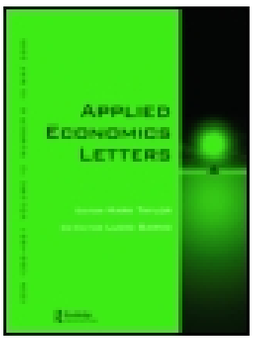

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The saving investment relation: a panel data approach

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Numerous studies have confirmed the initial 1980 finding of Feldstein and Horioka of a high positive correlation between saving and investment, a result that is difficult to reconcile with the increasing integration of financial markets. This current study re-examines the correlation between saving and investment with a panel data approach. The empirical analysis concerns 19 OECD countries over the period 1970–1998. Stability tests have led to the identification three periods: 1970–1980, 1981–1990 and 1991–1998 and estimated results show that, when a country-specific effect is introduced, there is no correlation between private saving and national investment and that there is high correlation between public saving and investment.

I. INTRODUCTION

In a closed economy, national saving equals domestic investment and the current account is always zero. Fiscal and monetary policy have a full effect on private consumption and private investment. Any observed increase in national saving induces an equal rise in domestic investment. In an open economy, current account imbalances and divergences between saving and investment are possible. Therefore the effectiveness of fiscal and monetary policies depends upon the degree of capital mobility.

In order to investigate the effectiveness of government policies, Feldstein and Horioka (1980) evaluated the correlation between savings and investment among OECD countries. They found high correlation and interpreted this result as evidence that capital is not internationally mobile. Economic data on savings and investment seemed to suggest that OECD countries approximate closed.

But this result is not consistent with the high capital mobility observed over the past two decades, as capital controls have been liberalized in many economies, and savings in each country seem to respond to the international opportunities for investment. This result led to a widespread debate on their interpretation (Baxter and Crucini, 1993; Coaley and Kulazsi, 1997) and on the method (Tesar, 1991; Hussein, 1998). Obstfeld and Rogoff (1995) suggested different plausible macroeconomic factors to explain the presence of common factors that might simultaneously influence saving and investment rates in various countries, for example, fiscal or monetary policies which avoid large and protracted current account imbalances.

This study revisited the Feldtein–Horioka result with a panel data approach. First, with cross-section estimations of the correlation between saving and investment in 19 OECD countries, over the period 1970–1998, structural breaks are identified in 1980 and in 1990. Second, with a panel data model covering the three periods 1970–1980, 1981–1990 and 1991–1998 it was found that private savings cannot explain national investment but that public saving is highly correlated to investment.

Section II presents the methodology employed in the study, Section III the results and Section IV concludes.

II. ECONOMETRIC METHODOLOGY

The following equation was suggested by Feldstein and Horioka (1980), to evaluate the degree of capital mobility:

$$\left(\frac{I}{Y}\right)_i = \alpha + \beta\left(\frac{S}{Y}\right)_i + \varepsilon_i \qquad (1)$$

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where $(I/Y)_i$ is the ratio of gross domestic investment of country i to gross domestic product, $(S/Y)_i$ is the corresponding ratio of gross domestic saving to gross domestic product and ε_i is an error term. Estimates of β close to one would indicate a low capital mobility and close to zero a perfect world capital mobility.

Feldstein and Horioka used data from 21 OECD countries. To evaluate the long-term relation between saving and investment they averaged the saving and investment ratios over the period 1960–1974. Then they estimated Equation 1 using the 21 observations. Regression results concluded that, contrary to popular belief, β was significantly different from zero but not significantly different from one.

In this study, this result is re-examined with a panel data approach, using data over the period 1970–1998, in 19 OECD countries: USA, Japan, Germany, France, Italy, Canada, Austria, Belgium, Denmark, Finland, Ireland, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Australia and the UK. In the analysis private and public savings ratios are distinguished and the following equation is estimated:

$$\left(\frac{I}{Y}\right)_i = \alpha + \beta_1\left(\frac{S_P}{Y}\right)_i + \beta_2\left(\frac{S_G}{Y}\right)_i + \varepsilon_i \qquad (2)$$

where S_P and S_G represent private savings and public savings respectively. The equality of parameters β_1 and β_2 are systematically tested with a Fisher test.

First, to identify structural breaks, Equation 2 is estimated with the mean saving and investment ratios over the period 1970–1975, then one year is added to the cross–section estimation of Equation 2 until a change of the estimated parameters is detected. To verify that parameters are identical in the successive estimations, each time one year is added, the following Wald statistic is calculated:

$$(\hat{\delta}_{t+1} - \hat{\delta}_t)'[\mathrm{Var}(\hat{\delta}_{t+1}) - \mathrm{Var}(\hat{\delta}_t)]^{-1}(\delta_{t+1} - \hat{\delta}_t)$$

where $\hat{\delta}$ is equal to the estimated parameters vector and $\mathrm{Var}(\hat{\delta})$ is the variance covariance matrix of the estimated parameter. The distribution of the statistic is a chi-square equal to the number of estimated parameters. When a structural break is detected, the corresponding year is used as the initial one and we proceed to another search for structural breaks.

Second, the entire period is subdivided into sub-periods corresponding to the detected structural breaks in the preceding analysis. The following equation is estimated:

$$\left(\frac{I}{Y}\right)_{it} = \alpha_i + \alpha_t + \beta_{1t}\left(\frac{S_P}{Y}\right)_{it} + \beta_{2t}\left(\frac{S_G}{Y}\right)_{it} + \varepsilon_{it} \qquad (3)$$

where the investment and savings ratios are averaged over the different sub-periods, the parameter α_i represents a country-specific effect and the parameter α_t a time- specific effect. Three Fisher tests are then carried out. First, the hypothesis $H_{0A}, H_{0A}: \alpha_i = \alpha_1$ and $\alpha_t = \alpha_2 \forall i, t$, is tested: if the hypothesis H_{0A} is not rejected Equation 3 is estimated under the constraint that $\alpha_i + \alpha_t = \alpha$ where α is a constant term. Else, if H_{0A} is rejected, the two following hypotheses are tested: $H_{0B}: \alpha_i = 0 \forall i$ and $H_{0C}: \alpha_t = 0 \forall t$.

III. ECONOMETRIC RESULTS

First, Equation 2 is estimated over the period 1970–1974. Results are presented in Table 1. The constraint model is retained. Parameters are significantly different from zero and the hypothesis that $\beta = 1$ is not rejected, concluding as Feldstein and Horioka, that capital mobility is low. Figure 1 shows the estimated value of parameter β when the constraint model is estimated over the period 1970–1975, 1970–1976, ... until 1970–1998. Results of the constraint model are presented because the hypothesis that $\beta_1 = \beta_2$ is never rejected by the data.

It is observed that the estimated parameter changes around the year 1980 and a Wald test detects a structural change in 1981. The Wald statistic was found to be 5.67 and the significance level of the test, 0.05. Another structural break test was therefore applied, estimating the model over the period 1981–1985 (Table 1) and we add one year to the time span until 1998. The estimated value of β is given in Fig. 2.

Another break is detected in 1991: the Wald statistic is equal to 10.54 and the significance level of the test is 0.005.

The second part of this empirical study uses these results. In order to evaluate the savings investment relation, three periods are now considered: 1970–1980, 1981–1990 and 1990–1998. The panel data set is composed of observations on 19 OECD countries for the three periods. Estimated results for the unconstrained model (3) and the model under hypothesis H_{0A}, H_{0B} and H_{0C} are given in Table 2. Testing procedures lead to retention of the model under H_{0C}. The model is estimated with an individual effect with no time effect in the constant term. A time effect is included in the slope parameters β_1 and β_2.

If this result is compared with cross-section estimations, the results change significantly. For each sub-period the hypothesis that $\beta_1 = \beta_2$ is rejected (the F statistic is equal to 7.39) and the hypothesis that β_1 is equal to zero is not

Table 1. *The OECD saving investment relation with cross-section data*

	1970–1974		1981–1985	
p-value ($\beta_1 = \beta_2$)	0.65		0.73	
α	0.08	(2.49)*	0.109	(3.10)*
β	0.74	(5.94)*	0.513	(3.30)*
R^2	0.675		0.40	

t-ratios in parentheses,* denotes significance at the 0.05 level

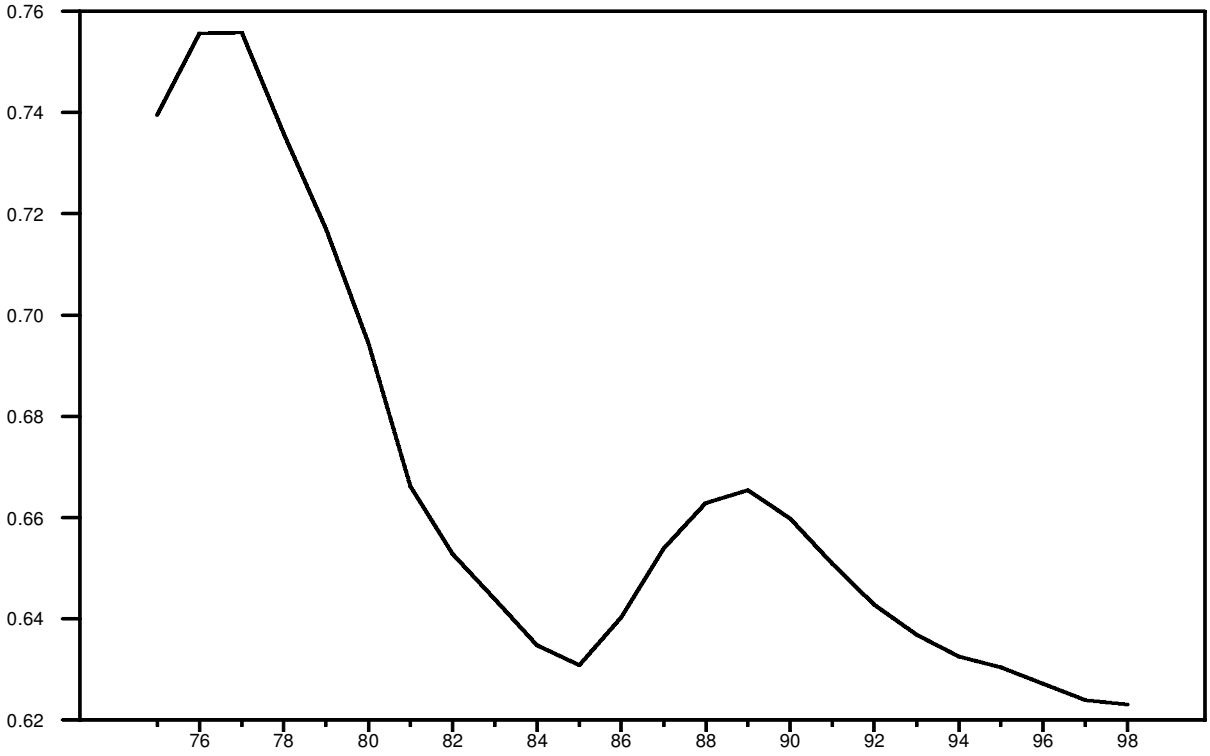

Fig. 1. *Estimated parameter β – period 1970–1998*

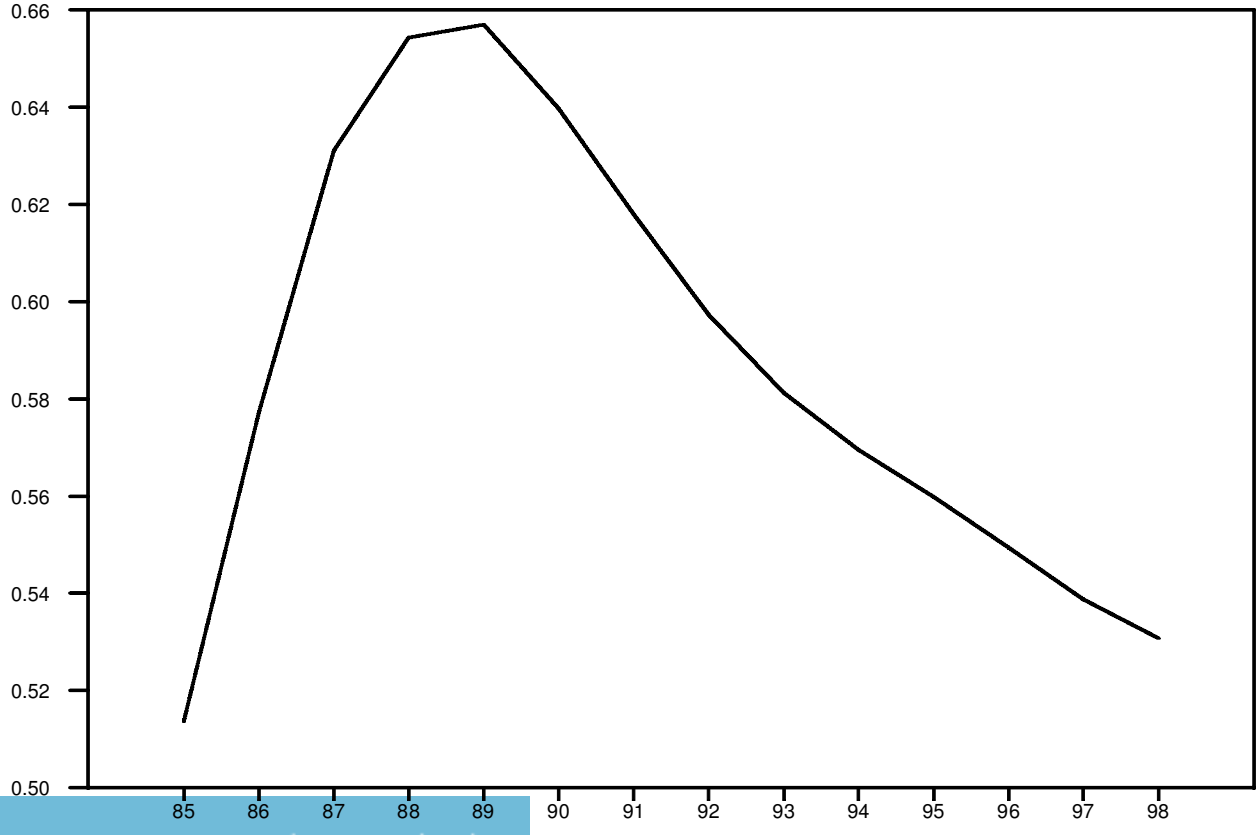

Fig. 2. *Estimated parameter β – period 1981—1998*

Table 2. *The OECD saving investment relation with panel data*

	Model							
			Under H_{0A}		Under H_{0B}		Under H_{0C}	
p-value	With no constraint		0.00*		0.00*		0.12	
$\beta_{1,70-80}$	0.33	(2.54)*	0.65	(6.3)	0.76	(4.99)*	0.21	(1.68)
$\beta_{1,81-90}$	−0.04	(−0.25)	0.53	(5.01)	0.61	(2.92)*	0.12	(0.91)
$\beta_{1,91-98}$	−0.20	(−1.31)	0.41	(3.96)	0.20	(1.13)	0.01	(0.14)
$\beta_{2,70-80}$	0.76	(4.15)*	0.47	(2.58)	0.54	(2.75)*	0.62	(3.41)*
$\beta_{2,81-90}$	0.70	(4.42)*	0.62	(4.12)	0.64	(3.94)*	0.71	(4.54)*
$\beta_{2,91-98}$	0.92	(5.33)*	0.60	(3.20)	0.59	(3.11)*	0.89	(4.98)*
R^2	0.90		0.66		0.67		0.92	

t-ratios in parentheses, * denotes significance at the 0.05 level, P-value denotes the significance level of hypothesis H_{0A}, H_{0B} and H_{0C}.

rejected. Consequently, it is shown that incremental private savings do not tend to remain in the country in which the saving are accumulated. Results lead to the conclusion that there is a high degree of capital mobility in OECD countries. Results also reflect the movement towards the abolition of capital controls. When results for the first period are compared with those for the last period, which corresponds to the complete liberalization of capital movement in European countries, it is seen that the level of parameter β_1 and its significance level change notably. Over the period 1970–1980 the significance level is 0.10 and over the period 1991–1998 it is 0.88. When heterogeneity is introduced among OECD countries, it is found that there is no correlation between investment and private savings. The high correlation between saving and investment ratios found in cross-section analysis is dependent on the country-specific effect.

Another important result concerns the correlation between public saving and investment ratios. Parameter β_2 is significantly different from 0 and is not significantly different from 1. So most of the incremental public saving in each country has remained there, and a sustained change in public saving rates has a large effect on investment in the long term.

IV. CONCLUSION

Surprisingly, cross-section analysis fails to validate the assumption that capital is perfectly mobile between countries. Numerous studies have confirmed the initial findings of Feldstein and Horioka (1980) of a high positive correlation between saving and investment, a result that is difficult to reconcile with the increasing integration of financial markets. This current study re-examines the correlation between saving and investment with a panel data approach. Three important results are presented. First, the relation between investment and saving is not homogenous over time and two structural changes are detected, in 1981 and 1991. Second, when account is taken of heterogeneity across countries, no correlation is found between private saving and national investment. Feldstein and Horioka have suggested that their result could reflect the impact of other variables. These current results confirm this hypothesis. Third, public saving and private saving do not have the same effect on national investment. High correlation is found between public saving and national investment. For economic policy, it is an important result because a sustained increase in public saving induces an equivalent increase of investment in the long term.

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