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**European Integration and External  
Sustainability of the European Union  
An application of the thesis of Feldstein-  
Horioka**

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# European Integration and External Sustainability of the European Union

## An application of the thesis of Feldstein-Horioka

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### Abstract

The Feldstein-Horioka thesis was considered one of the greatest puzzles in economics. Born to measure international capital mobility, has known a process of immunisation to be conformed to empirical evidence and respect econometric knowledge. We apply to EU countries a formulation of this thesis which is adequate to test external sustainability and measure international capital mobility. Applying appropriate econometric methods we can accept the hypothesis of external unsustainability for the UE before the enlargement. The enlargement allows the external sustainability of the new UE. The lesser mobility of capital in the countries of the enlargement must be considered as a positive shock on EU industry of financial.

**Keywords:** Feldstein-Horioka, Capital Mobility, Saving, Investment, External Balance. JEL : E21, E22 and F21.

### Introduction

Feldstein and Horioka (1980) (F-H) proposed a very simple and imaginative measure of the international capital mobility. The results obtained with it originate one of the most important «puzzles» in economics. They have caused innumerable debates, where corrections and extensions were suggested, as well as positions which deny the interest of this thesis. In Andrade (2007) we presented the idea that the studies of this thesis are an example of a scientific practice like Karl Popper described it. In reaction to the problems of refutation, attempts of immunization were built. We can also recognize in this evolution a certain “methodological anarchism” *à la* Feyerabend<sup>2</sup>.

Accepting the positive effects of the mobility of capital for the development, a measurement of this mobility is very important. The results of the tests to confirm the thesis were responsible by its evolution, either at the level of the analysis, or at the level of the econometric techniques. A theoretical position has adapted to the econometric methods and allowed an interpretation in terms of external sustainability and capital mobility. We will apply these ideas to the countries of the EU, since 1993 to 2006. We also study subsets of these countries. We use the econometrics of no-stationary variables, as well as dynamic methods applied to panel data. Finally we conclude.

### F-H and the international capital mobility

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<sup>2</sup> Feyerabend (1993).

The mobility of capital is important, if not even essential, to allow an efficient allocation of capital, from the point of view of the diversity of its industrial uses as well as geographical location. An economy is internationally integrated if its flows of capital can enter and leave the country freely and if the national financial assets are good substitutes of the financial assets of other countries. The real and financial integration of less developed economies has the consequence of worsen the negative external balances<sup>3</sup>. And a country, or a group of countries, whose growth is faster than that of the others will have, in theory, an imbalance of its external balance more important.

The development of the financial practices of protection against the risk will also contribute to the reduction of the national savings<sup>4</sup> and consequently to worsen external imbalance. Economic integration can lead, in the case of certain countries, or groups of countries, to external unsustainability of the economy. Independently of this last result, economists believe in the growth of the economy<sup>5</sup> as a result of the mobility of capital. As a consequence of this we are interested in a simple measurement of this mobility.

The idea, behind the thesis of Feldstein and Horioka (1980), (F-H), is quite simple: if an economy is well internationally integrated, then, its accumulation of capital should not be constrained by national savings. That paper, later on, was refined by Feldstein (1983) and Feldstein and Bacchetta (1991). The equation which summarizes their work is the following:

$$\frac{I}{Y} = \alpha + \beta \cdot \frac{S}{Y} \quad 6$$

Feldstein and Horioka (1980) concluded that 85% to 95% of the national saving was invested locally. Vis-a-vis these results, of absence of international mobility of capital, for developed economies, Obstfeld and Rogoff (2000) regarded this result as a enigma (a “puzzle”) and as one of the six larger “puzzle” than one knows in international economy.

The empirical result is difficult to accept. Since the beginning of the Eighties it is seen a reduction and elimination of regulations limiting international capital mobility. We became conscious that we live in a market which is international and the volatility of exchange rates precisely translates this mobility<sup>7</sup>. How can one accept that contrary to our convictions, about freedom of capital movements, the national saving can continue to constraint national investment?

The definition of F-H of international capital mobility, that the variations of domestic saving will not have effects on domestic investment, is the most demanding of the defini-

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<sup>3</sup> Or the average level of development. Blanchard and Giavazzi (2002).

<sup>4</sup> Kimball (1990) and Parker, Jonathan and Preston (2002).

<sup>5</sup> See Agenor (2003). For another point of view, Edison, Ricci and Slok (2002).

<sup>6</sup> They have studied the OCDE countries for the period of 1960 to 1976, with cross-section data, to eliminate cyclical and endogenous problems. See also Bayoumi (1990).

<sup>7</sup> Baxter and Crucini (1993). For a world stock market see Wheatley (1988), and for several European markets, Muller (2004).

tions<sup>8</sup>. Taking account of the existence of exchange rate risk and his cost (the cost of this risk) and also of real losses anticipations of the currency value, there will be certainly considerable differences, between countries, in the real interest rate. And consequently, one must expect that the coefficient of retention of F-H ( $\beta$ ) can have values far away from the unit<sup>9</sup>.

From a more formal point of view Lemmen and Eijffinger (1998) showed that the conditions required by F-H to evaluate a perfect integration are really leonine. It is consequently natural that one can arrive at different ideas on actual integration when other methods are used<sup>10</sup>. Methodologically this thesis is extremely powerful, because it is exposed to its refutation. The problem, moreover frequent in economy, it is that it's possible refutation resulted in creating auxiliary conditions to protect it, to immunize it<sup>11</sup>.

### **The adaptation of F-H Thesis to the results**

We can summarize in two tendencies the models which worked on the assumption of F-H: the conciliation of their results with the accepted fact of the mobility of capital and the proposal of the new methods more appropriate to the problem in question<sup>12</sup>. In the first case the authors are led to confirm two ideas: the international mobility of the capital was very high for the period of the traditional Gold Standard; it was considerable less for the period of Bretton-Woods agreements, with an increasing tendency after the abandonment of this regime<sup>13</sup>; at the same time, the mobility of the capital for the less developed countries is always higher than that obtained for developed countries<sup>14</sup>. Obviously that there are results which contradict those<sup>15</sup> and Coakley, Hasan and R.Smith (1999) support the assumption that a low value for the coefficient of retention can be, simply, the result of not strong economic policies measures in response to external imbalances. Other authors as Pomfret (1998) defend the idea according to which the test of F-H is a reasonable measurement of the immobility of capital, but not of the mobility of capital. The zero value of  $\beta$ , ( $\beta = 0$ ), is a sufficient condition but not a necessary condition for the perfect mobility of capital. And the value of  $\beta$  equal to 1, does

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<sup>8</sup> See Frankel (1992).

<sup>9</sup> For small economies the coefficient  $\beta$  must be zero. For big economies it must be equal to the contribution of the country to the world stock of capital. A big economy will have a higher retention coefficient, cf. Ho (2003). For Murphy (1986), a scale effect doesn't allow the F-H approach to measure the capital mobility.

<sup>10</sup> See Bayoumi (1990), Sachs (1981), Obstfeld (1986), Frankel (1991), Levy (1995), Frankel and MacArthur (1988), Popper (1990), Baxter and Crucini (1993), Bayoumi and MacDonald (1995) and Goldberg, James and Okunev (2003).

<sup>11</sup> In the sense of Popper. Popper (2002).

<sup>12</sup> Coakley, Kulasi and Smith (1998).

<sup>13</sup> Hogendorn (1998). Aussi Bayoumi (1990) and Blanchard and Giavazzi (2002).

<sup>14</sup> Coakley, Hasan and R.Smith (1999). See also Mamingi (1997), Chakrabarti (2006), Payne and Kumazawa (2006) and Payne and Mohammadi (2006).

<sup>15</sup> See Lemmen and Eijffinger (1998) and Rocha and Zerbini (2000).

not imply necessarily the immobility of capital<sup>16</sup>. With regard to the new econometric methods we must take into account the difficulty in comparing the former results, because a good share of them were obtained with stationary methods<sup>17</sup> applied to non-stationary variables<sup>18</sup>. We must apply non-stationary approaches, either with time series data, or panel data, for the study of the «puzzle» of F-H<sup>19</sup>. Even if with these techniques of Co-Integration (CI) the contents of information of the thesis can be destroyed<sup>20</sup>.

### **Mobility, External Soutenabilité and Co-integration**

Coakley, Kulasi and Smith (1996), applying non-stationary methods, support the thesis according to which F-H does not measure capital mobility, but external sustainability. A coefficient close to the unit is nothing more but the result of the intertemporal<sup>21</sup> budgetary constraint. A very simple development, starting from the accounting identity of the macro equality between global supply and demand, makes it possible to expose this argument. From the macro definition of product:  $Y = C + I + G + (X - M)$ <sup>22</sup>, we deduce:  $\frac{S - I}{Y} = \frac{(X - M)}{Y}$ . The stationnarity of  $\frac{(X - M)}{Y}$ <sup>23</sup> is sufficient to prove external solvency<sup>24</sup>. This stationnarity means that the series  $\frac{I}{Y}$  and  $\frac{S}{Y}$  are integrated of order 1 and co-integrated with the vector of Co-integration (1, -1). In this case, we cannot deduce anything with regard to the international capital mobility from the value of the long term coefficient.

The econometrics of the non-stationary variables involves with it new questions. How “to deduce” the thesis from the coefficients obtained? Corbin (2004) proposes that if Co-integration is not rejected, the adjustment coefficients in the ECM model represent the intensity of the capital mobility. But in this case we can also put the question of the policy interventions, in short period, to push the economy towards its balance of long period. And so will the analysis be done compared to the capital mobility or to the effectiveness of the interventions? One will be able to never answer this question in a simple way<sup>25</sup>. Moreover, let us not

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<sup>16</sup> See also Jansen and Schulze (1996).

<sup>17</sup> See Ho (2002).

<sup>18</sup> First difference estimates are not efficient if the variables are C-I. As certain authors have done, Feldstein (1983), Feldstein and Bacchetta (1991) and Bayoumi (1990).

<sup>19</sup> Coakley, Kulasi and Smith (1998). Coakley, Fuertes and Spagnolo (2004) and Kim, Oh and Jeong (2005).

<sup>20</sup> Totally in the case of Jansen (1997).

<sup>21</sup> Tesar (1991), Husted (1992), Jansen (1996), Jansen and Schulze (1996), Moreno (1997) and Corbin (2004).

<sup>22</sup> Where C, G, X and M represents Private Consumption, Public Consumption, Exports and Imports.

<sup>23</sup> If we want to be more precise we must add other variables to obtain the Current Account from the Commercial Account.

<sup>24</sup> Obstfeld (1991), Alyousha and Tsoukis (2003) and Coakley, Kulasi and Smith (1996).

<sup>25</sup> See also Fattouh (2005).

forget that, with the increase in the number of observations, the probability of the stationarity of the external balance increases<sup>26 27</sup>.

Taylor (1996) and Banerjee and Zanghieri (2003) propose the equation  $\Delta I_t = \alpha + \beta \cdot \Delta S_t + \gamma \cdot (S_t - I_t)$ <sup>28</sup> to test the presence of Co-integration<sup>29</sup>. For these authors,  $\gamma$  represents the degree of capital mobility. Jansen (2000) proposes  $\beta$  to measure short period mobility and  $\gamma$  the long period mobility. Beyond of an abusive simplification, the interpretation of the coefficients is obviously not clear.

## Empirical study

### Presentation

In this paper we will study the EU countries, except Luxembourg (26)<sup>30</sup> for the period of 1993 up to 2006<sup>31</sup>. Holding in account the possible presence of unit roots and not wanting to fall into fallacious regressions (Baltagi and Kao (2000)) we begin our empirical research with the study of the integration level of the variables.

### Stationarity Tests

We think that the more suitable assumption will be the heterogeneity of the coefficients, to hold in account the differences between the economies of the EU. Let us present in a summarized way the tests used.

a) Levin and Lin (1993). ADF type statistics, LL,

$$\Delta y_{i,t} = \alpha_{0,i} + \rho_i \cdot y_{i,t-1} + \sum_{j=1}^p \gamma_j \cdot \Delta y_{i,t-1} + \varepsilon_{i,t}^b$$

Holding in account the criticism of Breitung (2000) we did not use the model with a single trend.

<sup>26</sup> Taylor (2002) confirms the sustainability for 15 countries since 1870 to 1990.

<sup>27</sup> The ruptures in the series raise also particular problems. See Husted (1992), Ozmen and Parmaksiz (2003a), Ozmen and Parmaksiz (2003b) and Westerlund (2006).

<sup>28</sup> That we adapted here to the time series data.

<sup>29</sup> What poses interrogations concerning the remainder of the C-I model and constraints of nullity of the coefficients.

<sup>30</sup> Here is the list: Belgium (1), Czech Republic (2), Denmark (3), FR. Germany (4), Estonia (5), Greece (6), Spain (7), France (8), Ireland (9), Italy (10), Cyprus (11), Latvia (12), Lithuania (13), Hungary (14), Malta (15), Netherlands (16), Austria (17), Poland (18), Portugal (19), Slovenia (20), Slovakia (21), Finland (22), Sweden (23), United Kingdom (24), Bulgaria (25) et Romania (26). The groups PD and MD have the following composition: PD, 1 + 3 + 4 + 6 + 7 + 8 + 9 + 10 + 16 + 17 + 19 + 22 + 23 + 24; and MD, 2 + 5 + 11 + 12 + 13 + 14 + 15 + 18 + 20 + 21 + 25 + 26. The total group of the economies will be identified by "Total". Therefore we have for Total the new EU, for PD the old EU and for MD the economies of the enlargement process. In an enlarged version we have also included the dates of the enlargement and the complete results of PMG estimation, for Total and PD economies. We will send this last version upon request.

<sup>31</sup> We use the data of the macroeconomic statistics base of the European Commission, AMECO..

b) Im, Pesaran and Shin (2003). IPS, equation like LL, but the statistics is calculated from the average of the values obtained for the individual equations. The null hypothesis consists of  $\rho_i = 1$ , for all the individuals, against  $\rho_i < 1$  for at least one individual.

c) Breitung (2000): UB, like LL, except that one introduces a trend which is heterogeneous and non-homogeneous.

d) Hadri (2000): H, test of Kwiatkowski, et al. (1992) type, with the trend as the only determinant variable. The starting equation for the case without trend:

$$y_{i,t} = \alpha_{0,i} + \sum_{j=1}^t \xi_{i,t} + \eta_{i,t}$$

with  $\xi_{i,t}$  a process IID (0,1) and  $\eta_{i,t}$  stationary. The author proposes a LM tests for the stationnarity.

Except for this last case, all the tests are of ADF type. For the tests LL, IPS and H we used 1 lag to correct the natural presence of autocorrelation of the errors. The results of two Tables 1 and 2 were obtained with software NPT (Chiang and Kao (2002)). The variables are the ratio of the national saving and the investment on the Gross Domestic Product (S\_Y and I\_Y).

Table 1: tests of unit root of I\_Y and S\_Y

	Total		PD		MD	
	I_Y	S_Y	I_Y	S_Y	I_Y	S_Y
<b>LL</b>	11,076 ***	4,958 ***	0,455	1,683	5,909 ***	8,760 ***
<b>IPS</b>	-0,247	-3,600 ***	-2,233	-0,841	-0,111	-4,390 ***
<b>UB</b>	-1,131	-0,180	0,545	0,954	-1,074	-0,303
<b>H</b>	10,654 ***	9,386 ***	8,701 ***	7,033 ***	6,284 ***	4,747 ***

Table 2: Tests of unit root of dI\_Y and dS\_Y

	Total		PD		MD	
	dI_Y	dS_Y	dI_Y	dS_Y	dI_Y	dS_Y
<b>LL</b>	52,111 ***	28,44 ***	32,676 ***	15,607 ***	21,875 ***	28,374 ***
<b>IPS</b>	-4,374 ***	-8,395 ***	-2,537 ***	-3,486 ***	-3,699 ***	-8,591 ***
<b>UB</b>	-10,371 ***	-9,071 ***	-4,029 ***	-5,685 ***	-7,811 ***	-6,316 ***
<b>H</b>	0,175	2,325 **	-0,374	2,506 ***	0,661	0,716

As one can see<sup>32</sup>, there are contradictory results. In any event we think that one can retain, in general, I\_Y as integrated of order 1 and S\_Y, also, as integrated of order 1, but where the possibility of stationnarity for Total and MD must be also considered.

With these results we must use the methods of FMOLS (fully modified estimator of OLS) of Phillips and Hansen (1990) and DOLS (dynamic least squares) of Saikkonen (1991)

<sup>32</sup> The prefix «d» means first difference.

and Stock and Watson (1993). Kao and Chinag (2000) have shown that: a) the estimation error with OLS can be considerable with reduced samples; b) in general the FMOLS estimate does not improve the OLS estimate; and c) DOLS is the preferable method for obtaining long period relations. To answer the problem of non-convergence and inefficiency of OLS estimators Anderson and Hsiao (1981) proposed the use of instruments<sup>33</sup>, however the proposed estimator is convergent but non-efficient.

### Co-integration between saving and investment

We propose the study of the presence of Co-integration between investment and saving starting from the DOLS estimates. As we have a reduced number of available observations (14) for each variable we chose 1 lead and 1 lag of the first differences of S\_Y, in the case of Total and MD. For PD we chose 2 periods because the results obtained with 1 alone for leads and lags was not reasonable<sup>34</sup>.

We have applied the test of Pedroni (1999) to the errors of the Co-integration relation whose null hypothesis is the absence of Co-integration. From all the tests proposed by the author we have chosen the 3 last ones which, beyond the heterogeneity of the coefficients of Co-integration, do not impose the presence of a common root to the alternative hypothesis. The results are in Table 3.

Table 3 : Tests of Co-Integration

Statistics of Pedroni	Total	PD	MD
<b>Group <math>\rho</math></b>	-19,51 ***	-11,48 ***	-16,40 ***
<b>Group t (NP)</b>	-7,18 ***	-4,46 ***	-5,90 ***
<b>Group t (P)</b>	-8,08 ***	-4,55 ***	-6,94 **

All the results reject the absence of Co-integration. We can retain, in conclusion, that there is a long period relation between investment and saving. We now will study the possibility of long period homogeneous relations with heterogeneous short term coefficients. This type of behaviour was presented by M Hashem Pesaran, Yongcheol Shin and Ron Smith (1999) which named it by “Pooled Mean Group Estimation” (PMG). PMG estimates are convergent and efficient in the case of homogeneity of the coefficients of long term. The authors proposed a Hausman test of PMG against the assumption of “Mean Group Estimation” (MG)<sup>35</sup> <sup>36</sup>. If one rejects the null hypothesis PMG is not convergent.

We start from an assumption of long period relation:

<sup>33</sup> A lag of order 2 of the dependent variable in levels and also in first differences.

<sup>34</sup> A  $\beta$  coefficient negative.

<sup>35</sup> See for the « MGE », M Hashem Pesaran, Yongcheol Shin and Ron Smith (1999) and Pesaran, Smith and Im (1996).

<sup>36</sup> We have used the procedures from the authors, M. Hashem Pesaran, Yongcheol Shin and Ron Smith (1999).

$$I\_Y = \theta_{0,i} + \theta_{1,i} \cdot S\_Y + \mu_{i,t}$$

with the formulation of short period, including the “error correction” values, given by:

$$\Delta I\_Y_{i,t} = \phi_i \cdot (I\_Y_{i,t-1} - \theta_{0,i} - \theta_{1,i} S\_Y_{i,t-1}) + \sum_{h=1}^q \delta_{1h} \Delta I\_Y_{i,t-h} + \sum_{j=1}^p \delta_{2j} \Delta S\_Y_{i,t-j} + \mu'_{i,t}$$

The Schwarz criterion was used to select the number of lags,  $q$  and  $p$ , in the dynamization of the last equation for a maximum of two lags. The results in Tables 4, 5 and 6 summarize the estimates obtained<sup>37</sup> for the various groups of countries.

Table 4 : PMG and MGE - Total

	Pooled MGE Estimates			MGE Estimates				
Dependent variable: I_Y								
	Coef.	St. Er.	t-ratio	Coef.	St. Er.	t-ratio	h-test	p-val
<b>Long-run Coefficients</b>								
S_Y	1,236	0,094	13,194	0,861	0,490	1,758	0,61	0,44
<b>Error Correction Coefficients</b>								
Phi	-0,253	0,07	-3,627	-0,338	0,103	-3,277		
<b>Short-run Coefficients</b>								
S_Y	0,313	0,086	3,627	0,298	0,108	2,761		
dI_Y(-1)	0,101	0,058	1,744	0,115	0,092	1,256		
dS_Y	-0,079	0,094	-0,838	-0,140	0,107	-1,308		
dS_Y(-1)	-0,023	0,047	-0,497	-0,042	0,075	-0,564		
Inpt	-0,005	0,005	-0,981	0,012	0,026	0,457		

\* h-test is the Hausman test statistic with its associated p-value.

The test of Hausman does not reject the PMG model. The long period coefficient equal to the unit<sup>38</sup> cannot also be rejected. The quality of the adjustment by the standard deviation of the estimate,  $\sigma$ , has values between 0.002 and 0.078, for Belgium and Latvia. There are problems of autocorrelation in the case of Poland, Estonia and Romania. The specification test gives bad results for Belgium, Latvia and Finland. The response to imbalances between investment and saving being reasonable (25%) reflects at the same time considerable capital mobility<sup>39</sup>.

<sup>37</sup> We have reproduced in an Annexe the complete estimation output. Not for MD countries as will be understandable.

<sup>38</sup> The statistic t for  $\phi = 1$  is equal to 2.511.

<sup>39</sup> We follow the interpretation given by Taylor (1996) and Banerjee and Zanghieri (2003).

Table 5 : PMG and MGE - PD

	Pooled MGE Estimates			MGE Estimates				
<b>Dependent variable: I_Y</b>								
	<b>Coef.</b>	<b>St. Er.</b>	<b>t-ratio</b>	<b>Coef.</b>	<b>St. Er.</b>	<b>t-ratio</b>	<b>h-test</b>	<b>p-val</b>
<b>Long-run Coefficients</b>								
S_Y	1,112	0,108	10,252	0,936	0,592	1,580	0,09	0,76
<b>Error Correction Coefficients</b>								
Phi	-0,184	0,084	-2,199	-0,286	0,172	-1,663		
<b>Short-run Coefficients</b>								
S_Y	0,205	0,093	2,199	0,346	0,168	2,060		
dI_Y(-1)	0,158	0,087	1,818	0,179	0,157	1,139		
dS_Y	-0,046	0,078	-0,592	0,162	0,134	-1,208		
dS_Y(-1)	0,001	0,077	0,007	-0,028	0,133	-0,214		
Inpt	-0,007	0,007	-0,991	-0,018	0,036	-0,504		

\* h-test is the Hausman test statistic with its associated p-value.

As one can see, the PMG model, once again, is not rejected compared to the MG model. But now the long term coefficient is not equal to 1<sup>40</sup>. The limiting values of  $\sigma$  are 0.002 for Belgium and 0.011 for Greece and Ireland. There are problems of autocorrelation for France, Ireland and Holland. With regard to the problems of bad specification, Belgium and Finland don't reject this type of problem. At the same time, the process of adjustment is considerably slow (0.184) what can also be seen as representing strong capital mobility.

Table 6 : PMG and MGE - MD

	Pooled MGE Estimates			MGE Estimates				
<b>Dependent variable: I_Y</b>								
	<b>Coef.</b>	<b>St. Er.</b>	<b>t-ratio</b>	<b>Coef.</b>	<b>St. Er.</b>	<b>t-ratio</b>	<b>h-test</b>	<b>p-val</b>
<b>Long-run Coefficients</b>								
S_Y	2,466	0,297	8,315	0,773	0,835	0,926	4,71	0,03
<b>Error Correction Coefficients</b>								
Phi	-0,271	0,113	-2,388	-0,399	0,105	-3,810		
<b>Short-run Coefficients</b>								
S_Y	0,668	0,280	2,388	0,243	0,135	1,804		
dI_Y(-1)	0,021	0,087	0,248	0,041	0,082	0,506		
dS_Y	-0,125	0,196	-0,635	-0,115	0,178	-0,646		
dS_Y(-1)	-0,059	0,059	-1,000	-0,059	0,059	-1,000		
Inpt	-0,066	0,029	-2,296	0,047	0,034	1,359		

\* h-test is the Hausman test statistic with its associated p-value.

<sup>40</sup> The statistic t for  $\phi = 1$  is equal to 1.037.

For the PMG model we cannot reject the assumption of a long term coefficient equal to the unit<sup>41</sup>. But the PMG model must be rejected compared to the MGE model. And this last model rejects, in turn, the possibility of a long term homogeneous relation.

In conclusion the assumption of homogeneity was accepted in the case of all the economies (Total) and also for the PD group. But only for the first case we can retain the long term coefficient equal to the unit. If the sustainability cannot be retained for PD it can, on the other hand, be retained for the new EU.

### The dynamization of the FH relation

As our results for the countries of the enlargement had not been encouraging we have also tested ADL<sup>42</sup> models to arrive at long term relations between the two variables. To obtain efficient estimators with the number of observations available, we must use the method of Arellano and Bond (1991). Of all the simulated assumptions we retained only those of Tables 7 and 8.

Table 7: dynamization of FH model - Total

<b>Total</b>	<b>AB1</b>	<b>AB2</b>	<b>AB1</b>	<b>AB1</b>
<b>dI_Y(-1)</b>	0,936 ***	0,803 ***	0,978 ***	0,956 ***
<b>dI_Y(-2)</b>	-0,165 **		-0,137 **	-0,137 *
<b>dS_Y</b>	0,131 **	0,093 *	0,163 **	0,148 *
<b>Constant</b>	0,0002	0,0003	0,005	
<b>AR(2)</b>	1	-0,265	0,716	0,739
<b>Sargan</b>	124 ***	24,66	111,9 ***	113 ***
<b>Wald</b>	80,2 ***	46,88 ***	137 ***	115 ***
<b><math>\phi = 1</math></b>	0,489	0,626	0,002	0,018
<b><math>\sigma</math></b>	0,018	0,017	0,018	0,098
<b>T_M</b>	---	---	yes	yes

<sup>41</sup> The statistic t for  $\phi = 1$  is equal to 4.936.

<sup>42</sup> See Johnston and Dinardo (1997), pp. 244-48.

Table 8: dynamization of FH model - PD

<b>PD</b>	<b>AB1(6)</b>	<b>AB1(6)</b>	<b>AB1</b>	<b>AB1</b>
<b>dI_Y(-1)</b>	0,936 ***	0,993 ***	0,941 ***	1,008 ***
<b>dI_Y(-2)</b>	-0,485 ***	-0,454 ***	-0,487 ***	-0,459 ***
<b>dS_Y</b>	0,155 ***	0,108 **	0,158 ***	0,106 **
<b>AR(2)</b>	-0,076	-0,261	-0,106	-0,292
<b>Sargan</b>	113	122,9	114	122
<b>Wald</b>		8246 ***		7692 ***
<b><math>\phi = 1</math></b>	16,2 ***	18,9 ***	15,1 ***	19,9 ***
<b><math>\phi</math></b>	0,282	0,235	0,289	0,234
<b><math>\sigma</math></b>	0,008	0,008	0,008	0,008
<b>EFRN</b>	---	yes	---	yes

AB1 and AB2 respectively mean first step and second step of Arellano and Bond method. In Table 8 all estimates were made with fixed effects. T\_M means that we have introduced temporal dummy variables to take into account the presence of shocks on the countries of the sample. EFRN means that we made the exclusion of the dummy variables by countries which do not reject the null hypothesis in order to obtain a more parsimonious model. In the case of PD we only have used lags from 2 to 6 for the instrumental variables in the application of Arellano and Bond methodology, AB1(6). This option is justified by the data available for the study of this group of countries.

We did not obtain any result rejecting the null hypothesis for the coefficient of S\_Y for the countries of the third group, MD.

For all EU countries, even if only for the second estimate the Sargan test is suitable, we can never reject the hypothesis of a long term coefficient equal to 1. The standard deviation of the errors has a very low value for the four estimates. The estimation for the sample PD is still better from the point of view of the adjustment. But for this group of countries we can reject the hypothesis of a long term coefficient equal to 1, its value ranges between 0.23 and 0.29. The test of Sargan justifies the instruments used.

For the MD group it was not possible to obtain a dynamic model with the rejection of the null hypothesis of the saving coefficient. We have tested models with the method of Arellano and Bond, Anderson and Hsiao (1981) and also DOLS with common trends, individual trends and also changes of interception. The only result with a value different from zero for the saving coefficient was obtained with a static model without dummy variables beyond the interception (Table 9). The test for the rejection of the pooled (Pool) model against the fixed effects (FE) model gives  $F_{11,155}=11,3$  and so we accept the FE model. The Breusch-Pagan test ( $\chi^2 = 108,0$ ) led in turn to accept the random effects (RE) model and the test of Hausman ( $\chi^2 = 12,3$ ) to retain the FE model. Our problem it is that FE model does not reject the nullity of the saving coefficient. For this reason we have finally retained the RE estimate.

Table 9 : random effects model - MD

<b>MD - Random Effects</b>	<b>Coefficients</b>	<b>Standard deviation</b>
<b>Constant</b>	0,196 ***	0,015
<b>S_Y</b>	0,158 **	0,07
<b><math>\sigma</math></b>	0,043	

The more interesting aspect of this estimate is the reduced value of the saving coefficient (0.16) which means a considerable international capital mobility, and so a reduced constraint of national savings on investment.

### Conclusion

What is remarkable, concerning the “puzzle” of F-H, is that many economists continue to be interested in it and the published papers do not cease growing. One of the reasons must be the simplicity of its application and the process of permanent adaptation of the main thesis. According to recent authors that have proposed new explanations for the thesis, we have studied the countries of the EU from the point of view of the external sustainability and capital mobility.

Taking as the most probable that the variables are I(1), and after the confirmation of the presence of Co-integration, we tested PMG models against the MGE models and we tested, also, the dynamization of the F-H relation. The results obtained confirm the external sustainability of the new EU. For the group of old countries of the EU (PD) the PMG model does not confirm the external sustainability. With these results we can say that the enlargement has been a benefit for the external sustainability of the EU. The dynamisation of the original F-H relation confirms these results about the external sustainability. With regard to the mobility of capital, the PMG model confirms the idea of a strong mobility for the EU and an even stronger mobility in the first group (PD). This mobility is also confirmed by the dynamization of the F-H relation. For the countries of the enlargement (MD) the only interesting model is a RE static model confirming a strong mobility of capital. Therefore we can also conclude that the enlargement represents a positive shock for the financial services industry of the EU. With regard to the countries of the enlargement (MD), we think that a finer research for homogeneous sub-groups behaviour is justified to say more about their behaviour in terms of external sustainability.

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