{(1 - \alpha)(I' - S') + F'}. \quad (20)$$

Under perfect capital mobility we get

$$\lim_{F' \rightarrow -\infty} \frac{dI}{d\xi_S} = 0.$$

Thus, this model makes a testable prediction: it predicts a lack of Granger causality from private saving to investment. However, national saving responds to changes in investment since $dNS/d\xi_I = \alpha$, which does not depend on F' . Hence, in the case of endogenous fiscal policy, investment and national saving will be correlated no matter what the degree of capital mobility is.

Note that the crowding out effect of fiscal policy here will be similar to the effect when fiscal policy is exogenous. To see this, substitute (17) into (9) to get

$$dR = F' \left[\frac{(1 - \alpha)(d\xi_S - d\xi_I) - d\xi_F - d\xi_G}{(X' - M')[(1 - \alpha)(I' - S') + F']} \right] + \frac{d\xi_M - d\xi_X + d\xi_F}{X' - M'} \quad (21)$$

which implies that under perfect capital mobility

$$\lim_{F' \rightarrow -\infty} \frac{dR}{d\xi_G} = \lim_{F' \rightarrow -\infty} \left[- \frac{F'}{(X' - M')[(1 - \alpha)(I' - S') + F']} \right] < 0$$

by L'Hôpital's rule. Therefore, expansionary fiscal policy leads to an appreciation of domestic currency and consequently causes a crowding out of net exports. Since under perfect capital mobility $dr = 0$ from (17), $dI/d\xi_G = 0$ and fiscal policy will have no effect on investment. However, if capital is immobile, then $dR/d\xi_G = 0$, while

$$\lim_{F' \rightarrow 0} \frac{dI}{d\xi_G} = - \frac{I'}{(1 - \alpha)(I' - S')} < 0,$$

so we get a crowding out of investment.

To summarize, the model presented here shows that a positive correlation between domestic private investment and national saving is compatible with both exogenous and endogenous fiscal policy. In the case of exogenous fiscal policy, under perfect capital mobility, domestic investment and national saving are not correlated, while under immobile capital they tend to move together. If fiscal policy is endogenous, then domestic investment and national saving will be correlated even if capital is perfectly mobile. In such a case, an observed strong correlation between national saving and domestic investment will not necessarily indicate a lack of perfect capital mobility. This hypothesis has a testable implication: it predicts a lack of Granger causality from private saving to investment.

4. Granger causality and cointegration test results

As was shown in section 3, the hypothesis of endogenous fiscal policy of the type assumed in this paper predicts a lack of Granger causality from private saving to investment. As a test of this implication I run a bivariate Granger causality test between time series of gross private saving and gross private domestic investment using U.S. annual data covering the period 1929–89. The data for the 1929–82 period is taken from the NIPA tables of the BEA. For the 1983–89 period the data come from the Economic Report of the President (1990). The series are measured in 1982 dollars. The plots of the time series of domestic investment and private saving are shown on Figure 1.

The Granger causality test equation is given by

$$I_t = \alpha + \sum_{n=1}^4 \beta_n I_{t-n} + \sum_{n=1}^4 \gamma_n PS_{t-n} + \epsilon_t, \quad (22)$$

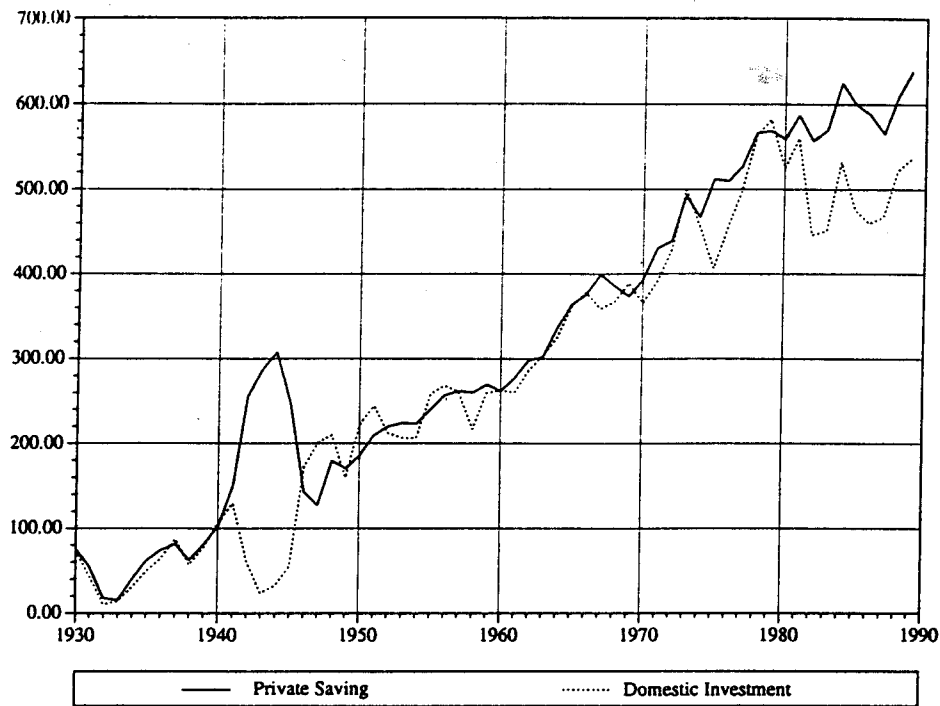


Figure 1. Private saving and domestic investment, U.S., 1929–89, billions of 1982 dollars. (Source: National Income and Product Accounts of the U.S., Bureau of Economic Analysis, Department of Commerce, 1992.)

where I_t denotes gross private domestic investment and PS_t denotes gross private saving. The null hypothesis is that private investment is not Granger-caused by private saving. Technically, this is tested by examining whether or not $\gamma_n = 0$ for each n simultaneously.

The results are reported in Table 1. I run the causality test for the entire sample period 1929–1989 as well as for two subperiods 1929–1972 and 1973–1989, which correspond to periods of fixed and flexible exchange rate regimes, respectively.

Table 1. Granger causality test results.

| Sample period | F-Statistic | p-Value | Is the H_0 rejected? |
|---------------|-------------------|---------|------------------------|
| 1929–89 | 1.93 | 0.12 | No |
| 1929–72 | 2.95 ^b | 0.03 | Yes |
| 1973–89 | 0.47 | 0.75 | No |

Note:

The H_0 hypothesis is that private investment is not Granger caused by private saving. Superscript b indicates a 5% significance.

According to the results, the null hypothesis cannot be rejected for the entire sample period. The null hypothesis also cannot be rejected for the second subperiod, but it is rejected at the 5% level of significance for the first subperiod. This means that the data is compatible with the hypothesis of endogenous fiscal policy during a flexible exchange rate period, but not during a fixed exchange rate period. Obviously, these findings do not prove that fiscal policy was endogenous over 1973–89 period because a lack of Granger causality from private saving to private investment could in principle be a consequence of other types of policies. For comparison purposes it should be mentioned that Summers (1988) and Bayoumi (1990), using a *cross-section* data of OECD and 10 industrial countries, respectively, find that an endogenous fiscal policy of the type modeled here might be playing an important role in generating the positive investment-saving comovement observed in the data of open economies.

It is possible to verify these Granger causality test results by considering a cointegration relationship between domestic investment and private saving.⁵ According to the Error-Correction Representation Theorem proved by Engle and Granger (1987), the concepts of cointegration and Granger causality are directly related. Specifically, they show that if two series are cointegrated, then there should be a Granger causality between these series at least in one direction. Thus, by examining the cointegration property of the investment-saving comovement, we can check whether the Granger-causality test results are consistent with cointegration tests.

Several authors have examined the cointegration relationship between investment and saving using the U.S. time series data. See, for example, Miller (1988), Otto and Wirjanto (1989), Leachman (1991), Gulley (1992), and Levy (1994, 1995). All these authors, however, focus their attention on the relationship between the time series of *national* saving and domestic investment. Here I am interested in examining the relationship between *private* saving and domestic investment.⁶

To test for cointegration, we first need to establish unit root properties of the time series of private saving and domestic investment. To determine whether private saving and domestic investment series are stationary, we examine each series for a presence of unit roots using the Augmented Dickey-Fuller tests of the form

$$\Delta x_t = \alpha_0 + \alpha_1 t + \gamma x_{t-1} + \sum_{i=1}^4 \phi_i \Delta x_{t-i} + \epsilon_t, \quad (23)$$

where x_t is the series we are examining and t is a linear time trend. The null hypothesis is that $\gamma = 0$, which means that the series contains an unit root and is thus nonstationary, that is, $x_t \sim I(1)$. The alternative hypothesis is that the series are stationary, that is, $x_t \sim I(0)$.

Initially, we test the hypothesis of an unit root in the series measured in levels. The results are reported in the first column of Table 2. As the values of the Augmented Dickey-Fuller t -statistics indicate, the hypothesis of nonstationarity cannot be rejected for domestic investment (denoted I) and private saving (denoted PS). Next, we test whether the first differences of the series are nonstationary. The figures presented in the last column of Table 2 indicate that the hypothesis of an unit root

Table 2. Unit root test results.^a

| Period | Series ^d | Augmented Dickey-Fuller <i>t</i> -statistic ^c | |
|---------|-----------------------|---|--------------------------------|
| | | Levels | First differences ^b |
| 1929-89 | <i>I</i> | -2.46 | -4.25 ^a |
| | <i>PS</i> | -2.23 | -4.56 ^a |
| | $[(X - M) + (G - T)]$ | -3.15 | -4.29 ^a |
| 1929-72 | <i>I</i> | -2.83 | -3.73 ^b |
| | <i>PS</i> | -2.12 | -3.40 ^c |
| | $[(X - M) + (G - T)]$ | -2.69 | -3.42 ^c |
| 1973-89 | <i>I</i> | -1.51 | -3.58 ^c |
| | <i>PS</i> | -0.91 | -4.70 ^a |
| | $[(X - M) + (G - T)]$ | -2.04 | -3.62 ^c |

Notes:

^aI used Box-Pierce, Ljung-Box, and Lagrange Multiplier tests to verify that the error terms in all the regressions reported in this paper are not serially correlated.

^bSuperscripts *a*, *b*, and *c* at the end of the *t*-statistics indicate statistical significance at 1%, 5%, and 10%, respectively.

^cThe 1%, 5%, and 10% significance critical values for the augmented Dickey-Fuller *t*-statistics are as follows: -4.12, -3.49, and -3.17 for the period 1929-89; -4.20, -3.52, and -3.19 for the period 1929-72; and -4.61, -3.71, and -3.29 for the period 1973-89, respectively. These critical values are tabulated in MacKinnon (1991).

^dNotation: *I* = Domestic investment, *PS* = Private saving, *X* = Exports, *M* = Imports, *G* = Government expenditure, and *T* = Government revenue.

in the differenced series can be rejected.⁷ Therefore, we conclude that private saving and domestic investment series are $I(1)$, and thus can be represented as difference stationary processes. The results reported by Miller (1988), Otto and Wirjanto (1989), Leachman (1991), Gulley (1992), and Levy (1994, 1995) on the unit root properties of domestic investment in the U.S. are essentially identical to what I report here.

To test for cointegration between the time series of private saving and domestic investment, I use Johansen's (1988) maximum likelihood method which seems to have better statistical properties than the more commonly used Engle-Granger (1987) two-step method. Below I define the test statistics used in this approach. For a detailed description of Johansen's maximum likelihood method, see Johansen's original article or Banerjee et al. (1993).

Johansen (1988) proposes two tests for estimating the number of cointegrating vectors. The first, called *maximal eigenvalue test*, is given by the statistic

$$\lambda_{\max} = -n \log(1 - \hat{\lambda}_r) \quad (24)$$

where n is the number of observations, and $\hat{\lambda}_r$ is the r -th eigenvalue determined by solving the determinantal equation associated with the residual product moment matrix constructed using the residuals' matrices. The maximal eigenvalue test is designed to test $H(r-1)$ against $H(r)$. That is, the null hypothesis is that there are $(r-1)$ cointegrating vectors against the alternative of r .

The second test, called *trace test* is designed for testing $H(r)$ against $H(m)$, where $r < m$. The trace statistic is given by

$$J_T = -n \sum_{i=r+1}^m \log(1 - \hat{\lambda}_i). \quad (25)$$

The cointegration test results are presented in Table 3. The critical values I use are taken from Osterwald-Lenum (1992).⁸ In estimating the cointegration vectors I use VAR(4).

In Johansen's framework the number of cointegrating vectors is determined sequentially. We start with the hypothesis that there are no cointegrating relations, that is, $r = 0$. We continue only if this hypothesis is rejected. In that case we test the hypothesis that there is at most one cointegrating vector ($r \leq 1$), and so on. The test results can be interpreted in favor of cointegration only if $0 < r < m$. Full rank, that is $r = m$, only indicates that the process is stationary.

Following this sequential procedure, we find that the time series of domestic investment and private saving are cointegrated only during the 1929-72 period (with one cointegrating vector, i.e., $r = 1$). To see this, look at the middle part in Table 3;

Table 3. Cointegration test results.

| Sample Period | Variables Included | Test ^{c,d} | H_0^e | | Test Statistic ^a | Critical Values ^b | |
|---------------|--------------------|---------------------|------------|------------|-----------------------------|------------------------------|-------|
| | | | | | | 95% | 90% |
| 1929-89 | I, PS | λ_{\max} | $r = 0$ | $r = 1$ | 10.64 | 14.06 | 12.07 |
| | | | $r \leq 1$ | $r = 2$ | 0.24 | 3.76 | 2.68 |
| | | J_T | $r = 0$ | $r \geq 1$ | 10.88 | 15.41 | 13.32 |
| | | | $r \leq 1$ | $r = 2$ | 0.24 | 3.76 | 2.68 |
| 1929-72 | I, PS | λ_{\max} | $r = 0$ | $r = 1$ | 12.79 ^c | 14.06 | 12.07 |
| | | | $r \leq 1$ | $r = 2$ | 0.31 | 3.76 | 2.68 |
| | | J_T | $r = 0$ | $r \geq 1$ | 13.40 ^c | 15.41 | 13.32 |
| | | | $r \leq 1$ | $r = 2$ | 0.31 | 3.76 | 2.68 |
| 1973-89 | I, PS | λ_{\max} | $r = 0$ | $r = 1$ | 8.98 | 14.06 | 12.07 |
| | | | $r \leq 1$ | $r = 2$ | 4.42 | 3.76 | 2.68 |
| | | J_T | $r = 0$ | $r \geq 1$ | 13.21 | 15.41 | 13.32 |
| | | | $r \leq 1$ | $r = 2$ | 4.42 | 3.76 | 2.68 |

Notes:

^aSuperscript *c* indicates a 10% statistical significance.

^bThe critical values are taken from Osterwald-Lenum (1992).

^c λ_{\max} is the maximal eigenvalue test statistic defined in (24).

^d J_T is the trace test statistic defined in (25).

^e r is the number of cointegrating vectors.

the values of both test statistics, $\lambda_{\max} = 12.79$ and $J_T = 13.40$, are slightly bigger than the corresponding 10% critical values. Therefore, the null of no cointegrating vectors ($r = 0$) is rejected in favor of the alternative with 10% significance. Now we proceed to the next hypothesis, $r \leq 1$. Here we see that both test statistics (0.31 and 0.31) are below the corresponding critical values.⁹ Therefore the null of one or less cointegrating vectors, ($r \leq 1$), cannot be rejected. Since the hypothesis of zero cointegrating vector was rejected in the preceding stage, we conclude that $r = 1$. That is, domestic investment and private saving are cointegrated with one cointegrating vector.

During the sample periods 1929–89 and 1973–89, the test statistics are not statistically significant in the first stage of the testing. Therefore the null of zero cointegrating vectors ($r = 0$) cannot be rejected for these periods. That is, domestic investment and private saving are not cointegrated for these sample periods. Thus, we find that the series are cointegrated during fixed exchange rate period, but not during flexible exchange rate period. Miller (1988) reports similar findings for the time series of *national saving* and domestic investment.

These findings are consistent with Granger causality test results reported above. This is because a cointegration relationship between the two series implies Granger causality at least in one direction. Indeed, for the 1929–72 period where we find an evidence of cointegration, we rejected the null of no Granger causality from private saving to domestic investment. For the other two sample periods, 1929–89 and 1973–89, we find that the two series are not cointegrated. And the finding that there is no Granger causality during these sample periods is clearly consistent with the cointegration test results.¹⁰

An additional implication of the observed cointegration of domestic investment and private saving during the fixed exchange rate period can be derived by looking at the national income accounting identity given in equation (7), which can be rewritten as

$$PS - I = [(X - M) + (G - T)]. \quad (26)$$

If PS and I are cointegrated, then their linear combination given on the left hand side of equation (26) should be stationary.¹¹ Consequently, the right hand side of (26), which is a sum of budget deficit and current account balance, should also be stationary during the fixed exchange rate period. On the other hand, during the periods of no cointegration, 1929–89 and 1973–89, we expect this sum to be nonstationary.

To examine the empirical validity of this prediction, I have applied Augmented Dickey-Fuller unit root test to the $[(X - M) + (G - T)]$ series. The results reported in Table 2 indicate that the unit root tests are not fully consistent with the cointegration test results. During the 1929–89 and 1973–89 periods the $[(X - M) + (G - T)]$ series are nonstationary (the null of unit root cannot be rejected) as predicted by cointegration test results. However, it is nonstationary also during the 1929–72 period which is inconsistent with the finding that domestic investment and private saving are cointegrated during that period.

5. Conclusions

In this paper I expand the standard neoclassical open economy model by introducing endogenous fiscal policy. Using the model, I demonstrate analytically how a positive investment-saving correlation can arise in a world with endogenous fiscal policy. I also show that this correlation does not depend on capital mobility and therefore is compatible with any degree of capital mobility. This means that the observed investment-saving comovement in the U.S. time series data does not necessarily imply imperfect capital mobility. The hypothesis of endogenous fiscal policy predicts a lack of Granger causality from private saving to investment. Empirical examination of this prediction indicates that the U.S. time series data of private saving and investment is compatible with the hypothesis of endogenous fiscal policy during a flexible exchange rate period, but not during a fixed exchange rate period.

The implication is that the investment-saving comovement observed in the U.S. time series data may indeed be due to an endogenous fiscal policy, where the government is trying to balance the current account by setting its budget plans according to the gap between private saving and investment.

How can we explain the differences in results between the fixed and flexible exchange rate periods? One possibility is that during fixed exchange rate period investment and saving were cointegrated simply because capital was not very mobile. The abandonment of the Breton Wood system and the elimination of capital controls in the early 1970s along with the increased integration of world financial markets during the last 20 years may have led to an increased international capital mobility, which eliminated the long-run (i.e., cointegration) relationship between investment and saving.

An alternative explanation may be given along the lines suggested in this paper. That is, it is possible that the government's fiscal policy was indeed endogenous during the flexible exchange rate period, but not during fixed exchange rate period. Note that in the context of the model presented in the paper, what I have in mind is a very specific form of endogeneity: the government reacts to current account imbalances by adjusting its budget balance according to the gap between private saving and investment.

In general it may be argued that this kind of policy is more plausible during fixed, rather than flexible, exchange rate periods as Miller (1988) suggests. An examination of the U.S. trade deficit development over the last 10–15 years, however, suggests the opposite. The continuous appreciation of the dollar during the 1980s has led to a large trade and current account deficits, which was viewed by many observers and administration officials as a cause for great concern. The increase in trade deficit led to a loss of exports and substitution of imports for domestic production. Consequently, there was a significant pressure on policy makers from the affected industries to reduce the trade deficit. Therefore, an endogenous fiscal policy was a rather likely scenario for the U.S. during the flexible exchange rate period.¹² Summers (1988) and Bayoumi (1990) reach a similar conclusion using cross-country data, which includes the United States.

An extension of this study tries to evaluate the empirical validity of the endogenous fiscal policy hypothesis by directly estimating a fiscal policy reaction function of the type considered in this paper using U.S. time series data. Although preliminary results suggest that the hypothesis of endogenous fiscal policy cannot be rejected, this question is still under investigation.

Acknowledgments

I thank the anonymous referee, the editor, and an associate editor of this journal for helpful comments and suggestions. This paper is an extension of Chapter 1 of my Ph.D. dissertation. I thank my Ph.D. thesis committee members, Maxwell Fry, Jack Johnston, David Lilien, and Giovanna Mossetti for commenting on earlier drafts of this paper.

This paper is based on the University of California/Irvine Economics Working Paper No. 90-91-04 titled "Investment-Saving Comovement, Capital Mobility, and Fiscal Policy," which was presented at the 1991 National Bureau of Economic Research Conference on the Macroeconomic Effects of Fiscal Policy. I benefited from the comments made by the participants of that conference, including Andrew Abel, V.V. Chari, Robert Eisner, Robert E. Lucas, Jr., Assaf Razin, and especially by my discussants, Marianne Baxter and Maurice Obstfeld. An earlier version of this paper was also presented at Bar Ilan, Ben Gurion, Board of Governors, Emory, Indiana (Bloomington and Indianapolis), Louisiana State University, Northeastern, State University of New York at Albany, Tulane, Union, and University of California at Irvine. I am grateful to these seminar participants, especially to Martin J. Bailey, Betty Daniel, Fuku Kimura, Kajal Lahiri, David Smyth, Avia Spivak, and Jimmy Weinblatt for useful comments and suggestions. Finally, I thank Shomu Banerjee, Robert Carpenter, Robert Chirinko, Hashem Dezhbakhsh, and Robert Utz for useful comments and discussions. All errors are mine.

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Notes

1. Studies that expand Feldstein and Horioka's (1980) analysis to different time periods and samples include Caprio and Howard (1984), Murphy (1984), Obstfeld (1986a, 1986b), and Wong (1988).
2. See, for example, Tobin (1983), Westphal (1983), Obstfeld (1986a, 1986b), Frankel and MacArthur (1988), Ghosh (1990), Tesar (1991), Baxter and Crucini (1993), and Levy (1995).
3. These studies often assume fiscal dominance, which means that fiscal authorities set their budget policy exogenously, and monetary authorities then have no choice but accommodate it. See, for example, Sargent and Wallace (1981). From the empirical point of view, classification of government budget policy as exogenous or endogenous seems largely to depend on the hypothesis being tested. For example, Evans (1987), Ghosh (1990), and Moreno (1988) model government budget deficit as exogenous while Dooley et al. (1987), Fieleke (1982), and Pigott (1989) treat the budget policy as endogenous.

4. The rule of thumb published by Congressional Budget Office (1985, p. 75) suggests that government budget policy is endogenous in CBO's view.
5. I thank the anonymous referee for suggesting this idea.
6. Although Bayoumi (1990) examines the relationship between private saving and domestic investment, he does not use the cointegration methodology since he estimates cross-section regressions using data from 10 industrial countries. Argimón and Roldán (1994) do examine the cointegration relationship between private saving and domestic investment but their data set does not include the U.S.
7. The unit root test results for the $[(X - M) + (G - T)]$ series are discussed below.
8. I choose not to use more commonly used critical values tabulated by Johansen and Juselius (1990) since Podivinsky (1990) shows that those critical values may be invalid for sample sizes of 100 or less.
9. The equality of these statistics is not a coincidence. In the final stage of sequential testing, their values always equal by construction of these tests.
10. However, it should be noted that an opposite result on Granger causality during these sample periods would not contradict cointegration test results either. This is because if there is no cointegration, then either one, Granger causality and Granger noncausality, are possible.
11. Actually, this analysis is based on the finding (not reported in Table 3) that the cointegrating vector is $[1, -1]$. Leachman (1991) reports a similar finding.
12. It should be mentioned, however, that setting the budget deficit according to the gap between private saving and investment is not the only way for reducing current account deficit. A reduction in a current account deficit can be accomplished also by means of monetary policy by affecting the exchange rate and thus the level of economic activity. Other possibilities include the use of investment tax credit, the adjustment of depreciation allowance schemes, etc. See Feldstein and Bacchetta (1989).

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