The Saving Retention Coefficient
After the Advent of Euro

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I. Introduction

The conventional wisdom that capital mobility increased at an accelerating rate since the early 1970s has been widely accepted by economists. The high growth of international financial transactions and capital flows is a very welcome phenomenon, raising levels of investment and encouraging economic growth at the late twentieth century. In recent times there has been a massive increase in the flows of capital mainly to developing countries (Dooley et al. (1996)). What is more significant is the size of capital which is short-term in nature usually referred to as "hot money" (Hossain and Chowdhury (1998)).

However, the issue of capital mobility and the related issue of financial market integration provide a contradiction between casual empiricism and conventional wisdom, on the one hand, and the results of formal empirical testing, on the other. This is one of the most intriguing puzzles in international finance that has arisen out of the work of Feldstein and Horioka (1980), who have shown a high association between the national saving and national investment rates.

The introduction of the euro marks a milestone in the process of European financial market integration. Capital mobility is helpful to cope with the loss of fiscal adjustment instruments in EMU. High capital mobility in the sense of Feldstein and Horioka can limit the negative consequences of shocks affecting the saving capacity of an economy in the Euro zone. In other words, if capital mobility is high, a country's growth prospect will not be constrained by its ability to save.

The implications of the euro for capital markets and cross-border banking activities are expected to be huge. In the new regime, a local

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borrower can access the entire market of investors in euro-denominated credits with a single instrument. Furthermore, she can provide to potential investors greater depth, breadth and liquidity than would have been feasible in the earlier segmented system. As far as banks are concerned, we note the role of banks as providers of informational and of risk-diversification services. By eliminating exchange rate risks, the euro enhances the incentives of banks to expand within Euroland. However, while the currency bias in bank and investors portfolios is eliminated, the home bias will remain.

One of the most famous theoretical criticisms of the use of Feldstein/Horioka condition as a measure of capital mobility is that the savings retention coefficient test is more restrictive than other definitions of capital mobility. According to Frankel (1992) there are at least four conditions of perfect capital mobility: (i) covered interest parity condition, (ii) a zero exchange risk premium, (iii) zero expected real depreciation and (iv) national savings to be exogenous. Thus, failure of condition (ii) or (iii) may cause a high positive correlation between savings and investment. This suggests that the high correlation observed between savings and investment is due to the non-zero currency premium. Empirical results provide significant support of Frankel's proposition. Bayoumi and Rose (1993) used regional data on savings and investment rates for the UK and showed that they were uncorrelated and Sinn (1992) using regional US data estimated an insignificant correlation between savings and investment. Yamori (1995) and Deckle (1996) confirmed this evidence by using Japanese intra-national regional data.

This paper empirically examines the magnitude of the saving retention coefficient, β, in a setting of an institutionally targeted near-perfect capital mobility and capital market integration, Euro Area countries. We also try to clarify wheather the adoption of the euro and the previously completed financial liberalisation has changed the slope of saving-investment association. For this purpose, the Feldstein/Horioka approach is extended and updated. Our findings show that the savings retention coefficient is relatively low for the whole EMS period but significantly different from zero. In addition, the empirical findings support a new puzzle. Domestic saving and investment within Euroland is more correlated than they were before the advent of the euro.

The rest of the paper is organised as follows. Section II. presents briefly the Feldstein/Horioka test of capital mobility and the proposed techniques in the literature to resolve the famous puzzle of unit saving

retention coefficient. Section III. describes the data and explains the estimation method. Section IV., reports the estimation results. Finally, Section V. concludes the paper.

II. What does the Saving Retention Coefficient Really Tell us?

Presented as a way of measuring the degree of international capital mobility, the estimation of a saving retention coefficient (β) has generated a voluminous literature. The logic of Feldstein/Horioka test is as follows. If capital is perfectly mobile, domestic investment could be financed by capital imports, which would be supplied perfectly elastically at the world interest rate. Consequently, any change in domestic saving would therefore have no effect on domestic investment. In order to test this proposition, we must estimate a cross-section regression of the type

$$(1) \qquad \frac{I_i}{Y_i} = a + \beta \frac{S_i}{Y_i} + u_i$$

over a sample of countries $i = 1, \ldots, n$, where I is investment, S is saving, Y is output and u is a random disturbance. With perfect international capital mobility, saving and investment shares should be uncorrelated ($\beta = 0$) while a β-coefficient close to or equal to unity would imply a low degree of capital mobility.

If financial markets are integrated then capital will move freely, and so it is plausible to view the volume of capital flows as an indicator of the extent of market integration. In an internationally integrated financial market, potentially infinite capital flows eliminate differentials among nominal and real rates of return on identical assets. This implies that a shortfall of saving in one country is unlikely to restrict its volume therein.

Using cross sectional analysis, Feldstein and Horioka's findings showed that 85–95 % of national savings is domestically invested and the regression coefficient of savings on domestic investments is insignificantly different from unity. They concluded that the level of international capital mobility is very low and the high correlation between savings and investment has not weakened over time.

A lot of estimates in the '80s and '90s generally support the idea that a sizeable portion of the marginal increases in saving finds its way into domestic investment instead of the current account balance. Many

papers subsequently confirmed Feldstein and Horioka result (Dooley et al. (1987); Bagnai and Manzocchi (1996); Amirkhalkhali and Dar (1993); Coakley and Kulasi (1997)) although opinions about its explanation differ sharply; see Tesar (1991) and Moosa (1997) for reviews of the literature. Summing up this empirical work, Feldstein (1995) notes that about two thirds of each additional dollar of sustained savings remains at home to finance additional domestic investment.

The puzzle refers to the stylised empirical finding that panel estimations of the saving-investment relationship has remained stubbornly high for OECD countries in recent decades.

Economists have attempted to resolve the puzzle by providing alternative explanations:

1. *The argument of endogeneity of savings (mispecification in the form of omitted variables or simultaneous equation bias).* If both investment and savings are driven by another factor or factors, strong correlation will be observed between them even though they may be unrelated. Obstfeld (1986) argues that these influencing factors could be the growth rate of the economy and a productivity shocks. This is because a country facing a positive productivity shock would experience an increase in investment, as capital is more productive, and a rise in savings, since wages are temporarily high. Backus et al. (1992) and Baxter and Crucini (1993) argue that positively correlated and temporary productivity shocks could produce a positive saving-investment correlation even under complete financial markets.

2. *Country (financial) size argument.* Murphy (1984), Baxter and Crucini (1993) and Ho (2003) suggest that a high domestic saving investment correlation reflects the country's financial size in the world economy. When the country's financial system is highly developed in international terms, exogenous variations in domestic saving and investment rates affect world interest rates and induce joint movements in domestic saving and investment rates. For example, a fall in the saving rate of a large country like USA, UK or Japan would lead to a rise in interest rates and, therefore, to a fall in investment in these countries. If the capacity of a country to influence interest rates on world capital markets is an important explanatory variable of the finding of a high correlation coefficient for saving and investment, the estimation of a regression in which the sample countries are treated as identical (in terms of their capacity to influence conditions on international capital markets) could bias the correlation coefficient upwards or downwards.

3. The argument of time averaging (or the solvency constraint as an alternative explanation): In fact the existence of a high correlation between savings and investment could be compatible with the hypothesis of capital mobility in the long term. The persistent correlation may not due so much to imperfect capital mobility than to the procyclical character of saving and investment in a real business cycle model (Corbin (2001)). The cross section analysis on sample averages in the period eliminates the influence of these cycles in the savings-investment correlation. Standard intertemporal macroeconomic models, which generally assume perfect capital mobility, imply that savings-investment dynamics are unrestricted in the short run, while in the long run the saving and investment rate are tied together by the intertemporal budget constraint. In the long term, the intertemporal budget constraint is an indicator of a country's solvency. The current account expressed as a ratio to GDP, (which is by definition equal to national gross saving minus national gross investment) is a stationary variable around a possibly non-zero mean. Hence, each country's saving and investment rates are co-integrated overtime[1]:

$$(2) \qquad \Delta\left(I/Y\right)_t = \gamma_0 + \gamma_1 \cdot \Delta\left(S/Y\right)_t + \gamma_2\left[\left(S/Y\right)_{t-1} - \left(I/Y\right)_{t-1}\right] + \varepsilon_t$$

In other words, an open economy faces a long run balance of payments constraint such that the long run value of β in equation (1) is unity irrespective of the degree of capital. Hence, the current account must be stationary in the long run otherwise a country's foreign debt would explode (Gundlach and Sinn (1992); Coakley et al. (1996)). Moreover, Jansen (1997; 1998) argues that the Feldstein/Horioka puzzle reflects the co-integration of national saving and investment in the time dimension, which is the combined effect of intertemporal budget constraint, low capital mobility and long run current account targeting by the government.

4. The policy response argument. Another explanation of the puzzle proposed by Fieleke (1982) and Tobin (1983) indicates that the original equation of Feldstein/Horioka test is misspecified. The argument is that savings and investment appear to be positively correlated because governments try to prevent large current account imbalances via budge-

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[1] If $\gamma_2 \neq 0$, saving and investment are co-integrated and the current account is stationary around $-\gamma_0/\gamma_2$. In the case of a closed economy, high values for γ_1 and γ_2 are expected. In contrast, for an open economy γ_1 is unrestricted and γ_2 has to be positive since the country can borrow or lend an amount equal to the difference $(S - I)$ in the international capital markets.

tary policy. Summers (1988) modelled this proposition by interpreting it to imply positive correlation between fiscal deficit, D, and the saving investment gap.

$$(3) \qquad\qquad D_j = \delta_0 + \delta_1 \cdot (S_j - I_j) + \psi_j$$

5. *A failure of the simple cross-section technique.* It is most likely to find a unity correlation between savings and investment when capital flows are mutually offset across the countries represented in the sample (Hussein (1998)). In addition, the cross section analysis may be subject to sample selection bias (Demitriades and Hussein (1996)).

Finally, there is a more technical criticism of the use of savings retention coefficient test as a measure of capital mobility. If a country witnessed large and offsetting capital flows in and out of the national borders, the coefficient should be equal to unity (Golub (1990); Moosa (1996)). Recently, Sachsida and Caetano (2000) provide a rigorous explanation of the Feldstein/Horioka puzzle based on an equation of external and domestic savings substitutability. In such a framework the savings retention coefficient should not be interpreted as indicating low capital mobility, but only the variability between external and domestic saving.

III. Research Strategy and Data

Several empirical methods have been applied, either formally or informally, to measure capital mobility. These include measures of the magnitude of capital flows, the degree to which a variety of arbitrage conditions are satisfied, the scope for sterilisation of the effects of reserve movements on the domestic money supply, saving-investment correlations and tests based on the Euler equation for the path of optimal consumption.

In this paper, we propose the use of Feldstein/Horioka test as useful tool to analyse the degree of capital mobility inside Euro Area. The trivial criticism for this test that restrictions on labour mobility or on trade in goods market are sufficient to produce the correlation between saving and investment, even in the presence of integrated financial markets, is very weak in the case of Euro Area. Another attractive feature of the Feldstein/Horioka test is that by directly focusing on a macroeconomic implication of strong financial integration , it does not face the problem of asset heterogeneity associated with tests of parity conditions for individual asset types.

To overcome the upward bias in results from time average cross section data, this paper presents results from estimates of the investment-savings relationship using pooled annual data for 12 Euro Area countries and 23 years. To test whether the adoption of euro has changed the slope of saving-investment association, we introduce two multiplicative dummy variables into the following panel data regression:

$$(4) \qquad I_{it}/Y_{it} = a + \beta_{ne}\left(\frac{S_{it}}{Y_{it}}\right) \cdot d_{it}^{ne} + \beta_e \cdot \left(\frac{S_{it}}{Y_{it}}\right) \cdot d_{it}^e + \gamma_0 \cdot b_{it} + \gamma_1 \cdot h_{it} + \gamma_2 \cdot g_{it} + e_{it}$$

where

$$\tilde{\alpha} = \sum_{\iota=1}^{12} a_\iota$$

and $d_{it}^{ne} = 1$ for the period of the European Monetary System (1980–1998) and 0 otherwise; $d_{it}^e = 1$ for the period of the single currency (1999–2002) and 0 otherwise; b_{it} is a fiscal shock variable, h_{it} is a productivity shock and g_{it} is a measure of the financial size of the country (each country's real gross domestic product per capita normalised with respect of Euro Area average = 100).

Dummy variables are included to capture individual country effects and time effects. In particular, the present study examines whether individual country specific effects exist in a context of international financial integration. This is because as indicated by Krol (1996), the use of time averaged data in cross sectional investment-savings regressions biases the results against capital mobility. However, the researchers working on Feldstein/Horioka test have traditionally averaged each country data over periods of various lengths in order to remove the common and simultaneous impact of the business cycle on investment and saving. For example, Caprio and Howard (1984) consider the 5 years as the length of the business cycle and use this time period for time averaging. We overcome this problem by including a business cycle variable in the regression. The estimate also controls for productivity and policy shocks, which may move saving and investment in the same direction, and as a consequence, produce a high correlation irrespective of capital market structure (Finn, 1990; Kim, 2001). More specifically, we use a Hondrick/Prescott filter to decompose productivity and fiscal shocks (criticism of type 1 and 4 respectively as mentioned in Section II.).

The estimation method is the generalised least squares technique. The White (1980) heteroskedasticity covariance method is used to estimate

covariances that are robust to general heteroskedasticity. This form of heteroskedasticity is more general than the cross-section heteroskedasticity, since variances within a cross-section are allowed to differ across time. The data sources are from *Quarterly National Accounts* of *Eurostat*.

IV. Empirical Results

The results are presented in Table 1. The coefficients of (S/Y) are all positive and significantly different from zero. It means that only a 25%–27% percent of domestic saving remains in a given European country to fund domestic investment.

All estimated coefficients have the expected signs. Positive productivity shocks increase investment but only the lagged shocks have statistically significant coefficient. Fiscal policy shocks are negatively correlated with investment. It means that a rise in government spending, increases government borrowing and affect business investment through a change in interest rate crowding out. However, the traditional Ricardian view suggests that forward looking agents internalise a government's budget constraint and adjust their own behaviour to offset changes in fiscal policy. Consequently, the specific effects of fiscal shocks depend upon whether the fiscal policy is permanent or temporary.

We run three versions of the basic regression. The first one includes fixed effects. In the second regression, we exclude Luxemburg from the data set. As indicated by Coiteux and Oliver (2000) and Obstfeld (1993), Luxembourg should be omitted from the sample on the grounds that it represents an extreme outlier[2]. Quite remarkably, however, the choice of whether or not to include Luxembourg in the panel does not change the results considerably. Finally, in the third estimate of Table 1, we present the results of a bivariate regression between investment and saving.

We test the statistical significance of the difference between the coefficients of the multiplicative dummies by using the Wald test. More specifically we test if $\beta_{ne} - \beta_e = 0$. As can be seen, the Wald test indicates that the slope of the investment-savings relationship is smaller after the adoption of the single currency.

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[2] *Als* (1988) provides a detailed analysis of the problems in explaining the national accounts of a country with a large international banking sector, since the output of financial intermediaries is not counted in gross domestic product.

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Table 1

Investment-Saving Association Results

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Dependent Variable: I/Y
Method: GLS (Cross Section Weights)
Sample: 1980 2002
Included observations: 23
Total panel observations 276 (Luxembourg included)

Variable	Regression 1	Regression 2	Regression 3
$(S_{it}/Y_{it})d^{ne}$	0.24	0.24	0.17
	(6.88)	(6.87)	(5.65)
$(S_{it}/Y_{it})d^{e}$	0.27	0.27	0.22
	(6.91)	(6.88)	(6.19)
b_{it}	−0.26	−0.29	–
	(−3.51)	(−3.75)	
b_{it-1}	−0.39	−0.37	–
	(−4.34)	(−4.08)	
h_{it-1}	0.18	0.22	–
	(3.05)	(3.39)	
g_{it-1}	0.09	0.09	–
	(3.10)	(3.19)	
Fixed Effects			
Austria	5.38	5.22	16.61
Belgium	1.67	1.52	13.24
Denmark	3.16	2.99	15.09
Finland	5.46	5.31	15.72
France	2.57	2.40	13.86
Greece	6.72	6.65	14.47
Ireland	5.83	5.74	13.78
Italy	2.07	1.92	13.23
Luxembourg	−8.43	–	–
Netherlands	3.27	3.12	14.69
Portugal	11.04	10.97	18.16
Spain	7.49	9.15	15.91
Weighted Statistics			
R-squared	0.94	0.94	0.94
Adjusted R-squared	0.94	0.94	0.94
S.E. of regression	1.89	1.95	2.16
Durbin-Watson statistic	0.49	0.48	0.42
Wald test	8.91	8.47	30.61

Notes: Numbers in parentheses are estimated t-statistics.

V. Conclusions

One of the most important elements in European integration is the widening and deepening of the euro area financial markets. Several recent studies find evidence of integration in the main EU financial markets, especially following the introduction of the euro (Danthine et al. (2000); Gros and Lanoo (2000); Santillan et al. (2000); Fratzscher (2001)). The common risk free yield curve and access to central bank liquidity under the single currency conditions have supported the creation of integrated money and capital markets replacing the previous national markets in the constituent currencies. This has also paved the way for the operation of financial institutions at the European level although in the retail field the introduction of the euro does not appear to be having such an impact (Cabral et al. (2002)).

There is a clear connection between market integration and capital mobility; if markets are integrated then capital will move freely, and so it is plausible to view the volume of capital flows as an indicator of the extent of market integration. This paper proposes the use of Feldstein/ Horioka test to examine the degree of capital mobility inside Euro Area during the EMS period as well as single currency period. We find a low savings retention coefficient (25%), which implies a high level of capital mobility. However, β is significantly different from zero. This evidence is inconsistent with the hypothesis that Euro Area is a fully financially integrated economy. However, it is consistent with the findings of Blanchard and Giavazzi (2002) that the cross-country correlation between savings and investment in the European Union has substantially declined over time, especially within the euro area. More specifically, they find that the dispersion of current account deficits across European countries has increased in the last five years.

In addition, our results seem to be consistent with the view that the 'currency premium' was substantial during the overall EMS period. Even though the financial liberalisation lowers the legal or institutional barrier to capital flows, the level of domestic investment has to be subject to the amount of domestic savings, particularly when investors become nervous about the uncertainty of the exchange rates (EMS crises).

Finally, the paper evaluates the role of the adoption of euro in strengthening capital mobility inside Euroland. The empirical findings seem to support the notion that domestic saving and investment are slightly more correlated than they were before the introduction of the single currency.

Although the Wald test indicates that the difference between β_{ne} and β_e is statistically significantly larger than zero, it is relatively small in real terms. However, this result could be considered as preliminary, given the short sample size after the advent of euro. This small difference could be also explained by the downward phase of the business cycle in this period, when both investment and saving were moving in the same direction for most countries in the sample depending on the degree of asymmetry. Further research into this issue would be considered more than valuable because it may help determine the extent to which the advent of the euro may be able to reduce further the savings investment coefficient inside Euroland.

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Summary

The Saving Retention Coefficient After the Advent of Euro

The introduction of the euro marks a milestone in the process of European financial market integration. Capital mobility is helpful to cope with the loss of fiscal adjustment instruments in EMU. High capital mobility in the sense of Feldstein and Horioka can limit the negative consequences of shocks affecting the saving capacity of an economy in the Euro zone. In other words, if capital mobility is high, a country's growth prospect will not be constrained by its ability to save. This paper empirically examines the magnitude of the saving retention coefficient in a setting of an institutionally targeted near-perfect capital mobility and capital market integration, Euro Area countries. We also try to clarify whether the adoption of the euro and the previously completed financial liberalisation has changed the slope of saving-investment association. For this purpose, the Feldstein/Horioka approach is extended and updated. We find that the savings retention coefficient is relatively low for the whole EMS period but significantly different from zero. Also, the empirical findings support a new puzzle. Domestic saving and investment within EMU is less correlated than they were before the advent of the euro. This result does not support the Frankel's (1992) proposition that the correlation observed between savings and investment is partly due to a non-zero currency premium. However, this result could be considered as preliminary, given the short sample size after the advent of euro. (F32, E22, G15)

Zusammenfassung

Der Sparkoeffizient nach der Einführung des Euro

Die Einführung des Euro stellt einen Meilenstein im Prozess der Integration der europäischen Finanzmärkte dar. Kapitalmobilität ist für die Bewältigung des Verlustes an fiskalpolitischen Instrumenten in der Europäischen Währungsunion hilfreich. Eine hohe Kapitalmobilität im Sinne von Feldstein und Horioka kann die negativen Konsequenzen von Schocks begrenzen, welche die Möglichkeiten einer Volkswirtschaft der Euro-Zone zur Bildung von Ersparnissen beeinträchtigen. Dies bedeutet mit anderen Worten, dass, wenn die Kapitalmobilität hoch ist, die Wachstumsaussichten eines Landes durch seine Möglichkeiten der Ersparnisbildung nicht beeinträchtigt werden. Dieser Beitrag beinhaltet eine empirische Untersuchung des Koeffizienten für die Ersparnisbildung in einer institutionell ausgerichteten Umgebung von fast perfekter Kapitalmobilität und Kapitalmarktintegration, d. h. in Ländern der Euro-Zone. Wir haben auch versucht zu klären, ob die Einführung des Euro und die zuvor vollendete Liberalisierung der Finanz-

märkte den Gradienten der Ersparnisbildung verändert hat. Für diesen Zweck wurde die Vorgehensweise von Feldstein und Horioka erweitert und auf den neuesten Stand gebracht. Wir sind der Auffassung, dass der Koeffizient für die Ersparnisbildung während des gesamten EWS-Zeitraums relativ niedrig war, sich jedoch von Null signifikant unterscheidet. Auch stützen die empirischen Erkenntnisse ein neues Puzzlespiel. Innerhalb der EWU korrelieret die Ersparnisbildung mit den Inlandsinvestitionen weniger als vor der Einführung des Euro. Dieses Ergebnis steht nicht im Einklang mit der Frankel-These (1992), dass die zwischen Ersparnisbildung und Investition beobachtete Korrelation zu einem Teil auf einen nicht Null betragenden Währungszuschlag (non-zero currency premium) zurückzuführen ist. Aber dieses Ergebnis dürfte als vorläufig gelten, da die Stichprobengröße nach der Einführung des Euro gering war.

Résumé

Le coefficient de rétention d'épargne après l'introduction de l'Euro

L'introduction de l'Euro constitue un élément déterminant dans le processus de l'intégration des marchés financiers européens. La mobilité des capitaux est utile pour faire face à la perte d'instruments d'ajustement fiscal dans l'UEM. Une forte mobilité des capitaux dans le sens de Feldstein/Horioka peut limiter les conséquences négatives des chocs affectant la capacité d'épargne d'une économie dans la zone Euro. En d'autres termes, si la mobilité des capitaux est élevée, une perspective de croissance d'un pays ne sera pas limitée par sa capacité d'épargner. Cet article examine empiriquement l'amplitude du coefficient de rétention d'épargne dans le cadre d'une mobilité institutionnelle presque parfaite des capitaux et d'une intégration du marché des capitaux dans les pays de la zone Euro. Les auteurs essaient également de clarifier si l'adoption de l'Euro et la libéralisation financière réalisée préalablement ont changé la corrélation investissement-épargne. A cet effet, l'approche de Feldstein/Horioka est étendue et actualisée. Les auteurs ont constaté que le coefficient de rétention d'épargne est relativement bas pour toute la période du SME mais significativement différent de zéro. En outre, les résultats empiriques fournissent un nouveau puzzle. La corrélation investissement-épargne au niveau national au sein de l'UEM est moindre que ce qu'elle était avant l'introduction de l'Euro. Ce résultat ne soutient pas la proposition de Frankel (1992) selon laquelle la corrélation observée entre l'épargne et l'investissement est partiellement due à une prime monétaire différente de zéro. Cependant, ce résultat devrait être considéré comme préliminaire étant donné que l'échantillon de la période après l'introduction de l'euro est encore limité.