Capital Mobility, Intertemporal Budget Constraint, Government Policy and Country Size

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Abstract

This paper re-examines the dynamics of the saving-investment relationship among OECD countries over the last three decades using an error correction model. Within this context, we also attempt to determine whether country size influences the saving-investment correlation over this period and what implications follow for capital mobility and/or the validity of intertemporal budget constraints. Our empirical results indicate differences across individual countries in terms of the nature of the saving-investment relationship in the short and long run. However, our group-wise results appear to support the view that the larger the economic size of the country, the lower capital mobility and accordingly, the greater the likelihood that domestic investment and long term economic growth will be tied to the domestic saving effort.

I. Introduction

In a well-known study, Feldstein and Horioka (1980) examined the relationship between the domestic saving and investment rates of a sample of industrialized countries. Their results pointed to the existence of a strong relationship with a saving retention coefficient in a regression of investment rates on saving rates being close to unity. They interpreted that finding as implying that the assumption of perfect capital mobility is invalid. The finding has far reaching implications. For instance, with low international capital mobility, a country's growth prospects would be constrained by its saving effort. If the saving effort is weak relative to investment opportunities, realized investment rates could fall short of their potential, and thus impact adversely on growth.

The Feldstein-Horioka result has been called a "puzzle" in regard to highly integrated financial markets that should result in high capital mobility. A large number of studies have attempted to offer alternative explanations for the observed correlation between saving and investment. Earlier studies attributed the strong saving-investment correlations to a number of other casual factors – from the response of the current account to investment shocks (Sachs 1981, 1983), to country size [Harberger (1980), and Murphy (1985)], to the response of government to current account imbalances [Tobin (1983), Obstfeld (1986), Summers (1998)], or econometric weaknesses of the Feldstein and Horioka methodology [(Dooley (1985), and Dooley, Frankel and Mathieson (1987)]. Feldstein and Bacchetta (1991) re-examined the issue in light of the criticism and concluded that the strong positive saving-investment correlation is quite robust and reflects low capital mobility. Some other empirical studies also appear to suggest that the Feldstein and Horioka study is, in many ways, more robust than its critiques [see for instance, Frankel (1991), AmirKhalkhali and Dar (1993)]. Recent explanations for the observed saving and investment correlation have shifted their focus and sought to explain the strong correlation within the context of theoretical open-economy macro models. For instance, a

persistent, positive correlation between saving and investment might alternatively reflect an intertemporal budget constraint. Specifically, within the context of the generic intertemporal open-economy macro model in which capital mobility is perfect, an intertemporal budget constraint implies that the ratio of current account to GDP must be constant in the long run, which would, via the accounting identity, imply that the relationship between the saving rate and investment rate is one-to-one. In other words, this one-to-one relationship could reflect the budget constraint and not zero long run capital mobility. Another implication of such models is the distinction between short run dynamics and the long run equilibrium. From an empirical perspective this can be addressed by looking at time series econometric models that employ the error-correction mechanism [see for instance, Jansen (1996, 1998)]. According to Jansen, while attributing high positive correlations between saving and investment ratios to limited capital mobility might well have some validity, such correlations are also entirely consistent with intertemporal budget constraints and high capital mobility.

This paper re-examines the dynamics of the saving-investment relationship among OECD countries over the last three decades. Within this context, we also attempt to determine whether country size, measured in terms of output, influences the saving-investment correlation over time and what implications follow for capital mobility and the validity of intertemporal budget constraints. To be more specific, we address the following question: are countries with a larger economic size also characterized by lower capital mobility? For instance, this might be the case if in such countries, governments become more interventionist and segment their capital markets from international capital markets beyond levels that would otherwise occur. There are a number of reasons why this might be the case. For instance, legal restrictions on institutional investors such as insurance companies and pension funds could limit the amount they can invest abroad; alternatively, the risk of capital controls, and changes in government regulations, tax rules, and government procurement rules in ways that are especially disadvantageous to foreign investors, could inhibit flows of direct investment [Feldstein (1994)]. Note that it is not so much that these impediments actually have to be in place to reduce capital mobility; rather it is the perceived risk that these might occur, which could deter investors from shifting capital abroad. It seems reasonable to assume that more interventionist governments are more likely to have a policy framework in place that is relatively more detrimental to the free flow of capital. Alternatively the likelihood of that happening is perceived by investors to be greater in larger countries with such governments. In either case, the effect would be to reduce the degree of capital mobility. Furthermore, smaller economies are expected more likely to see greater volatility in government expenditures. Since this volatility impacts on the domestic saving effort, it would be interesting to examine the implications of this for the investment-saving relationship. For instance, in the presence of limited capital mobility, this would be reflected in a near stationary current account, with investment responding in the same direction as the shocks to domestic saving from government saving. On the other hand, if this instability shows up in the current account, then one could conclude that capital mobility is correspondingly higher. Other arguments for the effect of country size are that large economies are more diverse and hence less in need of offshore funds in the events of shocks (Harberger, 1980), and that higher savings in large countries may make it likely that the negative impact on interest rates stimulates investment (Murphy, 1984). Thus, one would expect larger countries to display a larger saving retention coefficient.

The empirical model employed in our study is an error correction model with random coefficients, which we apply to data on twenty three OECD countries over the 1970-2006 period. The error correction mechanism is employed in order to distinguish between short run and long run behaviour. This is important if the model is to be given a capital mobility interpretation because, as noted by Feldstein (1994), the saving-investment correlation relevant for assessing capital mobility is a long run one. The error correction approach allows us to integrate both short run and long run behaviour within a single model. Further, the evidence in Jansen (1998) clearly points to the need for accommodating significant inter-country differences. Jansen attempts to deal with this issue by using a fixed effects approach. However, a model with random coefficients is a more general way of incorporating unmeasured differences between countries, differences that neither a random effects or fixed effects approach could not adequately capture. We first investigate the aggregate and country-specific saving-investment-current account relationship using random coefficients for all 23 countries. Following that, these countries are classified into five groups on the basis of the relative economic size of the country. This relationship is then estimated for each of these groups, to examine how country size would impact on the long run saving-investment correlation, and what implications follow for capital mobility and the validity of intertemporal budget constraints.

II. The Model, Estimation Strategy, and Empirical Results

The sample used in this study consists of annual data for twenty three countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom (UK), and the United States (USA), covering the 1970-2006 period. The data were obtained from various issues of Economic Outlook published by Organization for Economic Cooperation and Development (OECD) and International Financial Statistics published by International Monetary Fund (IMF).

Our model is the following modified error-correction model (ECM) proposed by Jansen (1996):

$$(1) \qquad \Delta I_{it} = \alpha_i + \beta_i \Delta S_{it} + \gamma_i CA_{it-1} + \delta_i S_{it-1} + u_{it}$$

where I, S and CA are ratios of investment (gross fixed capital formation), saving (basic saving calculated as GDP minus private and public consumption expenditure) and current account (S - I) to GDP, respectively. Δ stands for the first difference, and the subscripts i (i=1,2,...,N) and t (t=1,2,...,T) index the countries and time periods in the sample respectively. α, β, γ, and δ are the regression parameters.

This is a varying coefficients specification that may be seen as a refinement of the stochastic law relating investment rates to its main determinants [see Pratt and Schlaifer (1984,1988) and AmirKhalkhali and Dar (1993)]. The β parameters measure the short-run correlation between saving and investment. The other parameters α, γ and δ have important long run implications for the saving-investment relationship. In particular, γ is the

cointegrating parameter, and rejecting the hypothesis that $\gamma = 0$, would imply a long-run relationship between saving and investment. This long-run relationship can be shown to be:

(2) $I_i = (\alpha_i/\gamma_i) + [1 + (\delta_i/\gamma_i)]S_i + u_i^*$

where $u^* = u/\gamma$. A failure to reject $\delta = 0$ could be interpreted as implying that the intertemporal budget constraint is obeyed and the current account fluctuates around a constant $(-\alpha/\gamma)$ in the long run. If additionally $\alpha = 0$, then the current account would fluctuate around zero. In either case, the relationship between I and S would be one-for-one, which in the FH tradition is indicative of no capital mobility, although it could also reflect the intertemporal budget constraint. On the other hand, rejecting the hypothesis $\delta = 0$ would imply that the current account is non-stationary, and this would allow us to draw firmer inferences about the degree of capital mobility, since in this case, the intertemporal budget constraint does not hold. In general, in this case capital mobility can be expected to be relatively higher, the degree depending upon the size of the long run saving retention coefficient $[1 + (\delta/\gamma)]$, which would be bounded from above by unity, since we expect δ to be non-positive.

In studying the saving-investment relationship for this sample of countries, we estimated the error correction model (1). We considered alternative random coefficients estimators of the parameters. In the first instance, the model is estimated for the entire sample by pooling over all 23 countries as well as for each country using the country-specific time series data. The parameters are then permitted to vary across the five groups, classified according to relative country size, and estimated for each group. For a discussion of the details of the random coefficients techniques employed in this study see Swamy (1970), Swamy and Mehta (1975), and Swamy and Tavlas (1995, 2002). We discuss the results for each of these cases in turn.

Table 1 reports the results for the pooled sample - that is, twenty three countries over the 1970-2006 period. At the 5 percent (or less) significance level, the GLS estimates imply statistically significant short run as well as long run relationships between saving and investment. However, the failure to reject $\alpha = \delta = 0$ suggests that the current account is stationary and fluctuates around zero in the long run. The implied one-for-one relationship between I and S, which in the FH tradition is indicative of low capital mobility, could also reflect the intertemporal budget constraint. Accordingly, no clear conclusion about the degree of capital mobility can be drawn. The validity of the random coefficients model is supported by a highly significant Swamy's g-statistic that follows a χ^2 distribution under the null hypothesis of fixed coefficients [see Swamy (1970) for more details].

To assess whether and to what extent these aggregate results mask inter-country differences, we look at the country-specific estimates of the model. These estimates are reported in Table 2. The country-wise estimates of β are positive and statistically significant for all countries except Ireland, Luxembourg, Iceland, and Norway. Note that this coefficient represents " the average contemporaneous co-movement of saving and investment in response to shocks which have hit the economy in the past" (Jansen 1996, p. 754). As reported in Table 2, the significant estimates of short run correlation between saving and investment vary from a low of 0.26 for Netherlands to a high of 1.22 for Switzerland, reflecting different types of shocks hitting these economies. The country-specific estimates

of the cointegrating parameter γ, are positive and statistically significant for all countries except the USA, Belgium, and Finland. For these three economies, therefore, we cannot say anything about capital mobility or the intertemporal budget constraint. At the same time, the country-specific estimates of δ are not statistically significant for almost all countries with the exception of Australia, Spain, Luxembourg, Netherlands, and Finland. The rejection of the hypotheses $\delta = 0$ for the latter countries would imply that the current account is non-stationary. This is also consistent with relatively higher capital mobility. However, in the case of Spain and Finland, we cannot meaningfully draw implications about capital mobility from the long run saving retention coefficient since the estimate of δ turns out to be positive for both, while $\gamma = 0$ for Finland. For Australia, Luxembourg and the Netherlands, this condition holds and the saving retention coefficients are 0.50, -0.20, and 0.36 respectively. This is indicative of relatively high capital mobility. For the remaining countries in the sample, the evidence supports a stable current account and is, hence, indicative of low capital mobility or the validity of an intertemporal budget constraint.

To make generalizations (if any) about the role of country size, and to assess the sensitivity of our results to the relative economic size of these countries, we classify them into five groups, depending upon a measure of relative size of these countries' economies as a percent of total OECD aggregate output (based on 2000 GDP and purchasing power parities). Group I consists of the two largest economies: USA (35.8%) and Japan (11.8%). Group II includes Germany (7.8%), France (5.6%), UK (5.5%), and Italy (5.3%). Group III includes Canada (3.2%), Spain (3.1%), Australia (1.9%) and Netherlands (1.7%). Group IV consists of Belgium (1.0%), Sweden (0.9%), Switzerland (0.8%), Austria (0.8%), Greece (0.7%), Portugal (0.6%), Norway (0.6%), Denmark (0.6%), Finland (0.5%), Ireland (0.4%), and New Zealand (0.3%). Group V includes the two most smallest economies: Luxembourg (0.08%) and Iceland (0.03). We estimate the random coefficients error correction model separately for each group. These results are reported in Table 3. It can be seen that the random coefficients model is supported by the statistically significant value of the calculated g-statistic, which means that the null hypothesis of fixed coefficients across groups is rejected. The estimates of the short-run correlations are positive and statistically significant for all groups but Group V. As far as the magnitude of impacts is concerned, the significant estimates of short run correlation between saving and investment vary from a low of 0.384 for Group IV to a high of 0.935 for Group I. With regard to the cointegrating parameters, all estimates are positive and statistically significant for all five groups, thereby supporting the existence of a long-run relation between saving and investment for each group. The estimate of δ is negative and statistically significant for all five groups but Group I. The significant group-wise estimates of δ imply non-stationary current account, and support a greater but varying degree of capital mobility for Group II to Group IV. The estimates of the long-run saving retention coefficient are 0.70, 0.65, 0.35, 0.27 and -0.11 for groups I through V, respectively. These results appear to support the view that the degree of capital mobility is generally lower in larger countries.

III. Conclusion

This paper examined how country size influences saving-investment dynamics and what implications follow for capital mobility and the validity of intertemporal budget

constraints. The specific question was: are countries with greater economic size also characterized by lower capital mobility? We applied an error correction model with random coefficients to data on twenty three OECD countries over the 1970-2006 period to study this question . The error correction approach allows us to integrate both short run and long run behaviour within a single model. This is important if the model is to be given a capital mobility interpretation because the saving-investment correlation relevant for assessing capital mobility is a long run one. Further, a model with random coefficients is a more general way of incorporating unmeasured differences between countries.

Overall, our empirical results strongly supported the random coefficients approach, and while there were differences across individual countries in terms of the nature of the saving-investment relationship in the short and long run, we did find some support for the view that capital mobility is lower in countries with larger economies. This could imply that, the larger the size of the economy, the greater the likelihood that domestic investment and long term economic growth will be tied to the domestic saving effort.

References

AmirKhalkhali, S. and Dar, A., (1993). Testing for Capital Mobility: A Random Coefficients Approach, *Empirical Economics*, 18, 523-541.

Dooley, M., Frankel J., and Mathieson, D., (1987). International Capital Mobility: What Do Saving-Investment Correlations Tell Us? *IMF Staff Papers*, September, 503-530.

Feldstein, M. and Bacchetta, P., (1991). National Saving and International Investment. In: Bernheim, B.D. and Shoven, J.B. (Eds.), *National Saving and Economic Performance*, Chicago: University of Chicago Press, 201-226.

Feldstein, M. and Horioka, C., (1980). Domestic Saving and International Capital Flows, *Economic Journal*, February, 3l4-329.

Feldstein, M., (1994). Tax Policy and Capital Flows, *Weltwirtschaftliches Archiv*, 130, 129-151.

Harberger A, (l980). Vignettes on the World Capital Market. *American Economic Review*, 70: 33l-37.

IMF, (2002, 2006), *International Financial Statistics Yearbook*, Washington, D.C.

Jansen, W.,(1996). Estimating Saving-Investment Correlations: Evidence for OECD Countries Based on An Error Correction Model, *Journal of International Money and Finance*, 15, 749-781.

Jansen, W.,(1998). Interpreting Saving-Investment Correlations, *Open Economies Review*, 9, 205-218.

Murphy, R.G., (1984).Capital Mobility and the Relationship between Saving and Investment Rates in OECD Countries, *Journal of International Money and Finance*, 327-342.

OECD (1999, 2006). *Economic Outlook*, Organization for Economic Cooperation and Development. Paris, France.

Pratt, J. W. and Schlaifer, R., (1984). On the Nature and Discovery of Structure, *Journal of the American Statistical Association*, March, 9-33.

Pratt, J. W. and Schlaifer, R., (1988). On the Interpretation and Observation of Laws, *Journal of Econometrics*, September, 23-52.

Sachs, J., (1981). The Current Account and Macroeconomic Adjustment in the l970s, *Brookings Papers on Economic Activity*, l, 20l-268.

Sachs, J., (1983). Aspects of the Current Account Behaviour of OECD Economies. In: Claasen, E. and Salin, P. (Eds.) *Recent Issues in the Theory of Exchange Rates*. Amsterdam and New York: North-Holland.

Summers, L. H., (1988). Tax Policy and International Competitiveness. In: Frankel, J. (Ed.) *International Aspects of Fiscal Policies*. Chicago: University of Chicago Press, 349-386.

Swamy, P.A.V.B., (1970). Efficient Inference in a Random Coefficients Regression Model, *Econometrica*, March, 3ll-323.

Swamy, P.A.V.B.and Mehta, J.S., (1975). Bayesian and Non-Bayesian Analysis of Switching Regressions and of Random Coefficient Regression Models, *Journal of the American Statistical Association*, September, 593-602.

Swamy, P.A.V.B. and Tavlas, G.S., (1995). Random Coefficient Models: Theory and Applications, *Journal of Economic Surveys*, 165-196.

Swamy, P.A.V.B., and Tavlas, G.S., (2002). Random Coefficient Models. In: Baltagi, B.H. (Ed.) *Companion to Theoretical Econometrics*, Basil Blackwell, 410-428.

TABLE 1
Pooled Regression Results: Random Coefficients GLS
Model : $\Delta I_{it} = \alpha_i + \beta_i \Delta S_{it} + \gamma_i CA_{it-1} + \delta_i S_{it-1} + u_{it}$

Countries	α	β	γ	δ
All	0.934 (1.068)	0.528* (0.097)	0.222* (0.047)	-0.037 (0.045)
g-statistic =295.9*				

*indicates statistical significance at the 5% level or less. Figures in brackets are corresponding standard errors.

TABLE 2
Country-wise Regression Results: Random Coefficients GLS
Model : $\Delta I_{it} = \alpha_i + \beta_i \Delta S_{it} + \gamma_i CA_{it-1} + \delta_i S_{it-1} + u_{it}$

Countries	α	β	γ	δ
Australia	4.906*	0.654*	0.379*	-0.186*
Austria	-1.635	0.840*	0.163*	0.049
Belgium	-0.618	0.782*	0.101	0.017
Canada	0.397	0.560*	0.186*	-0.031
Denmark	0.989	0.602*	0.171*	-0.068
Germany	0.479	0.539*	0.182*	-0.041
Greece	3.698*	0.624*	0.603*	0.079
Finland	-3.73*	0.868*	0.082	0.126*
France	-0.628	0.702*	0.611*	0.002
Iceland	4.153	-0.118	0.233*	-0.168
Ireland	0.659	0.165	0.088	-0.031
Italy	0.103	0.546*	0.223*	-0.015
Japan	-0.288	0.885*	0.286*	-0.006
Luxembourg	8.704*	-0.149	0.293*	-0.351*
Netherlands	2.714*	0.262*	0.243*	-0.155*
New Zealand	-4.790	0.520*	0.361*	0.216
Norway	1.538	-0.253	0.118	-0.075
Portugal	1.253	0.647*	0.218*	0.066
Spain	-4.753	0.433*	0.281*	0.231*
Sweden	0.871	0.512*	0.181*	-0.071
Switzerland	2.008	1.220*	0.096	-0.087
U.K.	1.542	0.392*	0.305*	-0.070
US	0.999	1.007*	0.038	-0.045

TABLE 3
Group-wise Regression Results: Random Coefficients GLS
Model : $\Delta I_{it} = \alpha_i + \beta_i \Delta S_{it} + \gamma_i \ CA_{it-1} + \delta_i S_{it-1} + u_{it}$

Groups	α	β	γ	δ
Group I **USA, Japan**	0.668	0.935*	0.088*	-0.026
Group I **Germany, France, UK, Italy**	1.962*	0.535*	0.284*	-0.101*
Group III **Canada, Spain, Australia, Netherlands**	1.363*	0.509*	0.095*	-0.062*
Group IV **Belgium, Sweden, Norway, Switzerland, Austria, Portugal, Greece, Denmark, Finland, Ireland, New Zealand**	1.650*	0.384*	0.104*	-0.076*
Group V **Iceland, Luxembourg**	4.679*	-0.178	0.181*	-0.201*
g-statistic =93.4*				

* indicates statistical significance at the 5% level or less.
Figures in brackets are corresponding standard errors