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Saving-Investment Correlations

Immobile Capital, Government Policy, or Endogenous Behavior?

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The high postwar correlations between saving and investment, both across countries and over time, are analyzed. A major reason for these correlations over the recent period is found to be government policy. [JEL 423, 433, 441]

THE LEVEL of capital mobility between countries is clearly an important question in international economics. For analysts, the assumption of a high or low level of capital mobility has profound implications for their modeling strategy; for policymakers, the degree of capital mobility may significantly affect the impact of different policy instruments. There are two principal methods of measuring the level of international capital mobility: one involves comparing the movement of rates of return on capital across countries, and the other looks at actual international capital flows. This paper will focus on the latter approach, and in particular on what the correlation of saving and investment rates across countries may imply for the level of capital mobility. The focus on flows of capital rather than rates of return reflects an interest in whether real (as opposed to financial) capital has been mobile between economies; by contrast, studies of the behavior of relative rates of return have tended to concentrate on the behavior of financial capital.

Interest in the correlation of saving and investment across countries as a test of the degree of capital mobility stems principally from a paper by

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Feldstein and Horioka (1980). They argued that in a world characterized by high capital mobility, there is no a priori reason to expect saving and investment to be correlated across countries. Because savers in different countries face the same interest rate, the relative level of saving in one country compared to another will reflect structural factors in the two economies; similarly, investors also face the same interest rate, so investment decisions simply depend upon relative investment opportunities. Assuming that structural factors affecting saving and investment are not correlated, saving and investment rates will also be uncorrelated. If, however, capital mobility is restricted, then domestic investors will face a wedge between the cost of domestic and foreign saving, with the implication that domestic saving and investment rates are likely to be correlated. In the extreme case of zero capital mobility, saving and investment would be perfectly correlated.

Feldstein and Horioka (1980) found that saving and investment rates were highly correlated, both in terms of levels and in terms of changes over the medium term. When the ratio of saving to output was regressed on the investment-output ratio, the estimated coefficients were generally significantly different from zero, but not from unity, and showed no signs of declining over time. This finding led the authors to conclude that capital mobility was relatively low across countries and was not increasing over time. Subsequent work (including the results in this paper) have broadly confirmed the empirical findings of Feldstein and Horioka.[1] In addition, several studies have also found that domestic saving and investment are highly correlated in a time-series sense.[2]

Although the existence of these high correlations has been confirmed, the Feldstein-Horioka conclusion that they are due to a low level of international capital mobility has been challenged by a number of authors, partly because tests of capital mobility based on rates of return data suggest that capital mobility has been rising over time (Obstfeld (1986)). Alternative explanations for the correlations fall into two camps. Some authors have constructed theoretical models in which there is perfect capital mobility, but where investment and saving are correlated due to the nature of the disturbances affecting the economy. These authors argue that the propensities to save and invest are correlated among countries, owing to factors such as productivity shocks or lack of integration of goods markets.[3] Several other authors have pointed out

[1] For example, Feldstein (1983), Penati and Dooley (1984), Murphy (1984), Caprio and Howard (1984), Dooley, Frankel, and Mathieson (1987), Summers (1988), and Feldstein and Bacchetta (1989).

[2] For example, Frankel (1985, 1989), and Obstfeld (1986).

[3] Tesar (1988) gives a good summary of these arguments.

that government policy may target the current account through various policy measures designed to offset certain aspects of private behavior that are judged to be undesirable (see Fieleke (1982), Summers (1988), and Roubini (1988)).

This paper tests the empirical validity of three hypotheses for the high observed correlation of saving and investment: (1) it may reflect genuine lack of capital mobility, caused by structural factors such as information constraints, inapplicability of domestic law, risk aversion, or differences in legal codes, which can be considered independent of the policy regime; (2) it may be the result of endogenous behavior by private agents, such that even when capital mobility is high, saving and investment are still highly correlated; or (3) it may be due to government policy, such as capital controls and fiscal policy.

The results support the view that a major factor in the observed *cross-section* correlations is government policy, and that cross-sectional regressions of private sector saving and investment may provide a useful test of capital mobility. The observed *time-series* correlations, however, appear to be largely a product of disturbances to the economy.

I. The Empirical Tests

Three tests of the different hypotheses identified above are used. The first differentiates hypothesis (1) from (2) or (3) by seeking to determine whether the high correlations may reflect endogenous private sector behavior as opposed to government policy or low capital mobility. It involves dividing post-World War II data on total saving and investment into public and private components. To the extent that the high correlations in *total* saving and investment data are caused by endogenous private sector behavior, on the one hand, private sector data should be at least as highly correlated as data for the total economy. On the other hand, if government policy or low capital mobility explains the correlations in total saving and investment, then private sector saving and investment will have a lower correlation than total saving and investment, since part of the behavior causing the correlations (namely, government policy) is excluded from the regressions. An assessment of the importance of endogenous private sector behavior can thus be obtained by comparing the coefficients from a regression of private sector saving on private investment with those for the same regression using economy-wide saving and investment data.

The second test uses data from the classical gold standard period (1880–1913) to differentiate among the hypotheses. The gold standard

represented a regime in which there were few capital controls and little government intervention. If the postwar correlations reflect endogenous behavior or genuine structurally low capital mobility, then the gold standard and postwar periods should have similar levels of correlation between total saving and investment. If, however, the postwar correlations reflect government policy, then the gold standard results should reflect the lower level of government intervention in that period. A comparison of regressions using postwar and gold standard saving and investment data would thus allow an assessment of the importance of government policy in the observed postwar correlations.

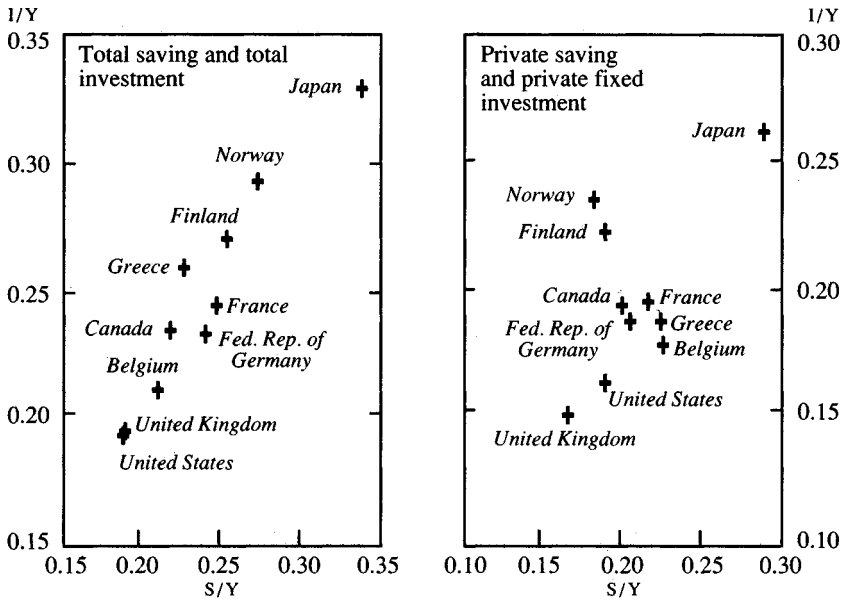
The third test looks at the importance of endogenous private sector behavior on the basis of *time-series* correlations of total domestic saving and investment. It compares the regression coefficients of equations using total saving and total investment with results based on total saving and total *fixed* investment. Since inventory investment may be viewed as largely reflecting the effects of unexpected disturbances, a decline in the observed correlations when inventory changes are excluded suggests that endogenous behavior is important in explaining the time-series correlations.

Cross-Section Results

The cross-section tests were carried out on the basis of annual observations for the period 1965–86, covering ten industrial countries—namely, the United States, Japan, the Federal Republic of Germany, the United Kingdom, France, Canada, Norway, Finland, Belgium, and Greece. These were the only countries for which the necessary data on government saving and investment were available on the Organization for Economic Cooperation and Development (OECD) annual national accounts data tape. Although it is a relatively small list, it includes six of the seven major industrial countries, plus a selection of smaller economies. All the saving and investment variables were converted into ratios by dividing by nominal gross national product (GNP). Throughout this paper, government saving and investment refer to general government data, and private sector refers to total data less general government. Hence, the private sector includes public enterprises.[4]

[4] The saving and investment data were examined on both a gross and net basis. Only the results for the gross data are reported, since the net data gave similar results. An earlier version of this paper included an analysis of data for developing countries. The results from this data set were consistent with those found using data for industrial countries, and are not reported for the sake of brevity.

Figure 1. *Saving and Investment: Average Values, 1965–86*
(As a ratio to GNP)



Before data are analyzed, some caveats should be noted. Although the data are based on OECD's standardized national accounts definitions, differences in accounting practices between countries are difficult to iron out. While some of the more glaring problems have been solved (such as the U.S. practice of counting all government expenditure as consumption), the data may still contain anomalies.[5] In addition, as discussed in Obstfeld (1986), national accounting definitions of saving and investment may not correspond to the concepts actually desired, owing to factors such as the exclusion of durable goods purchases, lack of adjustments for inflation, and failure to take proper account of valuation effects due to changes in asset prices and exchange rates.

The cross-section data are plotted in Figures 1–3. In Figure 1 the first panel shows the average level over 1965–86 of total investment against saving as a ratio to GNP; the second panel shows the private sector fixed investment ratio against the private sector saving ratio for the same period. Panels A through D in Figure 2 show scatter plots for total

[5] Balassa and Noland (1988) discuss some of the problems of comparing U.S. and Japanese saving and investment rates. What is striking is the size of the differences between the adjusted estimates produced by different researchers.

investment and saving ratios averaged over successive five-year periods, starting with 1966–70, and ending with 1981–85; panels A through D in Figure 3 show the same information for private sector fixed investment and saving.

These plots illustrate the relationships that are found subsequently by formal regression techniques. Panel A in Figure 1 shows a strong correlation between total saving and investment over 1965–86. From panel B in Figure 1, however, it is clear that when private sector saving and fixed investment are used, the relationship is much weaker; indeed, if Japan is excluded there is almost no relationship at all. Figure 2 shows that the strong positive relationship between total saving and total investment is also true for successive five-year periods. By contrast, when the data for private sector saving and investment are plotted for the same time periods in Figure 3, there is a clear positive relationship for the 1966–70 and 1971–75 periods, but very little correlation in the two subsequent five-year periods.

These visual impressions are confirmed by formal statistical techniques. Table 1 presents ordinary-least-squares estimates using cross-sectional data for the ten countries. In each case, the regression equation was of the form

$$(I/Y)_i = \alpha + \beta(S/Y)_i + \epsilon_i, \tag{1}$$

where the subscript refers to different countries. For each country the dependent variable was the average investment-output ratio over the sample period, and the independent variable was the average saving ratio. The sample period is given in the first column of the table. The first row shows the estimates of β on the basis of average data for the entire

Table 1. *Cross-Section Results for Ten Industrial Countries*
(Regression: $(I/Y)_i = \alpha + \beta(S/Y)_i$)

Time Period	Total Investment β_{TI} (1)	Private Fixed Investment β_{PI} (2)	Difference Between β_{TI} and β_{PI} (3)
1965–86	0.97 (0.11)	0.58 (0.29)	−0.40 (0.29)
1966–70	0.96 (0.10)	0.76 (0.18)	−0.20 (0.20)
1971–75	0.98 (0.13)	0.61 (0.29)	−0.37 (0.30)
1976–80	1.01 (0.18)	0.27 (0.29)	−0.73 (0.34)
1981–85	0.72 (0.12)	0.42 (0.35)	−0.30 (0.33)
1965–75 to 1976–86	0.65 (0.16)	0.42 (0.18)	−0.23 (0.26)

Note: The table shows estimates of β. Standard errors are shown in parentheses.

Figure 2. *Total Saving and Total Investment: Average Values Over Time*
(As a ratio to GNP)

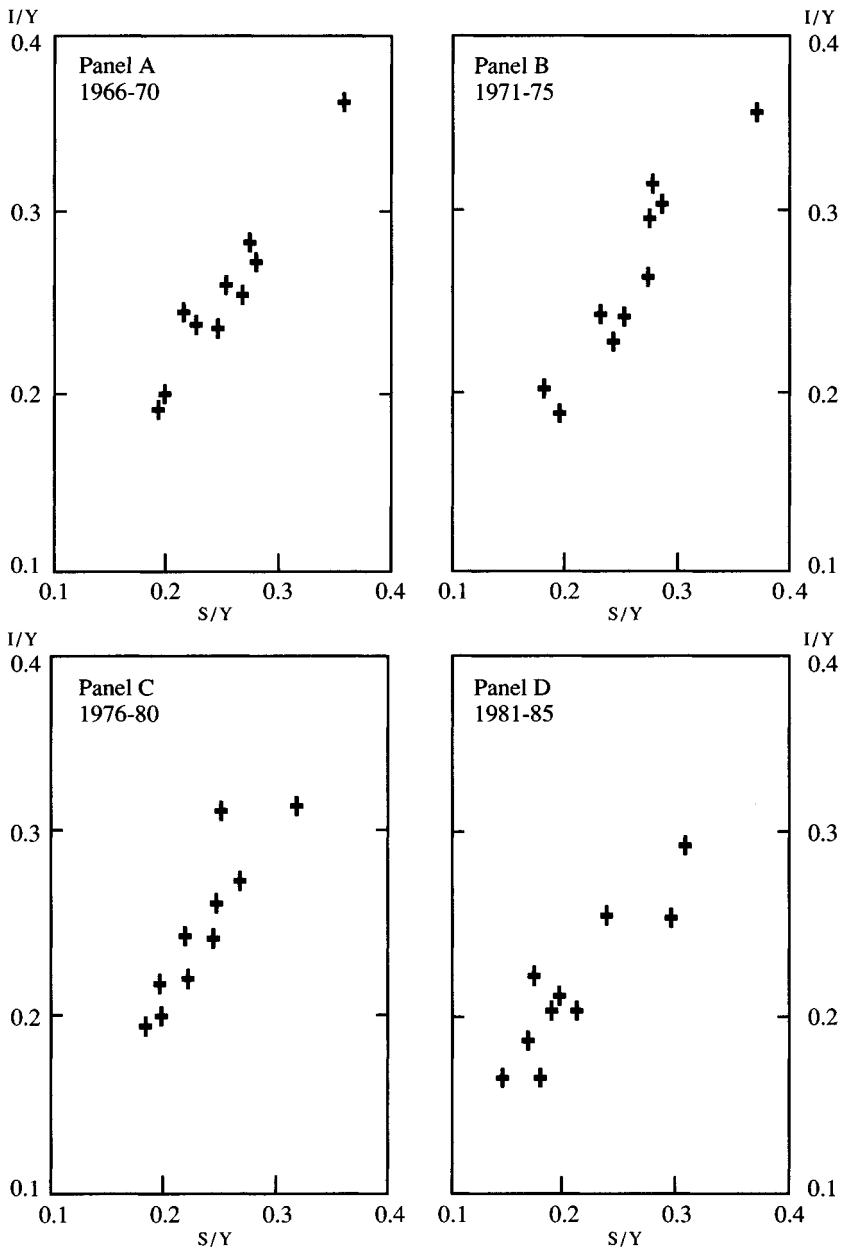
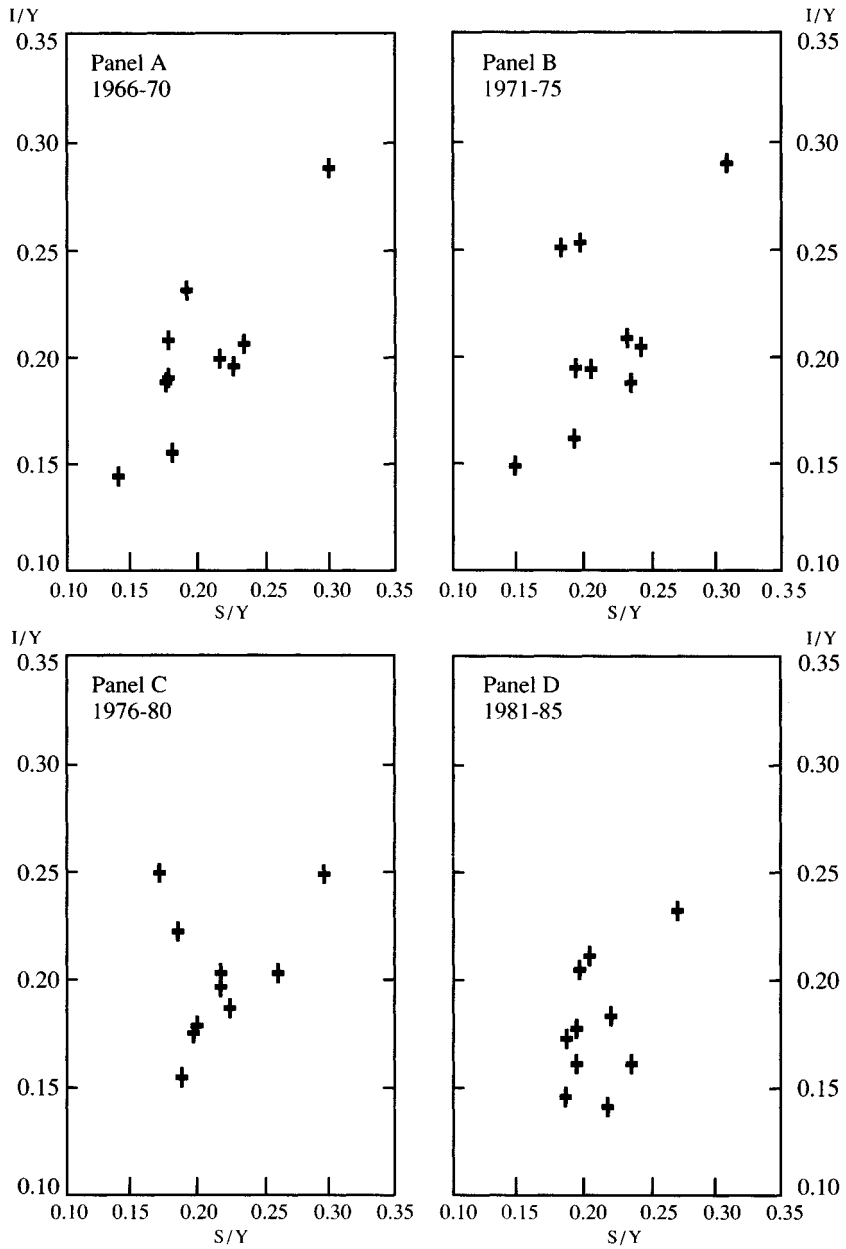


Figure 3. *Private Saving and Private Fixed Investment: Average Values Over Time*
(As a ratio to GNP)



1965–86 period. The next four rows show the results using average observations for successive five-year periods starting with 1966–70. The last row indicates the results of regressing the change in the average ratios between the two halves of the overall sample period. Averages over several years are used, as is standard in the literature, to abstract from the effects of the business cycle.

The results of regressing total saving on total investment (first column) confirm the standard Feldstein-Horioka conclusion. Using the full sample period, the estimate of β is 0.97, and is significantly different from zero and insignificantly different from unity. The estimates of β are large for all subperiods, and show no marked pattern over time; the changes in the average investment and saving ratios over the time period are also highly correlated. Results using total fixed investment as the dependent variable instead of total investment (not shown) have a very similar pattern, indicating that the exclusion of inventory investment from the dependent variable has little effect on the cross-sectional results.

The second column of Table 1 reports the results of regressing private saving on private fixed investment. These results show a markedly different pattern from those for total saving and total investment. Over the entire sample period, the value of β falls to 0.58, while the standard error rises to 0.29. The coefficient also falls over time, both in size and significance. When data for the late 1960s are used, β is estimated to be 0.76, significantly different from zero but not from unity. However, this coefficient is only 0.42 for the first half of the 1980s, with a standard error of 0.35.[6] The fall in the coefficient is consistent with the commonly held impression that the level of capital mobility has risen over time, reflecting the progressive liberalization of domestic financial markets and the dismantling of international capital controls. This aspect of the data will be discussed further below.

A comparison of the results in columns 1 and 2 of Table 1 reveals that the coefficients using private sector saving and investment data are consistently lower than the corresponding coefficients for total saving and investment. A formal test of this hypothesis can be obtained by stacking the two data sets and using dummy variables to allow the coefficients to differ between the total and private sector data. The coefficients on the change in the coefficient β between the two data sets are presented in the last column of Table 1. The hypothesis that the two coefficients are equal for the period 1976–85, which is generally considered to have had high

[6]This fall is not significant at conventional levels of significance. However, it was found to be significant at the 5 percent level in alternative regressions (not reported) using the actual annual observations for each five-year period rather than their mean.

capital mobility, attracts a probability value of 0.056. As explained above, these results are inconsistent with the hypothesis that the high postwar correlations reflect endogenous private sector behavior. It can therefore be inferred that the correlations are caused either by genuine, structurally low capital mobility or by government policy. The next two subsections explore the degree to which the results and conclusions are robust to two considerations: statistical misspecification and Ricardian effects on saving.

Statistical Misspecification

This section uses instrumental variable estimation and robust regression techniques to investigate two potential problems related to the estimation of equation (1); namely, the potential endogeneity of the saving ratio and the validity of the distributional assumptions that need to be fulfilled in ordinary-least-squares estimation.

As a general rule, if the saving and investment ratio reacts to the same endogenous shocks, ordinary-least-squares coefficient estimates will be upwardly biased. The standard method to control for this type of effect is to rerun the regressions using instrumental variables that are correlated with saving, but not investment. The instruments that were chosen were the percentage of the total population aged between 15 and 64, total employment as a percentage of the population aged between 15 and 64, social security transfers as a percentage of gross domestic product (GDP) and current disbursements of government as a percentage of GDP, averaged over the period 1967–84. According to the permanent-income hypothesis, all of these variables affect saving, although they are not obviously relevant for investment. The results of rerunning the regressions with these instruments using two-stage least squares are shown in Table 2. They are similar to those in Table 1, particularly for the private sector regressions.

Given the small data sample, it is important to investigate the validity of the distributional assumptions implicit in ordinary least squares. Robust regressions were carried out using the "bootstrap" technique, described in Efron (1982). The basis of this technique is that the empirical distribution of the data (made up, in this case, of the observed dependent and independent variables) is resampled a large number of times with replacement. For each resample the desired regression is then rerun. The mean of the resulting coefficient estimates is an unbiased, robust estimate of the parameter in question, with empirical confidence intervals determined by the distribution of the estimated coefficients.

The last two columns of Table 2 show the results of running the bootstrap technique on the regressions for total saving and investment and private saving and investment, using 500 data samples. The coefficient

Table 2. *Two-Stage Least Squares and Bootstrap Regression Results*
(Regression: $(I/Y)_i = \alpha + \beta(S/Y)_i$)

Time Period	Two-Stage Least Squares		Bootstrap Regressions	
	Total investment (1)	Private investment (2)	Total investment (3)	Private investment (4)
1965–86	0.85 (0.15)	0.55 (0.31)	1.01 (0.12)	0.39 (0.48)
1966–70	0.91 (0.12)	0.72 (0.20)	0.93 (0.12)	0.69 (0.24)
1971–75	0.82 (0.18)	0.56 (0.30)	1.05 (0.22)	0.48 (0.41)
1976–80	0.71 (0.25)	0.34 (0.31)	1.08 (0.22)	0.14 (0.43)
1981–85	0.75 (0.17)	0.45 (0.39)	0.72 (0.12)	0.26 (0.52)
1975–76 to 1976–86	0.68 (0.18)	0.49 (0.21)	0.69 (0.19)	0.43 (0.17)

Note: The table shows estimates of β. Standard errors are shown in parentheses.

estimates for the total saving and investment data are similar to those using ordinary least squares. For the private sector data the bootstrap coefficient estimates are lower than the ordinary-least-squares results. Moreover, the distribution of the bootstrap coefficient estimates is somewhat skewed, which may explain the upward bias of the ordinary-least-squares estimates.

Overall, the previous conclusions that endogenous private sector behavior does not seem to account for the high postwar correlations of total saving and investment and that there has been a fall in the regression coefficient of private saving on investment over the period 1965–86 are basically unchanged by the use of instrumental-variable or robust-regression techniques.

Ricardian Equivalence

Up to this point, the analysis has implicitly assumed that the behavior of the private sector is not affected by the behavior of the public sector. This is a strong assumption, and it is difficult to think of any well-specified model in which there would be absolutely no relationship between government fiscal policy and private sector behavior.

The Ricardian equivalence proposition states that changes in the financing of fiscal policy has no effect upon total saving of the nation. This result occurs when the private sector reacts to the change in future tax liabilities implied by the government's behavior by altering its saving decisions. Although the requirements for full Ricardian equivalence, in which the private sector entirely offsets the change in government saving, are quite stringent, some degree of substitution between private and public saving appears to be likely. It is also possible that there is a

connection between government and private sector investment, although the sign is not clear.

In terms of the data that have been used for this paper, the Ricardian proposition can be tested by examining the relationship between government saving and private sector saving,[7] while the endogeneity of investment decisions can be studied by considering the effect of government fixed investment on private fixed investment. The first column of Table 3 presents ordinary-least-squares estimates of β from the following time-series model:

$$\Delta(PS/Y)_t = \alpha + \beta\Delta(GS/Y)_t + \epsilon_t, \tag{2}$$

where *PS* denotes private sector saving, *GS* denotes government saving, and Δ denotes the first-difference operator.[8] Column 2 presents the results from the same model with investment substituted for saving.

Table 3. *Ricardian Equivalence: Coefficient Estimates*
(Regression: $\Delta(PS/Y)_t = \alpha + \beta\Delta(GS/Y)_t$)

Country	Saving	Investment
United States	−0.26 (0.11)	−2.80 (1.35)
Japan	0.06 (0.32)	−0.50 (0.87)
Federal Republic of Germany	−0.25 (0.12)	1.46 (0.76)
United Kingdom	−0.32 (0.28)	0.39 (0.26)
France	−0.56 (0.17)	−0.35 (0.77)
Canada	−0.23 (0.14)	0.73 (1.06)
Norway	−0.21 (0.23)	0.80 (0.79)
Belgium	−0.21 (0.23)	−0.81 (1.12)
Finland	−0.85 (0.31)	0.20 (1.49)
Greece	−0.42 (0.30)	0.57 (0.99)

Note: The table shows estimates of β. Standard errors are shown in parentheses.

The results in Table 3 using saving data indicate evidence of partial Ricardian effects. All but one of the coefficients have the expected negative sign. Although only four are significantly different from zero, a simple sign test indicates that the hypothesis that these coefficients are random can be rejected at the 5 percent significance level. The coefficients are also quite bunched; five out of ten lie in the range −0.21 to −0.26. These estimates were used to construct a "Ricardian-adjusted" saving series. The adjusted series assumes that the coefficient β is −0.25 for all countries, implying that 25 percent of all government saving

[7] This formulation ignores the effect of changes in government consumption on private sector behavior.

[8] First differences are used in order to make the data stationary.

represents substitution for private saving.[9] Accordingly, an alternative private saving series was calculated by adding 25 percent of government saving onto the original private sector saving data.

The results using investment data in equation (2) are also reported in Table 3. The coefficients are large, unstable, and generally insignificant. Given the lack of any common pattern among countries, no attempt was made to adjust private investment for the effects of government investment.

The cross-sectional regression results using the "Ricardian-adjusted" saving series described above are shown in Table 4. The coefficients are lower and considerably more significant in all subperiods, notably the early 1980s. Adjusting the saving data for Ricardian equivalence effects confirms the central conclusion that when private saving is regressed on private fixed investment, the regression coefficient is somewhat smaller than that obtained on the basis of total saving and investment data. The adjusted saving series also shows some fall in the regression coefficient over time.

Table 4. *Ricardian Equivalence: Cross-Section Results*

Time Period	Private Investment
1965–86	0.31 (0.07)
1966–70	0.36 (0.08)
1971–75	0.36 (0.10)
1976–80	0.27 (0.07)
1981–85	0.24 (0.06)

Note: The table shows estimates of β. Standard errors are shown in parentheses.

Comparison with the Gold Standard Period

The balance of the evidence appears to indicate that for the postwar period the observed correlations between investment and saving are caused either by government policy or structurally low capital mobility. By comparing this evidence with data from the period of the classical gold standard (1880–1913), a period characterized by few international

[9] This figure was chosen as the approximate mean of the estimates in Table 5. It is also within the range of −0.2 to −0.5 quoted by Bernheim (1987) in a survey of the results from consumption-function studies of Ricardian equivalence. A second "Ricardian-adjusted" saving series was constructed assuming that the coefficients in Table 5 were the true coefficients, except that the Japanese coefficient was set to zero. The results using these data are not reported for the sake of brevity.

capital controls and little government intervention, these hypotheses can be differentiated. If the explanation is structurally low capital mobility, then the gold standard data should show a similar degree of correlation to that observed in the postwar period. By contrast, if government policy explains the postwar correlations, the gold standard data should show little correlation.

For this purpose, annual data on nominal output, capital formation, and the current account over the period 1880–1913 were collected for seven countries: the Federal Republic of Germany, Italy, the United Kingdom, Australia, Denmark, Norway, and Sweden. In addition, some data that are useful only for cross-section work were collected on Canada.[10] National saving rates, which are not available in the historical data sources, were then calculated indirectly by adding the current account to the figures on capital formation.[11]

Figure 4 shows a scatter plot of these data over the full time period, 1880–1913. There appears to be little correlation between saving and investment rates, an impression that is confirmed by the regression results reported in Table 5. For the entire period, β is estimated (using ordinary least squares) at 0.29, with a standard error of 0.46; when decade averages are regressed, the estimates of β are unstable and insignificant, as are the coefficients on regressions using changes in investment and saving between decades. The robust estimates produced by the bootstrap technique described above yield the same basic results. There appears to be no evidence of a significant correlation between saving and investment in the gold standard period.[12]

The evidence would thus seem to imply that the observed postwar correlations reflect government policy.[13] However, there is another important difference between the gold standard period and the period since the breakup of the Bretton Woods exchange rate system, namely, the shift from a fixed to a floating exchange rate regime. The large fluctuations in nominal exchange rates experienced over the more recent period

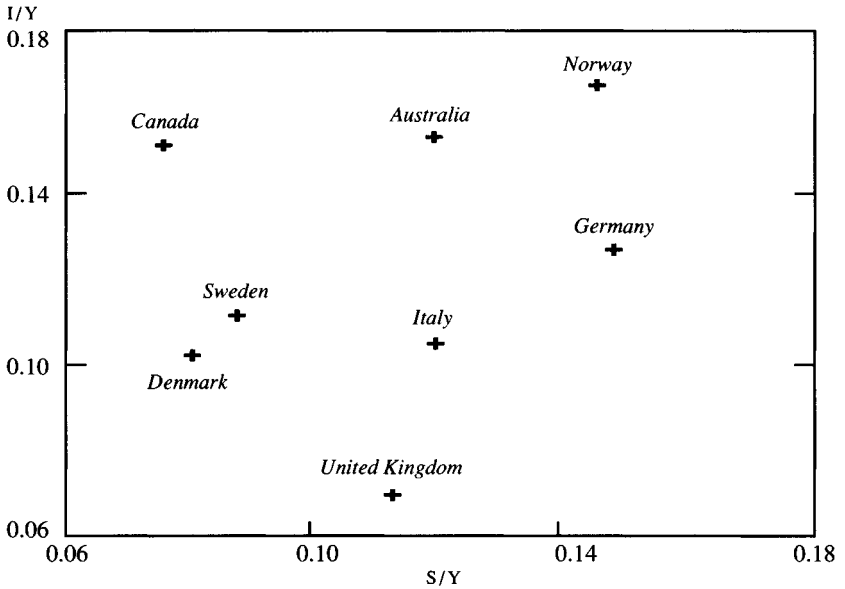
[10] The European data come from Mitchell (1980); the Canadian and Australian data are from Mitchell (1983).

[11] The investment data exclude stocks for the United Kingdom, Denmark, Sweden, Australia, and Canada; they include stocks in the case of the Federal Republic of Germany, Norway, and Italy. The German data refer to net investment and net national product, the rest to gross investment and GNP (or GDP).

[12] The standard error on the coefficient is, however, large. The formal test of the equality of the β for the full postwar period with the β from the gold standard period yields a probability value of 0.102.

[13] Bayoumi and Rose (1989) found no positive correlation between regional saving and investment using postwar data for the United Kingdom, in stark contrast to the international postwar data; since governments do not target "regional" current accounts, these results would also appear to point to a significant role for government policy.

Figure 4. *Total Saving and Total Investment Under the Gold Standard: Average Values, 1880–1913*



might have lowered the level of international capital mobility via increased exchange rate uncertainty or large deviations from purchasing power parity. However, the large gross flows of international financial assets in the recent period argue against such an explanation.

Table 5. *Cross-Section Results: Gold Standard Data*
(Regression: $(I/Y)_i = \alpha + \beta(S/Y)_i$)

Time Period	Ordinary Least Squares	Bootstrap
1880–1913	0.29 (0.46)	0.31 (0.53)
1880–1890	0.48 (0.50)	0.40 (0.42)
1891–1901	0.69 (0.48)	0.64 (0.77)
1902–1913	−0.10 (0.43)	0.09 (0.56)
	Differences Over Time	
1880–1890 to 1890–1901	0.13 (0.66)	0.32 (0.87)
1890–1901 to 1902–1913	−0.18 (0.40)	−0.09 (0.70)

Note: The table shows estimates of β. Standard errors are indicated in parentheses. The bootstrap regressions used 500 replications.

The results also indicate that there were substantial international capital movements during the gold standard period, involving large and persistent current account imbalances. Indeed, as shown in Table 6, during the gold standard period (1880–1913), six out of the eight economies for which data are available recorded an *average* current account surplus or deficit of over 2.5 percent of output. This contrasts with the shorter postwar period (1965–86), when only one of the ten economies included in this study had an average imbalance of over 2.5 percent of output, and only one of the six largest countries had an average imbalance of over 1 percent. Since the gold standard represents a period of free capital mobility with little government intervention, this comparison gives some idea of the potential implications of the recent liberalization and growing integration of financial markets.[14] The results underline that in a world of free capital mobility large imbalances are not, in themselves, unusual.

Table 6. *Current Account Imbalances: Gold Standard and Postwar*
(As a percentage of GNP/GDP)

Country	Average Current Account Balance
	Gold standard
United Kingdom	4.5
Federal Republic of Germany	1.8
Italy	0.6
Sweden	−2.7
Norway	−2.5
Denmark	−2.6
Australia	−3.7
Canada	−7.7[a]
	Postwar
United States	0.0
Japan	0.7
Federal Republic of Germany	0.9
France	0.2
United Kingdom	0.0
Canada	−1.5
Belgium	0.0
Norway	−2.1
Finland	−1.6
Greece	−3.1

Note: Gold standard data are for 1880–1913; postwar data are for 1965–86.
[a] Average of data for 1900 and 1910.

[14] These flows do not appear to have been secured by the use of imperialistic force, such as gunboat diplomacy. Defaults could and did occur throughout the gold standard period (Fishlow (1985)).

The Time-Series Correlations

So far, the paper has focused on the correlation of saving and investment across countries. This section explores the time-series correlations between saving and investment that have been documented by various studies.

Figure 5 in the Appendix graphs the time-series data for the same group of ten industrial countries used above.[15] The top panel (panel A) shows total investment, total fixed investment, and total saving, and the bottom panel (panel B) shows private sector saving and fixed investment plus government saving and fixed investment. The most striking feature of these plots is the stability of government investment compared to government saving. In addition, comparisons of the path of total saving and fixed investment to private saving and fixed investment appear to indicate a stronger correlation for the former than the latter.

Calculated standard deviations confirm the stability of government investment; the standard deviation for government investment is below half of that for government saving for every country except Norway, and is below half of the standard deviation for private investment for eight of the ten countries. The differences that exist between the economy-wide and private sector data generally reflect government saving behavior.

Table 7 presents results using ordinary least squares for annual data in terms of the following equation:

$$\Delta(I/Y)_t = \alpha + \beta\Delta(S/Y)_t + \epsilon_t, \tag{3}$$

where Δ is the first-difference operator.[16] The equations appear generally well-behaved, given the simplicity of the specification; only 6 of the 40 regressions have a Durbin-Watson statistic below the lower 5 percent significance interval.

The results for total investment (column 1) confirm the findings of earlier studies that these variables are closely correlated. The coefficient β is significantly different from zero in all but one of the regressions, and significantly different from unity in only two cases. When fixed investment is used as the dependent variable (column 2), there is a marked fall in the size and significance of the regression coefficient.[17] The difference between total investment and total fixed investment is inventory invest-

[15] The data for the United States, the Federal Republic of Germany, the United Kingdom, France, Canada, Belgium, Finland, and Greece cover the period 1960–86; those for Japan and Norway cover the period 1965–86.

[16] First differences were used in order to make the data stationary.

[17] Similar results (not reported) were found using OECD quarterly national accounts data.

Table 7. *Time-Series Results for Selected Industrial Countries, 1961–86*
(Regression: $\Delta(I/Y)_t = \alpha + \beta\Delta(S/Y)_t$)

Country	Total Investment (1)	Total Fixed Investment (2)	Private Fixed Investment (3)	Government Fixed Investment (4)
United States	1.00 (0.10)	0.49 (0.07)	−0.13 (0.20)	−0.03 (0.02)
Japan[a]	0.84 (0.15)	0.55 (0.11)	0.46 (0.18)	−0.05 (0.08)
Federal Republic of Germany	0.87 (0.17)	0.32 (0.16)	−0.14 (0.21)	0.02 (0.05)
United Kingdom	0.33 (0.18)	−0.02 (0.10)	0.03 (0.07)	0.05 (0.07)
France	0.80 (0.26)	0.19 (0.13)	−0.16 (0.10)	0.02 (0.04)
Canada	0.83 (0.16)	0.25 (0.13)	−0.06 (0.21)	−0.03 (0.03)
Norway[a]	−0.21 (0.31)	−0.55 (0.27)	−0.01 (0.36)	−0.08 (0.07)
Belgium	0.63 (0.12)	0.41 (0.09)	0.18 (0.16)	0.02 (0.05)
Finland	0.98 (0.30)	0.10 (0.19)	0.07 (0.16)	−0.05 (0.05)
Greece	0.73 (0.13)	0.40 (0.12)	0.26 (0.13)	−0.03 (0.05)

Note: The table reports estimates of β. Standard errors are shown in parentheses.
[a] Data for 1966–86.

ment, which can be broadly interpreted as representing unexpected shocks to the economy. These results suggest that aggregate demand and supply shocks explain much of the time-series correlation between total saving and investment.

Columns 3 and 4 of Table 7 show the results of dividing saving and fixed investment into private and government components. The private sector results indicate no stable correlation over the different countries; only five of the ten estimates of β are positive, and only two are significant at conventional levels. Overall, it appears that private saving and fixed investment behave independently of each other. There also seems to be no time-series correlation between government saving and investment. None of the estimated coefficients is larger than 0.1, six out of ten are negative, and none is significantly different from zero. Despite the lack of correlation of either private or government saving and investment over time, the results in column 2 indicate that their sums are correlated.

Overall, the time-series results indicate that a large part of the correlation between total saving and investment identified in the literature reflects endogenous inventory investment behavior. In order to investigate whether the results for the entire period mask some interesting differences in behavior over time, Table 8 presents estimates of equation (2) over two subperiods—1960–73 and 1974–86. *F*-tests of the stability of the parameters indicate no significant change over time except in the case of the French data, notwithstanding considerable changes in the degree of capital controls in many countries. Hence, the time-series results do not appear to correspond to changes in capital mobility over time.

II. Conclusions

This paper has analyzed the reasons for the observed high correlations between total saving and investment, both among countries and over time. Three possible explanations have been explored; that the correlations are the result of structurally low international capital mobility; that they are caused by the reaction of private agents to disturbances in an economy with perfect capital mobility; and that the correlations are a product of governments seeking to maintain a balanced current account.

Postwar data on total saving and investment were divided into private sector and government series. Regressions using data for the private sector consistently showed a lower correlation than the economy-wide data, using different data periods and alternative regression techniques, and thereby rejecting the hypothesis that the correlations are caused by endogenous private sector behavior. In comparison, regressions using data from the gold standard period showed a low correlation between saving and investment, suggesting no evidence of structurally low capital mobility.

Table 8. *Time-Series Results for Subperiods*

Country	Total Fixed Investment	Private Fixed Investment	Total Fixed Investment	Private Fixed Investment
	1960–73		1974–86	
United States	0.38 (0.09)	−0.15 (0.18)	0.55 (0.10)	−0.18 (0.38)
Japan[a]	0.50 (0.19)	0.57 (0.30)	0.39 (0.16)	0.04 (0.18)
Federal Republic of Germany	0.40 (0.32)	−0.02 (0.30)	0.27 (0.17)	−0.28 (0.34)
United Kingdom	0.08 (0.15)	0.05 (0.10)	−0.10 (0.12)	0.02 (0.11)
France	0.02 (0.17)	0.03 (0.08)	0.03 (0.19)	−0.26 (0.11)
Canada	0.46 (0.22)	0.35 (0.34)	0.14 (0.20)	−0.28 (0.28)
Norway[a]	0.93 (0.67)	0.35 (0.51)	−0.72 (0.30)	−0.21 (0.50)
Belgium	0.51 (0.10)	0.43 (0.26)	0.30 (0.15)	0.06 (0.21)
Finland	0.18 (0.27)	0.03 (0.29)	−0.02 (0.29)	0.09 (0.20)
Greece	0.04 (0.28)	−0.11 (0.26)	0.42 (0.16)	0.27 (0.17)

Note: The table reports estimates of β. Standard errors are shown in parentheses.
[a] First period runs from 1966–73.

These results point to government policy as a major factor in the postwar cross-sectional correlations. In the early part of the postwar period, this policy included the widespread use of capital controls. For the more recent period, these controls have been largely abandoned. It is also possible that exchange rate instability associated with floating exchange rates may have lowered international capital mobility.[18]

Postwar private sector data also show some decline in the correlation between saving and investment between the late 1960s and the early 1980s, a period in which capital mobility is generally thought to have risen. As such, the private sector saving-investment regressions may provide a useful measure of the degree of capital mobility in the international economy; government policy may mask this trend when the economy-wide saving and investment data are considered.

The high postwar *time-series* correlations were found largely to reflect the inclusion of inventory investment. The results do not appear to be affected by changes in capital mobility over time.

The conclusion that a major reason for the small size of current account imbalances in the postwar period is government behavior has important implications for current international economic issues. Targeting the current account may make sense to the extent that capital outflows are judged to be undesirable, because they may be less easy to tax, are open to expropriation of one sort or another, and may have negative terms of trade effects; capital inflows may also be unwelcome due to their effects on the traded goods sector. However, from the point of view of world welfare, free movement of capital is probably a desirable objective, since it allows investors to diversify their portfolios and because it helps to enhance the efficiency of resource allocation among countries.

APPENDIX

Time-Series Data for Ten Industrial Countries

This Appendix contains a graphical representation of the time-series data for the ten industrial countries discussed in the text: the United States, Japan, the Federal Republic of Germany, the United Kingdom, France, Canada, Norway, Belgium, Finland, and Greece (Figure 5). The data are for the period 1960–86, except for Japan and Norway where the data are for the period 1965–86. Panel A shows total investment, total fixed investment, and total saving; panel B shows private saving and fixed investment plus government saving and fixed investment.

[18] Artis and Bayoumi (1989) discuss the evidence on international financial integration. They also present estimates of government reaction functions for monetary and fiscal policy in the 1970s and 1980s across several different countries. They find evidence that monetary policy has reacted to changes in the current account, but the results for fiscal policy are less conclusive.

Figure 5. *Saving and Investment in Ten Industrial Countries*
(As a ratio to GNP)

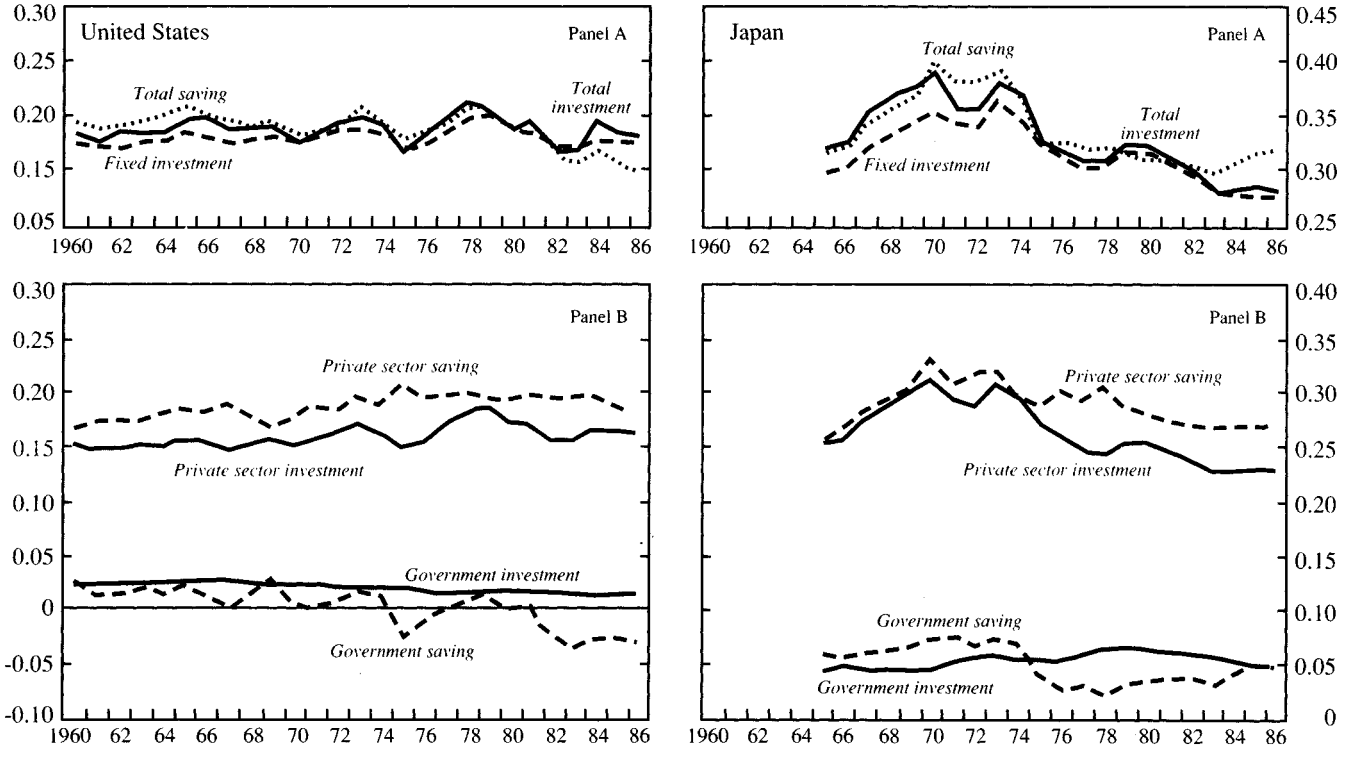


Figure 5 (*continued*).

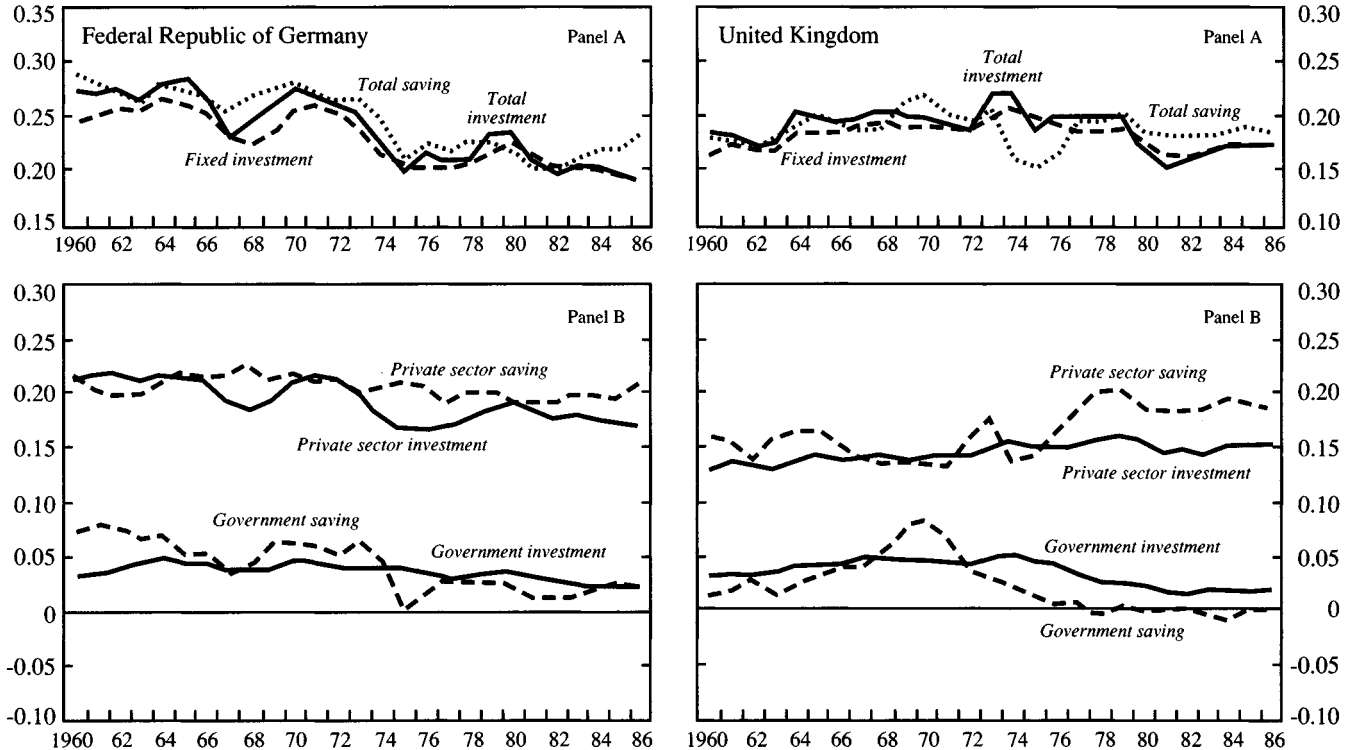


Figure 5 (*continued*).

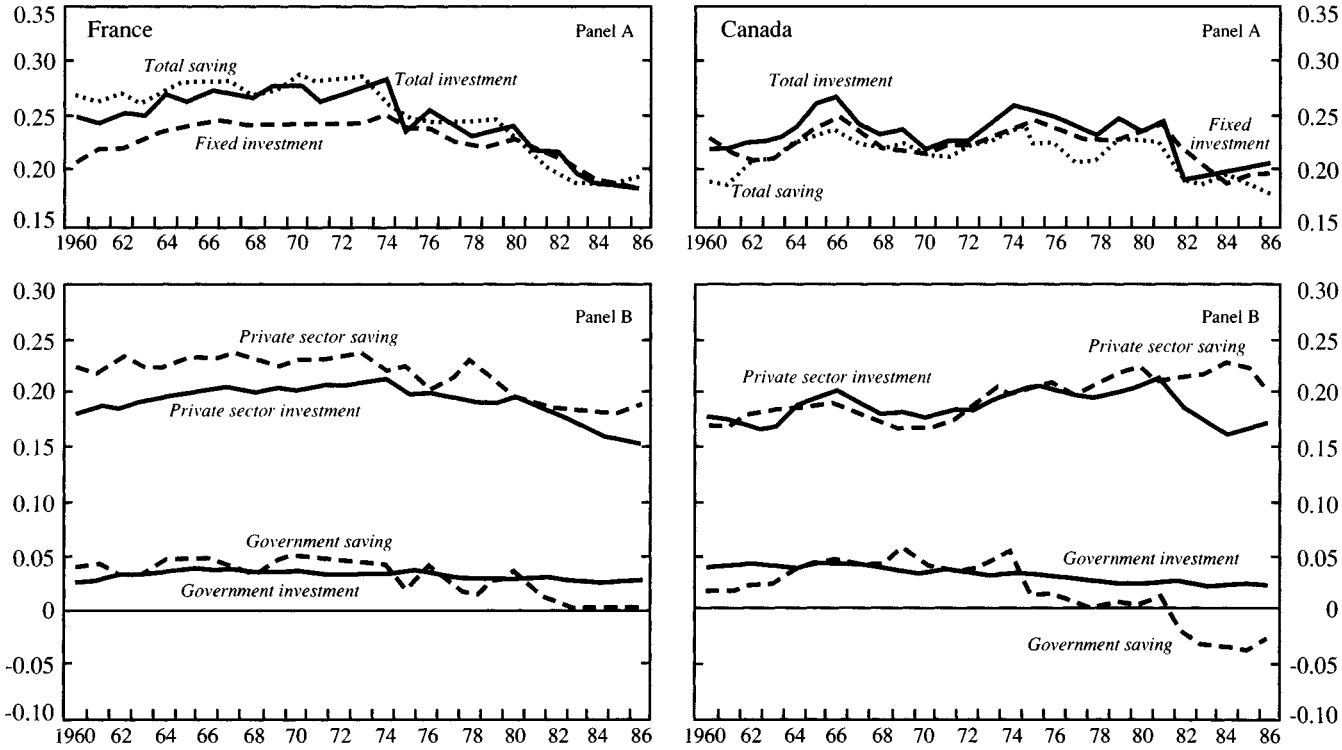


Figure 5 (*continued*).

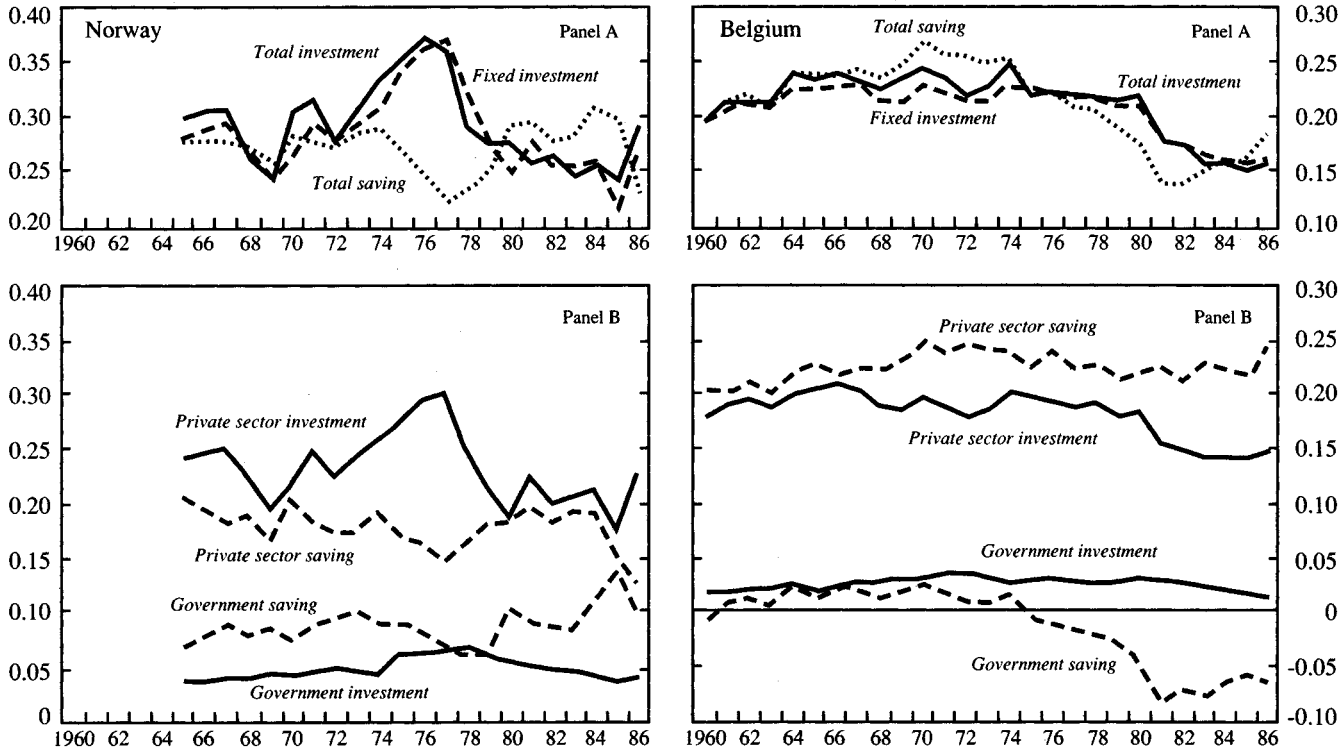
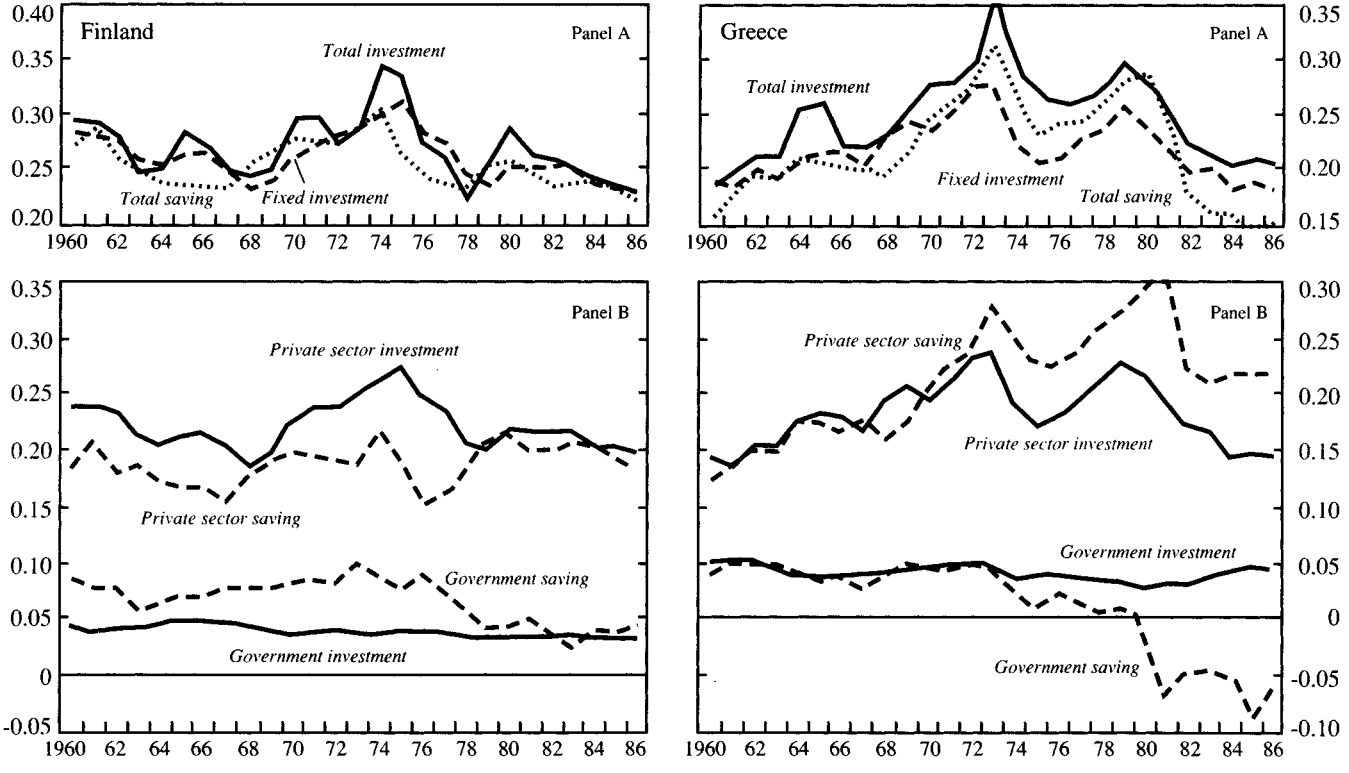


Figure 5 (*concluded*).



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