Revisiting the Feldstein-Horioka Hypothesis of savings, investment and capital mobility: evidence from 27 EU countries

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Abstract: This paper is an attempt to estimate the magnitude of integration for capital mobility among EU economies for the time period 1991-2009. It has been empirically observed that there is strong evidence in favor of higher degree of capital mobility for many EU countries, especially at euro currency period and in euro zone. We conclude that short run and long run capital mobility test based on Feldstein-Horioka (F-H) estimation method is likely to provide a measure of EU capital mobility.]

JEL: C22, F15, F21, F36

Key words: Savings, Investment, Capital Mobility and EU.

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I. Introduction:

The European economy has been changing dramatically in different ways since 1950s when the treaty of Paris (1951) and the treaty of Rome (1957) were signed. The last decade has witnessed a dramatic increase in the Europeanization of capital markets with an enhanced level of capital flows across EU member countries. A notable feature has seen as the removal of barriers to of various “emerging” capital markets. In recent years, the scenario and process of integration in the European countries is very rapid, and it is certain that, EU represents the deepest integration in the world in an updated form until recently. One of the significant issues, perhaps the most important issue is associated with this integration is, whether capital is free to move across EU national territories or not ? In this paper we recap the Feldestein-Horioka (F-H) model to examine EU capital mobility. Savings Investments (S-I) criteria which is developed from Feldstein and Horioka(1980) hypothesis, a test of capital mobility which used data for the 1960s and early 1970s on national saving and domestic investment rates, argued that the cross-sectional correlation of saving and investment provides a test of global capital mobility. Employing the time-series techniques, this study investigates both short run and long run capital mobility as a vital ways of speeding up the process of integration.

According to the market segment, the EU holds 20% to 40% of world capital.The degree of capital mobility in the EU area is vital issue, not for regarding the better risk management or efficient current and capital account management, rather than EU policy makers are much more concerned to analysing the implications of capital mobility in the EU, including many other economic issues associated with fiscal and monetary operations. Pentecost (2008) argued that there is extensive capital mobility, although this is still not perfect mobility. More recently, P. Henry (2007) showed that capital account liberalization has significantly increased the free capital movement, investment, portfolio and FDI inflows and economic growth.

II. Objectives

This paper mainly concentrates on the progress made in integrating the EU capital markets and will investigate the degree of capital mobility. There are several reasons for employing European capital markets as the principal object of study. Most importantly, the EU capital and financial markets are in the process of integration, where physical, institutional and legal integration also involved. The question of overall structures of capital markets in the EU and the degree of capital mobility in the member countries has evolved an important issue of European commission. Among lots of models and measurement techniques on capital market integration developed before, Feldstein-Horioka (1979) model is one of the important and pioneer approaches to measure the degree of capital market integration.

The other specific objectives are as follows:

- to determine the degree of EU capital market integration
- to delineate the stochastic nature of savings and investment over time

The rest of the paper is **organized** as follows. After a details literature review of F-H test in section III, section IV explains the methodology which includes description of variables and model specification; then section V delineates Stochastic Analysis of the F-H Model over time; finally in section VI, we conclude our paper with some policy recommendations.

III. Review of Literature:

Although regression procedure and attractive conclusion presented by Feldstein-Horioka (1980) have been subjected to a great variety of criticisms and still a debatable model to many researchers, but their basic model and testing procedure(with econometric corrections) is influential to examine the capital market integration. Using cross country national saving and domestic investment rates for 1960-1974 period, F-H test shows surprisingly high correlation of saving and investment, where estimated correlations coefficient β was closer to one , suggesting very lower degree of world capital mobility. Extensive empirical literature has been replicated and confirmed their model in several times, but most of them was unwilling to accept their inference that capital market are not highly integrated, suggested by high correlation coefficient values between saving and investment rates.

Jansen(1998) estimated saving investment correlation coefficient for 23 OECD country case by using single equation error correction model(ECM) and suggested that the variation in the short run S-I correlation is across the countries and across the time, which actually reflects the view that S-I correlation coefficient focuses country specific business cycle influences and not the degree of international capital mobility. Similarly current account solvency constraints (Coakley et, al. 1998), the growth rate of income(Obstfeld 1986), productivity shocks (Obstfeld 1986) and country size effects (Tsung-Wu Ho 2003) can also generate co movements between savings and investments , even if capital is mobile. As Obstfeld –Taylor (2005) argued, 'Since saving and investment are jointly determined variables, common underlying shocks may induce a high saving investment correlation even with perfectly mobile capital. Baxter and Crucini(1993) concluded the fact that S-I correlation are longer for larger countries but are still substantial for small countries. Buch (1999) assessed the degree of integration that the transition economies have attained and the impact of EU membership on the volume and structure of capital flows and found the estimated coefficients value between 0.5 to 0.6 and also found similar result for industrial countries.

Contrastly another line of empirical research supports the validity of the F-H test to measure the capital mobility and they gathered many methodological and econometric grounds in favor of this test. In most of the cases they arrived at conflicting results.

Feldstein-Horioka (1980), Feldstein (1984), Bayoumi (1990), Tesar (1991), Feldstein & Bacchetta(1991), Jansen (1996), Jansen and schulze (1996), Coiteux and Oliver (2000) and Coakley et, al. (2004) produced in favor of positive and statistically significant correlation between saving and investment.

Christopoulos (2007) reexamined the F-H test in view of recent advances in the econometrics of panel data modeling and found that the degree of capital mobility is very low among the various sub periods and relatively high degree of capital mobility for the whole periods (1885-1992). Krol (1996) and Sinn's (1992) argued that investments and savings are expected to move together in the long run and not in the short run. Baxter and Crucini's (1993) model and findings are consistent with the empirical results obtained by Sachs (1981). Both Murphy (1984) and Baxter & Crucini (19993) find that small OECD countries exhibit higher capital mobility than larger ones. Similar results are presented by Mamingi (1994) who investigated the F-H test by using data on 58 developing countries. Kollias et, al. (2008) examined the F-H test for EU 15 member countries for 1962-2002 periods. They used ARDL bounds testing procedure and panel techniques and their findings demonstrated in favor of high, as well as moderate to low capital mobility (ranging β from 0.11 to 0.15), with no particular pattern emerging either in terms of country size, level of development or economic structure.

More recently, Obstfeld & Taylor (2005) has provided a comprehensive and complete presentation of F-H test. Their statistical test have enhanced power compared to all previous historical studies and their findings show the consistency with the idea of U – shaped pattern in the evolution of the world capital mobility. They estimated various comparable estimators for five time periods and found high value of β for the 1973-2000 periods, but they mentioned, it has fallen sharply in recent years within the EU which is clearly consistent with Kollias et, al. (2008) findings. On recent developments in the European Union and euro zone, Blanchard and Giavazzi (2002) study provided the correlation between domestic saving and investment which has declined over time (mainly in the euro zone) which suggesting higher integration in the capital market.

IV) Methodology

The well known F-H model has been examined extensively in the current literature by many experts for different regions, except EU 27 countries. In this paper we use this familiar model for EU 27 countries. We construct a pooled sample of stacked cross section as well as time series of I/GDP, S/GDP, CA/GDP in the EU for the period of 1991-2009. We use three quantitative tests and examine various time series properties of our data set and finally we develop an Error correction model (ECM) to distinguish the long run and short run capital mobility.

i) Definitions of Variables and Data:

The data used in this paper is secondary in nature covering the period 1991-2009 for F-H test. The key time series included in this paper are Gross Capital Formation or Investment (**I**), Gross Domestic Saving (**S**), Gross Domestic Product (**GDP**). For 2008-2009, we used annual forecasted value for I, S, GDP, taken from EUROSTAT (2008) calculation. Time series data of investment, saving and current account to GDP ratio were collected for every available year between 1991-2007 from the World Bank. These variables are measured in current dollar prices (2000).The investment rate **I/GDP**, is measured as the ration of Gross domestic capital formation to GDP and for saving ratio **S/GDP**, we have used Gross domestic saving to GDP at current US dollar prices (2000).

ii) The **Feldstein – Horioka (F-H) Model**

Based on 22 OCED country data set on saving and investment, Feldstein and Horioka suggested that, if there is a strong positive relationship between gross saving and investment, then in the long run capital market among these countries are not integrated. To investigate the saving-investment relationship, F-H regressed the I/GDP ratio on S/GDP ratio, they used the following linear regression model

$$\left(I/GDP\right)_i = \alpha + \beta\left(S/GDP\right)_i + U_i \quad \ldots\ldots \quad (1)$$

$\left(S/GDP\right)_i$ == Ratio of gross domestic saving to gross domestic product in country i

$\left(I/GDP\right)_{it}$ = Ratio of gross domestic investment to gross domestic product in country i

α = Constant term

U_i = Error term

Here, β, the correlation coefficient of the ratio of gross saving to gross domestic product, is the prime indicator of capital mobility. If we find that estimated value of β is close to one, then we can conclude that capital is not mobile in the EU region. So higher value of β is associated with the lower capital mobility in the EU area and low value of β, will be strong evidence in favor of EU capital market integration.

Two main disapproval are closely associated with the F-H model falling into empirical and theoretical grounds. Theoretically common critique point argued by many econometricians is the endogenity of saving, where national saving data is correlated with the disturbance term u_i. Another methodological critique is related with the country size and world interest rate(r^*), where r^* is not exogenous (in large country case) and both domestic interest rate (r) and I/GDP will be correlated with the (S/GDP).

V) Stochastic Analysis of the F-H Model:

a) Setting up the Model for Unit Root Test in level and Difference Form:

First we turn our attention to the unit root test for stationarity for two series, namely I/GDP$)_{it}$, S/GDP$)_{it}$. A non stationary time series is said to be integrated to order one, or I (1), if the series of its first difference,

$$\Delta g_t = g_t - g_{t-1} \text{ ………………} (2) \text{ is I (0).}$$

Such series is I (1) if it contains what is known unit root, i.e., a non stationary situation. As we know, using standard regression methods with variables that are I (1) can yield highly misleading results. So, for a number of reasons, it is important for us to test the hypothesis whether our series has a unit root or not. To do this, we will apply both Augmented Dickey-Fuller (ADF) (1979) and GLS-detrended Dickey –Fuller (GF-GLS) test. We perform our test in level form and then in first difference form that includes exogenous regressors, i.e., a constant and a linear trend in the test regression and employs automatic lag length selection using Schwarz Information Criterion (SIC) and a maximum lag length of 1. Applying these settings to data on for 27 EU countries for the period of 1991-2009, the results are presented in following table 2.1 and table 2.2. The most popular regression approach (ADF test) is used to test for unit root in the following form:

$g_t = \{CA/GDP, I/GDP, S/GDP\}$ Where

$$\Delta g_t = \mathrm{H}_t \gamma^0 + (\psi - 1) g_{t-1} + U_t \text{ …………………………} (3)$$

Where H_t is a row vector that consist of deterministic repressors are included in the test regression. If we assumed that the error term U_t in above equation follows the stationary process AR (1), as

$U_t = \rho_1 U_{t-1} + e_t$; Where e_t is the white noise, then regression would become

$$\begin{aligned}\Delta g_t &= \mathrm{H}_t \gamma^0 - \rho_1 \mathrm{H}_{t-1} \gamma^0 + (\rho_1 + \psi - 1) g_{t-1} - \psi \rho_1 g_{t-2} + e_t \\ &= \mathrm{H}_t + (\rho_1 + \psi)(\beta - 1 - \psi \rho_1) g_{t-1} + \psi \rho_1 + (g_{t-1} - g_{t-2}) + e_t \\ &= \mathrm{H}_t \gamma + (\psi - 1)(1 - \rho_1) g_{t-1} + \psi \rho_1 + \Delta g_{t-1} + e_t \\ &= \mathrm{H}_t \gamma + \psi' g_{t-1} + \psi_1 \Delta g_{t-1} + e_t \text{ ……………………………………………} (4)\end{aligned}$$

For some choice of γ we are able to replace ($H_t\ \gamma^0 - \rho_1\ H_{t-1}\ \gamma^0$) by $\mathrm{H}_t \gamma$ in the second line. According to our estimation procedure, H_t includes only deterministic variables such as a constant and a linear trend. The augmented version of the tau (τ) statistic is simply the ordinary t statistic for the coefficient ψ' on g_{t-1} in equation (4) to be zero. Because it is assumed that $|\rho_1| < 1$, this coefficient can be zero only if $\psi = 1$. Thus a test for $\psi' = 0$ in regression (4) is equivalent to a test for $\psi = 1$.

Table 2.1: The F-H test and Time series analysis – Testing for Unit Root (in level form)

Country			ADF	
	I/GDP(tau-ct-1)*	p♀	S/GDP(tau-ct1)*	p♀
AT(Austria)	-0.6180(-2.0664)	0.564	-0.72712(-2.63461)	0.2647
BE(Belgium	-0.602873(-2.27311)	0.4482	-0.999147(-3.43301)	0.04704
BG(Bulgaria)	-0.453293(-3.39469)	0.05202	-0.700828(-3.4947)	0.03987
CY(Cyprus)	-0.1631(-1.487)	0.8341	-0.589533(-2.12542)	0.531
CZ(Czech-Republic)	-0.508739(-2.692)	0.2399	-0.936652(-2.69297)	0.2395
DK(Denmark)	-0.755747(-2.6421)	0.2614	-0.37443(-1.54119)	0.8156
EE(Estonia)	-0.736049(-2.01437)	0.5929	-0.678392(-3.01449)	0.1281
FI(Finland)	-1.59042 (-4.8701)	0.0003202	-0.280049(-2.06295)	0.566
FR(France)	-0.66134 (-3.7287)	0.02045	-0.342361 (-1.67151)	0.764
DE(Germany)	-0.486842 (-2.16961)	0.5061	-0.0990403(-0.471044)	0.9849
GR(Greece)	-0.943877 (-3.64562)	0.02611	-0.547868(-1.8410)	0.6847
HU(Hungary)	-0.266938(-2.2771)	0.446	-0.43201(-2.87386)	0.1711
IE(Ireland)	-0.392276 (-2.7351)	0.2222	-0.134608(-0.880778)	0.9566
IT(Italy)	-1.04844 (-7.78767)	9.632e-012	-0.419941 (-2.72542)	0.2261
LV(Latvia)	-1.1244 (-7.69644)	1.889e-011	-0.619245 (-7.44859)	1.132e-010
LT(Lithuania)	-0.545027 (-1.989)	0.6068	-0.848447(-4.40004)	0.002133
LU(Luxembourg)	-0.482158(-2.18772)	0.4959	-0.301684(-1.01384)	0.9406
MT(Malta)	-0.521046 (-2.03266)	0.5828	-0.436217(-1.29518)	0.8889
NL(Netherlands)	-0.421154(-2.12146)	0.5332	-0.401516(-1.70795)	0.7481
PL(Poland)	-0.381095(-2.7757)	0.2063	-0.490615(-2.4858)	0.3353
PT(Portugal)	-0.26186(-2.1447)	0.5201	-0.279794(-1.488)	0.834
RO(Romania)	-0.169977(-0.74127)	0.9692	-0.226775(-0.792808)	0.965
SK(Slovakia)	-0.837487(-3.94358)	0.01048	-1.26275(-3.8592)	0.0137
SI(Slovenia)	-0.57462 (-2.82744)	0.1872	-1.25653(-5.58667)	1.073e-005
ES(Spain)	-0.551861 (-3.25645)	0.07366	0.00767514 (0.036983)	0.9967
SE(Sweden)	-0.728318 (-3.30014)	0.06616	-0.947909(-3.30076)	0.06606
UK(United Kingdom)	-0.480852 (-2.36753)	0.3967	-0.403295(-2.828)	0.1867

*Test statistic tau-Ct-1(τ) indicates test with constant and trend in order 1; critical values are in parentheses,

♀Asymptotic p-values are calculated by means of the algorithm developed in Mackinnon (1996)

In general, provided the number of lags q is chosen appropriately, we will perform the following types of ADF test on regression

$$\Delta g_t = \mathrm{H}_t \gamma + \psi^{/} g_{t-1} + \sum_{i=1}^{q} \psi_i \Delta g_{t-i} + e_t \quad \text{..........} \quad (5)$$

Equation 5 represents a one sided test whose null hypothesis is $\psi^{/} = 0$ versus the alternative $\psi^{/} < 0$. Under the null hypothesis, it must be differentiated at least once to achieve stationary, where as under the alternative, it is already stationary and no difference is required. So significant large negative values of the test statistic lead to the rejection of null, and we will be in non stationary case.

Table 2.2: The F-H test and Time series analysis – Testing for Unit Root (in difference form)

Country	DF-GLS			ADF		
	CA/GDP	S/GDP	I/GDP	CA/GDP	S/GDP	I/GDP
AT	-3.94(-3.77)***	-5.14(3.77)***	-4.40(-3.77)***	-3.68(-3.29)*	-4.95(-4.61)***	-4.14(-3.71)**
BE	-6.04(-3.77)***	-5.01(-3.77)***	-4.06(-3.77)***	-5.72(-4.66)***	-4.70(-4.61)***	-3.80(-3.71)**
BG	-4.32(-3.77)***	-3.64(-3.19)***	-4.19(-3.77)***	-4.04(-3.71)**	-4.35(-3.71)***	-3.89(-3.71)**
CY	-4.75(-3.55)***	-4.28(-3.77)***	-2.20(-2.29)*▲■	-4.22(-3.73)**	-4.02(-3.71)**	-13.34(-4.61)***
CZ	-4.97(-3.77)***	-5.35(-3.77)***	-3.45(-3.19)**	-4.68(-4.61)***	-5.18(-4.61)***	-3.32(-3.29)*
DK	-5.73(-3.77)***	-4.09(-3.77)***	-4.26(-3.77)***	-5.07(-4.61)***	-3.95(-3.73)**	-3.99(-3.71)**
EE	-3.60(-3.19)**	-5.18(-3.77)***	-5.09(-3.77)***	-4.72(-3.75)** ▲	-4.85(-4.61)***	-4.76(-4.61)***
FI	-4.59(-3.77)***	-3.96(-3.77)***	-4.99(-3.77)**	-4.333(-3.71)**	-4.11(-3.71)**	-5.10(-4.66)***
FR	-4.68(-3.77)***	-3.63(-3.19)**	-4.36(-3.77)***	-4.77(-3.71)**	-3.44(-3.29)*	-4.79(-4.66)***
DE	-4.63(--3.77)***	-5.58(-3.77)***	-3.23(-3.19)**	-4.34(-3.71)**	-5.22(-4.61)***	-4.31(-3.75)** ▲
GR	-4.35(-3.77)***	-4.74(-3.77)***	-5.34(-3.77)***	-4.14(-3.73)**	-5.10(-4.16)***	-7.26(-4.61)***
HU	-5.48(-3.77)***	-4.21(-3.77)***	-5.43(-3.77)***	-5.05(-4.06)***	-4.91(-4.66)***	-6.37(-4.61)***
IE	-4.10(-3.77)***	-3.78(-3.19)**	-3.20(-3.19)**	-3.83(-3.71)**	-3.61(-3.29)*	-3.59(-3.31)*
IT	-3.86(-3.77)***	-4.43(-3.77)***	-3.98(-3.77)***	-3.54(-3.31)*	-4.45(-3.71)**	-3.71(-3.71)**
LV	-3.82(-3.77)***	-3.27(-3.19)**	-7.09(-3.77)***	-3.54(-3.31)*	-19.20(-4.66)*** ▲	-5.63(-4.66)***
LT	-5.23(-3.77)***	-3.69(-3.19)**	-6.15(-3.77)***	-4.95(-4.61)***	-4.60(-4.61)***	-7.47(-4.61)***
LU	-5.65(-3.77)***	-4.98(-3.77)***	-3.90(-3.70)***	-5.39(-4.61)***	-4.67(-4.61)***	-3.79(-3.71)**
MT	-4.33(-3.77)***	-5.53(-3.77)***	-4.21(-3.77)***	-4.22(-3.73)**	-5.18(-4.61)***	-3.88(-3.73)**
NL	-4.13(-3.77)***	-3.10(-2.89)*	-3.36(-3.19)**	-3.90(-3.71)**	-4.89(-4.72)*** ▲	-7.49(-4.66)*** ▲
PL	-4.37(-3.77)***	-3.67(-3.19)***	-2.94(-2.89)*	-4.20(-3.73)**	-3.84(-3.31)*	-4.17(-3.73)** ▲
PT	-4.45(-3.77)***	-3.83(-3.77)***	-4.95(-3.77)*** ▲	-4.23(-3.71)**	-3.69(-3.29)*	-4.72(-4.66)*** ▲
RO	-4.77(-3.77)***	-4.63(-3.77)***	-4.96(-3.77)***	-4.47(-3.71)**	-4.34(-3.71)**	-5.02(-4.61)***
SK	-5.30(-3.77)***	-5.10(-3.77)*	-4.06(-3.77)***	-4.96(-4.61)***	-6.70(-4.66)*	-3.97(-3.73)**
SI	-7.79(-3.77)***	-5.58(-3.77)***	-3.66(-3.19)**	-9.50(-4.61)***	-5.24(-4.61)***	-3.43(-3.29)*
ES	-4.05(3.77)***	-3.37(-3.19)**	-3.21(-3.19)**	-3.79(-3.71)**	-3.45(-3.29)*	-5.71(-4.72)*** ▲
SE	-4.38(-3.77)***	-4.18(-3.77)***	-3.89(-3.77)***	-4.29(-3.71)**	-4.32(-3.73)**	-3.67(-3.29)*
UK	-3.29(-3.77)***■	-4.01(-3.77)*** ▲	-3.44(-3.19)**	-3.94(-3.73)**	-4.62(-3.75)** ▲	-3.42(-3.31)*

* ; ** ; *** = Test critical values are in 1%, 5% , and 10% level respectively ▲Test in second difference form, max lag 1 ■The null hypothesis of a unit root is not rejected at the 90% level of confidence

As we mentioned above, we selected a constant and a linear trend in our ADF test regression. In this case Elliott, Rothenberg, and Stock (ERS, 1996) proposed a simple modification of ADF test in which the data are detrended so that explanatory variables are "taken out" of the data prior to running the test regression. DF-GLS test involved estimating the standard ADF test equation of 5, after substituting the GLS detrended g_t^d for the original g_t.

$$\Delta g_t^d = \eta g_{t-1}^d + \psi \sum_{i=1}^{q} \Delta g_{t-i} + v_t \qquad \text{(6)}$$

Here, the g_t^d are detrended, so we do not include the H_t in DF-GLS test equation. Like ADF test, we will compare the critical values and estimated values. We include the number of lags (q in equation) as minimum as to ensure that equation 5 is a parameterization flexible enough to represent adequately the short run persistence of Δg_t and ensure that the residuals are white noise. As we know, setting q too high would lead to reduce the power of the test. We used Mackinnon (1991, 1996) and ERS (1996) critical values.

With respect to the table 2.1, we reported critical τ values at the 5 % level ,while in table 2.2 we reported τ values at the 1 %, 5 % and 10 % level of significance respectively. In level form we can not reject the null hypothesis of non stationarity for both I/GDP and S/GDP series at the 95 % or 90 % level of confidence for all countries. Regarding DF-GLS test in difference form presented in table 2.2, only for UK (1991-2007), non stationarity of the CA/GDP series was not rejected at the 90 % level of confidence and for Cyprus (1991-2009), non stationarity of the I/GDP series was not rejected at 99 % level of confidence. But the null hypothesis of non stationarity for all series was rejected at 95 % and 99 % level of confidence for all countries when we used ADF test in difference form, but CA/GDP series for Estonia(1991-2007), S/GDP series for Latvia, Netherlands, UK for 1991-2009 periods and I/GDP series for Germany, Netherlands, Poland, Portugal and Spain, we tested unit root in second difference form and null hypothesis was rejected at 95 % level of confidence. We will, of course, use this information when we will estimate F-H model in difference form, where stationarity of data is required.

We need to be careful to describe our result as the critical values are calculated for large number of observations and may not be adequate for DF-GLS test. Based on our findings as presented in table 2.1 and in 2.2, we can draw our conclusion that S/GDP, I/GDP and CA/GDP series are non stationary and regression in level form will lead us to draw misleading conclusion. Since both saving and investment ratios are stationary in difference form as shown in table 2.2, so regression based on difference form would provide reliable short run coefficient .

In appendix, we graph the time series behavior of saving, investments and current account balance to GDP ratio over the period 1991-2009. The most striking feature of these plots is the consistent relationship between saving and investment raito, experienced with the stability of current account balance. For some countries, current account balance to GDP ratio has fluctuated considerably from 1999 to 2007. In addition, if we compare the line of S/GDP and I/GDP, then both lines indicates stronger correlation for 1991-2009 periods.

Since both I/GDP and S/GDP series are non stationary, so as a consequence, next we will move to test of cointegration. Here we will rely on VAR based cointegration test following methodology developed by Johansen (1991, 1995). In order to carry out Johansen cointegration test, assumption on the deterministic trend specification is required. Since our series have non zero means, following deterministic trend cases considered by Johansen (1995, p. 80-84), we specified that the level data g_t have linear trends and we believe that all trends are stochastic and cointegration equation have only intercept with one lag.

b) **Johansen Co-integration Test in the F-H model**:

The table below (table 2.3) presents the results of Johansen cointegration test between I/GDP and S/GDP series. We compare our estimated trace statistic and max-eigen statistic values to the critical values for the test taken from Mackinnon-Haug-Michelis (1999) p-values at 5 % level. Two types of test statistics are reported in third and in fifth column. The second column shows the number of cointegrating relations under the null hypothesis. And the fourth an fifth column shows the critical values at 5 % level. Based on trace statistic , we can not reject cointegration hypothesis for Bulgaria, Czech-Republic, Ireland, Latvia, Lithuania, Slovakia, Spain, Sweden and we find significant evidence for cointegration of saving and investment ratios . For CZ, LV, LT, SV, ES and for SE, trace test indicates at least two cointegrating equations at 5 % level, while one cointegrating equation appears for BG and IE associated with significant p values. Similarly max Eigen value test statistic rejects "no cointegration" between savings and investments ratios for BG, CZ, GR, IE, LV, LT, SV, and ES and for SE. For SV and LT, test indicates two cointegrating equations at the 0.05 level and one for remaining other countries. It is interesting to look in table 2.3 that the trace statistic and the max Eigen value statistic yielded conflicting results for CZ, LV, ES and for SE. In this case we will report two cointegrating equations for these countries. Again we should aware about the length of our data series. The Johansen test is biased in small samples because it is based upon asymptotic theory.

As Engle and Granger (1987) argued that a linear combination of two or more non-stationary series may be stationary. If such a stationary linear combination exists, the non-stationary time series are said to be *cointegrated*. The stationary linear combination is called the *cointegrating equation* and may be interpreted as a long-run equilibrium relationship among the variables.

Table 2.3: F H Test – Johansen Cointegration Test (I/GDP, S/GDP)

Country	Hypothesized No. of CE(s)	Trace Statistic	Critical Value†	Max-Eigen Statistic	Critical Value†
AT	None	7.611294	15.49471	6.801611	14.26460
	At most 1	0.809683	3.841466	0.809683	3.841466
BE	None	14.13777	15.49471	12.59739	14.26460
	At most 1	1.540380	3.841466	1.540380	3.841466
BG	None	25.07539*	15.49471	24.88596*	14.26460
	At most 1	0.189429	3.841466	0.189429	3.841466
CY	None	11.42527	15.49471	8.431948	14.26460
	At most 1	2.993322	3.841466	2.993322	3.841466
CZ	None	18.40868*	15.49471	13.42191	14.26460
	At most 1	4.986775*	3.841466	4.986775*	3.841466
DK	None	3.337450	15.49471	2.456908	14.26460
	At most 1	0.880543	3.841466	0.880543	3.841466
EE	None	9.993400	15.49471	8.262633	14.26460
	At most 1	1.730766	3.841466	1.730766	3.841466
FI	None	13.31569	15.49471	9.976728	14.26460
	At most 1	3.338963	3.841466	3.338963	3.841466
FR	None	7.610117	15.49471	7.605101	14.26460
	At most 1	0.005015	3.841466	0.005015	3.841466
DE	None	8.360930	15.49471	6.568911	14.26460
	At most 1	1.792019	3.841466	1.792019	3.841466
GR	None	15.45341	15.49471	14.88653*	14.26460
	At most 1	0.566877	3.841466	0.566877	3.841466
HU	None	14.18140	15.49471	11.75600	14.26460
	At most 1	2.425408	3.841466	2.425408	3.841466
IE	None	14.56768	15.49471	10.36843	14.26460
	At most 1	4.199252*	3.841466	4.199252*	3.841466
IT	None	13.73296	15.49471	13.66454	14.26460
	At most 1	0.068426	3.841466	0.068426	3.841466
LV	None	16.66860*	15.49471	9.664473	14.26460
	At most 1	7.004132*	3.841466	7.004132*	3.841466
LT	None	34.29417*	15.49471	29.24353*	14.26460
	At most 1	5.050631*	3.841466	5.050631*	3.841466
LU	None	13.19160	15.49471	11.59083	14.26460
	At most 1	1.600772	3.841466	1.600772	3.841466
MT	None	4.276839	15.49471	3.855780	14.26460
	At most 1	0.421059	3.841466	0.421059	3.841466
NL	None	5.222978	15.49471	5.060863	14.26460
	At most 1	0.162115	3.841466	0.162115	3.841466
PO	None	14.14973	15.49471	10.79455	14.26460
	At most 1	3.355178	3.841466	3.355178	3.841466
PT	None	3.124501	15.49471	2.642896	14.26460
	At most 1	0.481605	3.841466	0.481605	3.841466
RO	None	7.165819	15.49471	6.283247	14.26460
	At most 1	0.882572	3.841466	0.882572	3.841466
SV	None	25.539*	15.944	17.77*	14.26460
	At most 1	7.76*	3.841466	7.76*	3.841466
SI	None	11.26169	15.49471	10.50091	14.26460
	At most 1	0.760784	3.841466	0.760784	3.841466
ES	None	20.55305*	15.49471	11.16726	14.26460
	At most 1	9.385789*	3.841466	9.385789*	3.841466
SE	None	22.65931*	15.49471	13.62650	14.26460
	At most 1	9.032809*	3.841466	9.032809*	3.841466
UK	None	1.939179	15.49471	1.807219	14.26460
	At most 1	0.131960	3.841466	0.131960	3.841466

† Critical values are in 5 % level; Mackinnon-Haug-Michelis (1999) p values used, * Denotes rejection of the hypothesis and indicates cointegrating equations at 0.05 level

c) Co-integrating Regression in the F-H Model:

In the following table 2.4, we have estimated results for the cointegrating regression. Since both series are cointegrated, they satisfy one or more long run relationship, although they may diverge substantially from these relationships in the short run. Here β_E indicates a long run equilibrium relationship among the variables and we can interpret β_E as an indicator of long run capital mobility. Over the period 1991-2009, the long run saving investment correlation differs substantially among EU member countries. The estimated value of correlation coefficients ranges from 0.004 to 0.97, associated with 95 % level of confidence. So greater evidence in favor of increasing degree of long run capital mobility have found for CY(0.21), GR(0.51), IE(0.18), MT, SI and for SE. For nine countries (BE, CZ, DE, GR, HU, IT, MT, SI, and UK) the estimated correlation coefficient β_E value ranged from 0.38 to 0.62, suggesting evidence in favor of moderate capital mobility and for six countries (BG, LV, NL, PL) , β_E suggesting long run low capital mobility. Estimated results are not statistically significant for eight countries. For two countries, RO and for PT, the coefficients β_E are statistically significant and above one, showing that investment systematically exceeds saving.

Table2.4: The F-H test and Time series analysis – Co integrating Regression (1991-2009)

Country	β_E	t(β)	R^2	DW♀
AT	0.05(0.27)**	0.21	0.30	0.97
BE	0.62(0.27)*	2.48	0.38	0.57
BG	0.77(0.28)*	2.69	0.74	0.55
CY	0.21(0.14)**	1.51	0.24	0.48
CZ	-0.42(0.38)*	-1.10	0.09	0.77
DK	0.05(0.22)*	0.26	0.68	1.14
EE	0.04(0.07)*	0.63	0.69	1.27
FI	-0.12(0.25)*	0.49	0.35	2.02
FR	0.14(0.35)*	0.39	0.34	0.55
DE	0.54(0.15)**	3.54	0.87	0.97
GR	0.51(0.16)**	3.01	0.49	0.84
HU	0.62(0.12)**	5.07	0.66	1.38
IE	0.18(0.05)**	3.41	0.77	0.87
IT	-0.50(0.21)**	-2.36	0.40	1.20
LV	0.77(0.12)**	6.37	0.77	1.75
LT	0.21(0.11)*	1.90	0.62	1.44
LU	0.10(0.03)*	0.29	0.41	0.77
MT	-0.38(0.17)**	-2.16	0.63	1.22
NL	0.76(0.25)**	3.04	0.66	0.72
PL	0.97(0.39)**	2.46	0.45	0.59
PT	1.15(0.20)**	5.52	0.68	0.87
RO	1.10(0.11)**	9.5	0.85	1.54
SK	-0.004(0.01)*	-0.22	0.009	1.03
SI	-0.41(0.26)*	-1.56	0.85	0.90
ES	0.08(0.20)*	0.42	0.79	0.50
SE	0.39(0.26)*	1.52	0.25	0.52
UK	0.47(0.09)**	5.10	0.80	0.92

* Indicates that coefficient is significantly different from zero at 95 % level of confidence, ** Indicates that coefficient is not significantly different from zero at 95 % level of confidence; null hypothesis is not rejected at 5% level of significance, ♀ DW critical values at 5 % level are d_L= 1.07 and d_U=1.53

Given the findings reported in table 2.1 and in 2.2, next we will proceed to estimate the β_E by using OLS and Cochrane – Orcutt methods, where the test of correlation coefficient are based on regression models in first difference form of the following one

$$\Delta(I/GDP)_{it} = \alpha + \beta_E \Delta(S/GDP)_t + e_t \text{..........} (12)$$

d) OLS and the Cochrane-Orcutt Estimates in the F-H model

Table 2.5 summarizes the estimation result for the regression model in first difference form, showing that estimated β ranges between the lowest 0.36 for BG and the highest 1.21 for LV in OLS and estimated β ranges between the lowest 0.23 for GR and highest 1.25 for LV in Cochrane-Orcutt method. How ever both regression results showing evidence in favor high capital mobility for BG, LT, GR and showing moderate to low capital mobility for BE, FR, GR, NL, PL, PT, RO, SE, UK and for SK. For LV again we find same situation, where investment systematically exceed saving. For remaining 14 countries, the estimated β coefficients are not statistically significant. However, here we captured short run variation of S-I correlations for many countries when the regression is run in first difference form.

Table 2.5: The F-H test and Time series analysis – OLS and Cochrane-Orcutt estimates

Country	OLS		Cochrane-Orcutt	
	β_E	t(β)	β_E	t(β)
AT	-1.19(0.72)*	-1.16	-1.34(0.76)*	-1.75
BE	0.75(0.18)**	4.16	0.78(0.16)**	4.60
BG	0.36(0.20)*	1.83	0.46(0.35)*	1.31
CY	0.01(0.12)*	0.14	0.08(0.80)*	0.93
CZ	0.03(0.24)*	0.15	0.21(0.20)*	1.05
DK	0.39(0.30)*	1.32	0.39(0.30)*	1.30
EE	-0.03(0.09)*	-0.33	-0.05(0.09)*	-0.58
FI	0.72(0.56)*	1.35	0.23(0.50)*	0.45
FR	0.97(0.29)**	3.33	0.85(0.24)**	3.56
DE	0.36(0.22)	1.62	0.30(0.23)	1.23
GR	0.58(0.15)**	3.87	0.23(0.11)*	1.95
HU	0.21(0.17)*	1.20	0.16(0.15)*	1.08
IE	0.08(0.09)*	0.91	0.03(0.07)*	0.48
IT	-0.02(0.30)*	-0.09	-0.06(0.32)*	-0.20
LV	1.21(0.18)**	6.43	1.25(0.20)**	6.22
LT	0.40(0.15)**	2.62	0.05(0.14)*	0.34
LU	-0.04(0.03)*	-1.27	-0.04(0.02)*	-1.62
MT	-0.06(0.18)*	0.33	-0.04(0.18)*	-0.25
NL	0.64(0.27)**	2.35	0.73(0.27)**	2.68
PL	0.77(0.37)**	2.08	0.40(0.32)*	1.26
PT	0.62(0.25)**	2.46	0.43(0.22)*	1.90
RO	0.82(0.17)**	4.71	0.88(0.15)**	5.66
SK	-0.30(0.35)*	-0.85	-0.66(0.30)**	-2.20
SI	-0.11(0.21)*	-0.53	-0.13(0.21)*	-0.61
ES	0.33(0.24)*	1.39	0.11(0.11)*	0.53
SE	0.53(0.16)**	3.36	0.47(0.06)**	2.83
UK	0.53(0.13)**	3.92	0.47(0.15)**	3.16

**Indicates that coefficient is significantly different from zero at 95 % level of confidence, *Indicates that coefficient is not significantly different from zero at 95 % level of confidence

e) Error Correction Mechanism (ERM) in the F-H Model:

As we see, findings presented in table 2.2 and in 2.3 showing that two series are cointegrated. When variables are cointegrated, they likely satisfy one or more long run relationship, although they may diverge substantially from these relationships in the short run. So we can apply an Error correction model (ECM) to distinguish between the short run and long correlations between savings and investment.

Based on ADL (1, 1) model equation, we can write the following standard error correction model as following

$$\Delta g_t = \beta_0 + (\beta_1 - 1)(g_{t-1} - \psi \mathrm{H}_{t-1}) + \gamma^0 \Delta \mathrm{H}_t + e_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 13$$

Setting coefficient ψ equal to 1, here we follow the work of Jansen (1996) and will estimate the following ECM to examine the saving-investment correlations for 27 EU member countries

$$\Delta(I/GDP)_{it} = \alpha + \beta_E \Delta(S/GDP)_{it} + \gamma^E (S/GDP - I/GDP)_{i,t-1} + e_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 13$$

e_t is well behaved disturbance term, that is white noise, β_E is the impact multiplier which represented the short run S-I correlations and feedback parameter γ^E represents the long run S-I correlations. γ^E is the key indicator and $\gamma > 0$ indicates that the saving and investments are cointegrated associated with cointegrating vector (1,-1), implying a long run correlation of unity. $\left(S/GDP - I/GDP\right)_{i,t-1}$ denoting the error correction term which serves as a control variable for dynamic adjustment.

For all countries, estimated value of β_E and γ^E are presented in table 2.6. Statistically significant non-zero values of the coefficient γ^E for AT(1999-2009), BE(1991-98,1999-2009), BG(1991-1998), CZ(1991-1998, 1991-2009), EE(1999-2009), FI(1991 1998), DE(1999-1909), IE(1991-1998,1999-2009,1991-2009), IT(1991-1998), LV(1999-2009), MT(1991-1998), NL(1991-1998), RO(1991-1998), SK(1991-2009), SI(1999-2009), SW(1999-2009, 1991-2009) and for UK(1991-1998) indicates that saving and investment rates are cointegrtaed at 95 % level of confidence. In addition γ^E provided an estimate for the speed of adjustment of investment to the previous period's deviation from the long run equilibrium.

Table2.6: The F-H test and Time series analysis – ECM

country	year	Model $:\Delta\ (I/GDP)_{it} = \alpha + \beta_E\ \Delta\ (S/GDP)_{it} + \gamma_E\ (S/GDP - I/GDP)_{i,t-1} + e_t$					
		β_E	$t(\beta)$	γ^E	$t(\gamma^E)$	R^2	F
AT	1991-1998	0.33(0.25)*	1.31	0.19(0.54)*	0.36	0.32	0.94
	1999-2009	-1.08(0.48)**	-2.22	0.48(0.14)**	3.27	0.70	8.39
	1991-2009	0.06(0.26)*	0.24	0.12(0.09)*	1.29	0.10	0.84
BE	1991-1998	0.92(0.08)**	11.23	0.36(0.11)**	3.12	0.96	63.48
	1999-2009	0.81(0.45)**	11.23	0.36(0.11)**	3.12	0.96	1.95
	1991-2009	0.81(0.45)*	1.79	0.29(0.29)*	0.98	0.35	10.26
BG	1991-1998	0.37(0.23)*	1.59	0.67(0.26)**	2.52	0.67	4.17
	1999-2009	0.32(0.71)*	0.45	-0.03(0.11)*	-0.29	0.09	0.37
	1991-2009	0.37(0.21)*	1.68	0.00086(0.09)*	0.0087	0.17	1.58
CY	1991-1998	0.21(0.50)*	0.41	0.16(0.49)*	0.34	0.04	0.08
	1999-2009	0.36(0.33)*	1.09	0.31(0.29)*	1.07	0.14	0.60
	1991-2009	-0.02(0.13)*	-0.20	-0.06(0.07)*	-0.87	0.05	0.39
CZ	1991-1998	0.25(0.51)*	0.50	0.45(0.20)**	2.26	0.56	2.63
	1999-2009	0.20(0.22)*	0.91	0.15(0.20)*	0.74	0.12	0.50
	1991-2009	0.25(0.21)*	1.17	0.37(0.12)**	2.91	0.36	0.36
DK	1991-1998	1.18(0.78)*	1.51	-0.01(0.51)*	-0.03	0.37	1.17
	1999-2009	0.46(0.30)*	1.56	0.03(0.15)*	0.24	0.27	1.35
	1991-2009	0.40(0.30)*	1.32	0.14(0.15)*	0.90	0.14	1.26
EE	1991-1998	-0.12(0.05)**	-2.18	-0.08(0.05)*	-1.6	0.54	2.42
	1999-2009	0.13(0.21)*	0.63	0.62(0.17)**	3.49	0.67	7.18
	1991-2009	0.02(0.11)*	0.21	0.08(0.10)*	0.82	0.05	0.39
FI	1991-1998	0.58(0.18)**	3.11	0.35(0.10)**	3.42	0.91	21.3
	1999-2009	1.23(1.11)*	1.10	0.64(0.34)*	1.87	0.37	2.13
	1991-2009	0.02(0.11)*	0.21	0.08(0.10)*	0.82	0.05	4.92
FR	1991-1998	0.88(0.31)**	2.82	0.38(0.27)*	1.43	0.85	12.24
	1999-2009	1.18(0.81)*	1.44	0.03(0.13)*	0.26	0.23	1.07
	1991-2009	0.97(0.31)**	3.13	-0.002(0.12*)	-0.01	0.41	5.22
DE	1991-1998	1.14(0.18)**	6.05	-0.11(0.17)*	-0.62	0.93	28.72
	1999-2009	0.11(0.30)*	0.38	0.24(0.11)**	2.05	0.42	2.55
	1991-2009	0.23(0.23)*	0.97	0.10(0.07)*	1.34	0.23	2.28
GR	1991-1998	0.89(0.10)**	8.81	1.04(0.37)**	2.79	0.97	65.81
	1999-2009	0.19(0.16)*	1.19	0.11(0.15)*	0.72	0.19	0.84
	1991-2009	0.59(0.15)**	3.8	0.09*	0.16	0.49	7.31
HU	1991-1998	0.25(0.40)*	0.61	0.19(0.44)*	0.44	0.08	0.19
	1999-2009	0.25(0.21)*	1.21	-0.58(0.22)**	-2.60	0.51	3.65
	1991-2009	0.34(0.22)*	1.54	0.24(0.25)*	0.96	0.13	1.18
IE	1991-1998	0.08(0.48)*	2.59	0.58(0.08)**	6.81	0.94	37.2
	1999-2009	-0.0005(0.07)*	-0.006	0.10(0.04)**	2.45	0.46	3.01
	1991-2009	0.06(0.07)*	0.82	0.13(0.04)**	2.90	0.39	4.81
IT	1991-1998	0.08(0.48)*	0.17	0.43(0.20)**	2.06	0.51	2.14
	1999-2009	0.26(0.28)*	0.94	0.08(0.09)*	0.84	0.20	0.90
	1991-2009	-0.07(0.30)*	-0.24	0.10(0.09)*	1.10	0.07	0.61
LV	1991-1998	1.49(0.24)**	6.19	0.31(0.26)*	1.16	0.90	19.17
	1999-2009	-0.28(0.38)*	-0.73	0.40(0.14)**	2.74	0.51	3.76
	1991-2009	1.36(0.17)**	7.6	0.25(0.10)**	2.36	0.79	29.41
LT	1991-1998	1.27(0.96)*	1.31	0.69(0.78)*	0.89	0.46	1.74
	1999-2009	-0.001(0.41*)	-0.003	0.36(0.19)*	1.86	0.37	2.11
	1991-2009	0.74(0.26)**	2.82	0.31(0.20)*	1.55	0.39	4.94
LU	1991-1998	0.29(1.16)*	0.25	0.46(0.29)*	1.54	0.45	1.66
	1999-2009	-0.05(0.03)*	-1.77	-0.03(0.02)*	-1.21	1.84	0.34
	1991-2009	-0.04(0.03)*	-1.4	-0.02(0.03)*	-0.74	0.12	1.06
MT	1991-1998	-0.24(0.43)*	-0.50	0.74(0.34)**	2.17	0.54	2.41
	1999-2009	-0.01(0.24)*	-0.07	0.12(0.16)*	0.75	0.07	0.30
	1991-2009	-0.02(0.17)*	-0.14	0.17(0.12)*	1.39	0.12	1.03
NL	1991-1998	0.16(0.55)*	0.29	0.89(0.36)**	2.46	0.68	4.27
	1999-2009	0.58(0.23)**	2.48	0.15(0.11)*	1.42	0.65	6.64

	1991-2009	0.59(0.30)*	1.91	0.05(0.12)*	0.41	0.26	2.72
PO	1991-1998	0.64(0.68)*	0.93	0.23(0.46)*	0.50	0.23	0.60
	1999-2009	0.55(0.60)*	0.92	0.43(0.32)*	1.35	0.40	2.39
	1991-2009	0.62(0.38)*	1.63	0.25(0.18)*	1.35	0.29	3.19
PT	1991-1998	1.16(0.27)**	4.25	-0.12(0.60)*	-0.20	0.82	9.21
	1999-2009	-0.15(0.51)*	-0.30	-0.02(0.31)*	-0.07	0.01	0.06
	1991-2009	0.62(0.24)**	2.66	0.25(0.17)*	1.5	0.36	4.39
RO	1991-1998	0.65(0.57)*	1.13	0.88(0.47)*	1.85	0.50	2.05
	1999-2009	0.88(0.14)**	6.28	0.06(0.16)*	0.38	0.85	2.70
	1991-2009	0.91(0.19)**	4.6	0.20(0.21)*	0.96	0.60	11.51
SK	1991-1998	-0.13(0.59)*	-0.22	0.44(0.36)*	1.20	0.28	0.80
	1999-2009	0.10(0.46)*	0.21	0.62(0.36)*	1.74	0.34	1.87
	1991-2009	-0.09(0.30)*	-0.29	0.5(0.18)**	2.83	0.37	4.53
SI	1991-1998	-0.30(0.32)*	-0.92	0.06(0.17)*	0.37	0.21	0.53
	1999-2009	0.21(0.34)*	0.62	0.47(0.22)**	2.09	0.41	2.51
	1991-2009	0.07(0.23)*	0.32	0.19(0.11)*	1.69	0.17	1.58
ES	1991-1998	-0.03(0.54)*	-0.06	0.89(0.30)**	2.9	0.87	14.64
	1999-2009	-0.17(0.17)*	-1.01	0.22(0.06)**	3.4	0.66	6.89
	1991-2009	0.17(0.32)*	0.52	0.08(0.10)*	0.76	0.14	1.23
SW	1991-1998	0.58(0.23)**	2.54	0.29(0.15)*	1.86	0.75	6.21
	1999-2009	0.43(0.14)**	3.02	0.49(0.20)**	2.44	0.67	7.14
	1991-2009	0.51(0.11)**	4.48	0.31(0.07)**	4.10	0.72	19.66
UK	1991-1998	0.60(0.23)**	2.6	0.71(0.33)**	2.13	0.78	7.15
	1999-2009	0.19(0.42)*	0.42	-0.27(0.35)*	-0.76	0.52	3.82
	1991-2009	0.53(0.14)**	3.78	0.01(0.07)*	0.25	0.49	7.27

**Indicates that coefficient is significantly different from zero at 95 % level of confidence, *Indicates that coefficient is not significantly different from zero at 95 % level of confidence

Over the period , short run correlation coefficient varies highly across the countries and estimate ranges from 0.08 to 0.97, showing evidence of moderate to low capital mobility for BE(1991-1998, 1991-2009), FI(1991-1998), FR(1991-1998, 1991-2009), GR(1991-1998, 1991-2009), LT(1991-2009), NL(1999-2009), PT(1991-2009), RO(1999-2009, 1991-2009), SW(1991-1998), UK(1991-1998) and showing high capital mobility for EE(1991-1998), IE(1991-1998), SI(1999-2009), SW(1999-2009, 1991-2009) and for UK (1991-2009). Estimated lowest value 0.08 for IE (1991-1998) shows perfect short term capital mobility and the highest value of β_E is 1.49 for LV showing more investment rate compare to savings rate.

Similarly, long run saving investment correlations coefficient γ^E for AT(1999-2009), BG(1991-1998), CZ(1991-1998), EE(1999-2009), IE(1991-1998), IT(1991-1998), MT(1991-1998), LV(1999-2009), NL(1991-1998), SK(1991-2009), RO(1991-1998), SI(1999-2009), SW(1999-2009) and for UK(1991-1998) showing evidence in favor of moderate to low capital mobility at 95 % level of confidence. And, higher degree of capital mobility is evident at the 95 % level of confidence for BE(1991-1998, 1999-2009), CZ(1991-2009), FI(1991-1998), DE(1999-2009), IE(1999-2009, 1991-2009) and for SE(1991-2009). Estimated β_E and γ^E for remaining countries are statistically insignificant to be useful. All of our regression models presented in this paper are significantly fit with respect to other diagnostic test (R^2 , DW, HQ, AIC) as we noticed in different tables.

VI) Conclusion

This paper has examined the degree and progress of capital market integration in the EU area. There has been worth policy changes in capital market in the euro area in recent years and these have pointed towards the increased degree of capital market integration. Especially in the euro zone, these changes have been driven by the introduction of the single currency euro, technological advances and increased cross boarder transactions. Apart from all other previous studies of the F-H test, the present study has used time series econometric technique to test the capital mobility for 27 EU member countries. In time series analysis , we found that correlation coefficients varies significantly across the EU member countries , ranges from 0.21 to 0.95, suggesting higher to low degree of capital mobility. So we can conclude that, F-H test, in other words, correlations coefficient between saving and investment are appropriate with the situation where degree of capital mobility is high.

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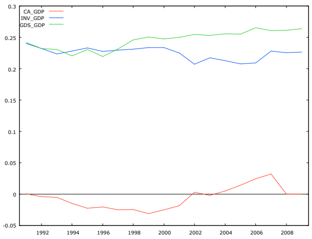
Appendix: Time series Plot

Saving, investment and current account balances in relation to GDP for various countries



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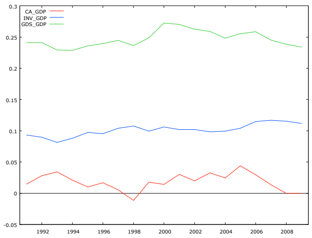

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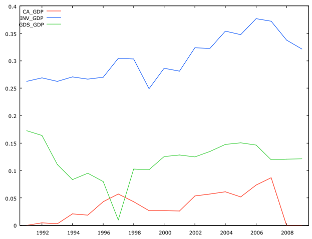
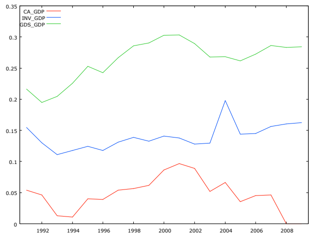
Belgium



Estonia

Bulgaria



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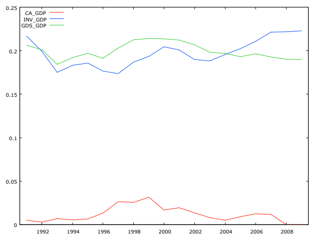
Cyprus



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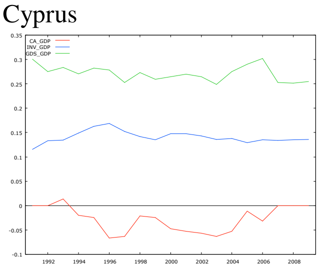
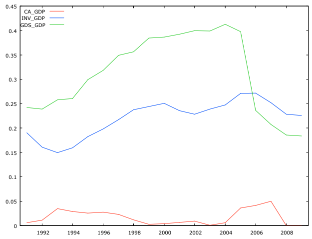


Czech Republic

Greece

Hungry



Ireland

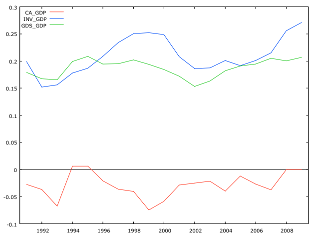
Italy

Latvia

Luxembourg

Malta

Netherlands



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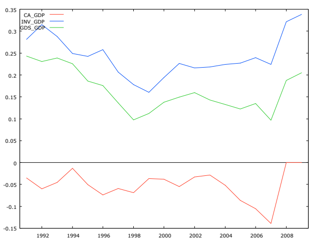
Portugal

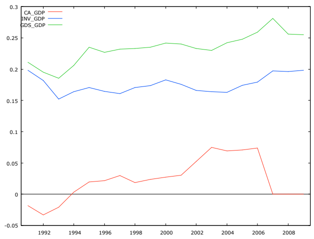


Romania

Slovakia

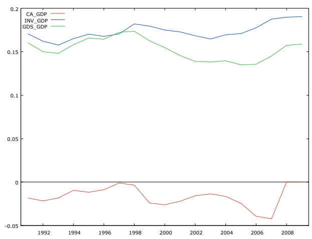
Slovenia

Spain



Sweden

Lithonia



UK