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Capital mobility in the panel GMM framework: Evidence from EU members

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Abstract

This paper examines the level of international capital mobility in European Union members under the Feldstein and Horioka (1980) hypothesis. The validity of the Feldstein-Horioka puzzle is investigated taking into account the impact of the global financial crisis employing the generalized method of moments (GMM) estimation technique developed by Hansen (1982). In general, the world countries with time have a tendency to a higher level of capital market openness. According to Feldstein and Horioka (1980), a higher saving-investment correlation is related to lower capital mobility. In this paper, panel data for 27 European countries were used for the period of 1995-2013 on the quarterly basis. The empirical results provide evidence of high capital mobility in EU members, obtaining a low value of a saving retention coefficient. The results of estimations indicate significant dependence of investments on its past values. It is found that the global financial crisis had a deeply negative impact on investment rates in 2007 and for the general period of 2007-2013. The empirical results indicate that the level of capital mobility increased during the global financial crisis, 2007-2013. Thus decrease in investments and increase in the international capital mobility level of European countries during the period of the global financial crisis of 2007-2013, taking into account high risk in the international market, indicates a reallocation of capital from international to regional markets.

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Keywords: Capital mobility, Feldstein-Horioka puzzle, saving-investment association, generalized method of moments (GMM), EU, panel data.

1. Introduction

Many studies on international capital mobility in the literature have been inspired by the seminal work of Feldstein and Horioka (1980), who examined the level of capital mobility in OECD countries, estimating the following equation:

$$(IYR)_{it} = \alpha_0 + \beta(SYR)_{it} + e_{it} \tag{1}$$

Where *IYR* is the ratio of gross domestic investment to gross domestic product, *SYR* is the ratio of the gross domestic savings to the gross domestic product of the country *i* at period *t*. Coefficient β, which is known as a saving retention coefficient, measures the degree of capital mobility. High international capital mobility refers to low

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correlation between investments and saving flows, or the value of β, is supposed to be close to 0. A low level of capital mobility in a country suggests a low correlation between investments and saving flows, or the value of the saving retention coefficient is supposed to be close to 1, indicating the capital immobility of the country. Feldstein and Horioka (1980) found that the value of the saving retention coefficient for developed countries is closer to 1 than to 0 value, illustrating by this international capital immobility in the estimated countries. These controversial results gave start to widespread debates in the economic literature. Numerous studies have provided evidence supporting these results, but other results exist in the literature with a wide array of interpretations.

Various literature reviews were made related to the Feldstein Horioka Puzzle, for example, Tesar (1991), Frankel (1992), Coakley et al. (1998), Obstfeld and Rogoff (2000), and the latest updated literature review by Apergis and Tsoumas (2009). Obstfeld and Rogoff (2000) referred to the findings of Feldstein and Horioka (1980), which are indeed contrary to economic theory, as “the mother of all puzzles.” Frankel (1992) argued that the Feldstein Horioka puzzle is not that surprising as it can be explained by the failure of some form of interest rate parity, for which arguments such as transaction costs and regulations can be made. The author suggested that the high value of the coefficient may be due to the procyclicality of savings and investments. Obstfeld and Rogoff (2000) suggested that the high value of the saving retention coefficient is due to the “home bias” in investor preferences. Apergis and Tsoumas (2009) concluded that the results of the majority of studies support a high correlation between savings and investments, but at a lower level. At the same time, they indicate that most studies do not validate the capital mobility hypothesis.

Most empirical studies with panel data have concentrated on large samples of OECD countries following the work of Feldstein and Horioka (1980) (see, for example, Ho 2002, 2003; Fouquau et al., 2008; Adedeji and Thornton, 2008; Ketenci, 2013), or on smaller samples of OECD countries (Georgopoulos and Hejazi, 2009; Rao et al., 2010; Narayan and Narayan, 2010). Another group of studies narrows its focus to EU countries (for example, Feldstein and Bachetta, 1991; Artis and Byoumi, 1991; Banerjee and Zanghieri, 2003; Telatar et al., 2007; Kollias et al., 2008; Ketenci, 2012).

Fouquau et al. (2008) in their study on OECD countries employed a panel smooth threshold regression approach proposed by Gonzalez et al. (2005) that can capture heterogeneity across countries and the time variability of the saving retention coefficient. The threshold variables considered in the study by Fouquau et al. (2008) are the economic growth of the analyzed countries, demography, degree of openness, country size, and current account balance. The authors found that the highest impacts on the international capital mobility are degree of openness, country size, and current account balance. It was found that the countries in the sample have a heterogeneous degree of international capital mobility, and that the estimated saving retention coefficients have a tendency to decline in the estimated period, between 1960 and 1990.

Ho (2003), for example, employed only a country-size threshold variable for measuring its impact on the saving retention coefficient. The study was conducted for the panel of 23 OECD countries, covering the period from 1961 to 1997. The author provided substantial evidence of the threshold effects of the country size variable on the saving retention coefficient, which can be a partial explanation of Feldstein Horioka Puzzle. Ketenci (2013) estimated the saving retention coefficient for four groups of OECD countries: OECD, EU15, NAFTA, and G7 samples. The results of the study indicated that the saving retention coefficient estimates are sensitive to panel selection. Thus, the high saving retention coefficient was found at the 0.784 level only for the G7 group, while the saving retention coefficients for other groups were detected at lower levels, rejecting the hypothesis of the Feldstein Horioka Puzzle existence.

The degree of capital mobility between EU countries has to be above the capital mobility between OECD countries due to the presence of homogenous institutions, the degree of financial openness, and regulations in the EU. This hypothesis is supported in many studies. For example, Feldstein and Bachetta (1991) and Artis and Byoumi (1991) compared EU and OECD countries in their studies on savings-investment relations and on financial integration. In both studies, the results were in favor of the higher degree of the capital mobility inside the EU than between OECD members. Kollias et al. (2008), in their studies on Feldstein Horioka Puzzle across EU members using the ARDL bounds approach and panel data, illustrated that the savings-retention coefficient for EU15 is 0.148, and that this coefficient increases to 0.157 when Luxemburg is excluded from the panel. Therefore, the estimations of this study provided evidence of high capital mobility in the group of EU members, which contradicts the findings of Feldstein-Horioka (1980) for OECD countries.

Investment and saving flows are exposed to various changes in domestic as well as in world economies. Recently, more authors have started to take into account the presence of structural breaks or regime shifts using different econometric techniques. See, for example, Ozmen and Parmaksiz (2003), Telatar et al. (2007), Mastroyiannis (2007), Kejriwal (2008), Rao et al. (2010), and Ketenci (2012). Ozmen and Parmaksiz (2003), in their capital mobility analysis of the UK, and Mastroyiannis (2007), in his capital mobility analysis of Greece, did not find evidence supporting Feldstein Horioka Puzzle in the presence of structural breaks.

Telatar et al. (2007) employed the Markov-switching model to examine the behavior of saving retention coefficients in the presence of regime change. In their study of several European countries they found evidence of increasing capital mobility in Belgium, Denmark, Finland, France, Italy and Sweden after the regime change in 1994, which was the year of the establishment of the EU. They confirmed that the saving retention coefficient declined after taking into account the regime change. Kejriwal (2008), as well as the above-mentioned authors, did not find evidence of the existence of Feldstein Horioka Puzzle in European countries in the presence of structural breaks. However, the author argues that the reason for the overstated saving retention coefficients in the literature can be in the misspecification of regression models. Ketenci (2012) employed the Gregory and Hansen (1996) cointegration test in the presence of one structural break and the Johansen cointegration test with dummy variables, located at known points for structural dates. The results of this empirical research illustrated a low level saving retention coefficient estimated in the presence of structural breaks. The results indicate high capital mobility in most of the countries, providing evidence against Feldstein Horioka Puzzle in the European Union countries sample.

This study investigates the degree of capital mobility in EU members using the panel Generalized Method of Moments (GMM) approach and its dynamic model. At the same time, it inquires into the effect of the global financial crisis on capital mobility employing dummy variables for different years and periods of the crisis. In the case of perfect capital mobility, investment depends on the rate of interest; however, the decisions of investors very often depend on experience of previous decades having dynamic nature. The level of international capital mobility is exposed to various changes in domestic as well as in world economies. Particularly the global financial crisis had an impact on developed economies where fluctuations of capital flows are considered to have been one of main reasons for the crisis spread.

This topic has received significant coverage in the literature. See, for example, Baldwin (2009), Fratzscher (2011), Milesi-Ferretti and Tille (2011), and Broner et al. (2013). Broner et al. (2013), for example, argue that gross capital flows are pro-cyclical and follow economic cycles. Particularly gross capital flows significantly decrease during crises, when investors leave foreign markets. The authors found that even though such retrenchments take place during both domestic and global crises, they are much stronger under the effect of global crises.

The motivation of this study is to employ different econometric technique that takes into account the dynamic nature of capital flows and to detect the effect of structural breaks known a priori, in terms of periods for the global financial crisis, on capital mobility of the EU members. The novelty of this study are evaluations of capital mobility in the EU controlling for its dynamic nature, and estimation of the global financial crisis effect, in different points, on capital mobility level of the EU members. To my knowledge there are no similar studies for the EU members in the literature. This study contributes to studies on capital mobility and the Feldstein Horioka puzzle in the EU, by applying different methodologies. The data sample of this study includes EU27 member countries except Greece, Ireland, Malta, and Romania because of the lack of homogenous data for these countries for the full estimated period in the used source. The data for selected countries are extracted from the official statistical site of the EU, Eurostat. The quarterly data are used in this research and cover the period from 1995 to the last quarter of 2013. The rest of the paper is organized as follows. In the next section the applied methodological approach is presented. In section 3, the obtained empirical results are reported; and finally, the last section concludes.

2. Methodology

2.1 Unit root tests

The GMM estimation framework was developed for strictly stationary data. In order to test the stationarity of panel data, various panel unit root tests were employed. These are four first generation panel unit root tests, the Im, Pesaran, and Shin (IPS) test (Im et al., 2003), Fisher-type tests that employ the Augment Dickey-Fuller (ADF) and the Phillips-Perron (PP) tests (Maddala and Wu, 1999; and Choi, 2001), and Hadri tests (Hadri, 2000). The IPS test is a heterogeneous panel unit root test based on individual ADF tests and proposed by Im et al. (2003) as a solution to the homogeneity issue. It allows for heterogeneity in both the constant and slope terms of the ADF regression. Maddala and Wu (1999) and Choi (2001) proposed an alternative approach employing the Fisher test, which is based on combining the P-values from individual unit root test statistics such as ADF and PP. One of the advantages of the Fisher test is that it does not require a balanced panel. Finally, the Hadri test is a heterogenous panel unit root test that extends the KPSS (Kwiatkowski-Phillips-Schmidt-Shin) test, outlined in Kwiatkowski et al. (1992), to a panel with individual and time effects, as well as deterministic trends, which has as its null hypothesis the stationarity of the series. In addition to discussed tests the second generation panel unit root test was employed, the cross-sectionally augmented IPS (CIPS) test developed by Pesaran (2007). Pesaran extended the IPS test by introducing a common factor to the regression in order to consider correlation between data cross sections. The main difference of second generation panel unit root tests from first generation tests is the consideration of cross-sectional dependencies. Several studies have shown that series size distortions can occur if cross-sectional dependencies are not taken into account (Strauss and Yiğit, 2003; Banerjee et al., 2005; Pesaran, 2007).

2.2 GMM

This study employs the GMM (Generalized Method of Moments) for a dynamic analysis of the capital mobility in the EU member countries. The GMM first was introduced by Hansen (1982) and can be recast as an instrumental variables estimation. The GMM is a flexible estimation principle where many estimators, including ordinary least squares and instrumental variables, can be seen as special cases and different econometric models can be cast. The GMM uses the orthogonality conditions to allow a weighting matrix to account for serial correlation and heteroskedasticity of unknown form. One of the important advantages of the GMM method is that the problems of heteroskedasticity and autocorrelation are avoided. Even though advantages of the GMM test dominate, the test has some drawbacks as well which have to be mentioned. The standard GMM estimators do not deal with cross-sectional dependence. However Sarafidis (2009) showed in his study that independence across cross-sectional individuals is not necessary for the consistency of GMM or for its asymptotic efficiency, if the correlation in the errors exists, it is weak, because "the sequence of the covariances of the disturbances across individuals *i* and *j* at time *t*, given the conditioning set of all time-invariant characteristics of individuals *i* and *j*, converges absolutely as N→∞" (p.2). Another drawback of the GMM is that the number of sequential moment conditions in dynamic panel data regressions rises with the availability of the number of time periods. Therefore results of the GMM estimators may be biased by using the large number of moment conditions, even in the case when number of cross sections is large, Bun and Kiviet (2006). Another disadvantage which is commonly discussed in the literature is weak instruments of regressions. Instruments employed in the GMM test are presented by lagged endogenous regressors of a model. However in the case where the panel data are persistent, the employed instruments are weakly correlated with endogenous changes leading to the poor performance of the GMM estimators (Blundell and Bond, 1998; Kruiniger, 2009; Bun and Windmeijer, 2010).

Employing the GMM estimation approach, this study estimates equation 1. Additionally, this study estimates dynamic model, where lagged investment is included as an explanatory variable. The estimated dynamic regression can be written as follows:

$$(IYR)_{it} = \alpha_0 + \alpha_1 (IYR)_{it-1} + \beta(SYR)_{it} + \varepsilon_{it} \tag{2}$$

International capital flows can be considered as of dynamic nature. Interest rate is not the only determinant of investments. At the same time decisions of investors very often depend on the experience of previous decades. Therefore, the inclusion of past value of investment as an explanatory variable gives opportunity to assess investment and saving relations under the condition of the dynamic behavior of capital flows. The level of international capital mobility is exposed to various changes in domestic as well as world economies. Particularly, the global financial crisis impacted developed economies where fluctuations of capital flows are regarded as one of the main reasons for the spread of the crisis. For example, Fratzscher (2011) analyzes the effect of different drivers on capital flow patterns for a set of 50 advanced and emerging economies during the global financial crisis of 2007-2008. The findings of the paper show that common shocks such as global financial crises have substantial effects on international capital flows. Particularly the global financial crisis triggered a reallocation of capital flows from emerging market economies to advanced economies.

Therefore, in order to estimate the effect of the global financial crisis on investment- savings relations, dummy variables are included in estimated models. Thus equation (1) can be rewritten as follows:

$$(IYR)_{it} = \alpha_0 + \beta(SYR)_{it} + \alpha_2 D_j + u_{it} \tag{3}$$

And dynamic model (2) can be rewritten as follows:

$$(IYR)_{it} = \alpha_0 + \alpha_1 (IYR)_{it-1} + \beta (SYR)_{it} + \alpha_2 D_j + v_{it} \tag{4}$$

where *IYR* is the ratio of gross domestic investment to gross domestic product, *SYR* is the ratio of gross domestic savings to the gross domestic product of the country *i* at period *t*. D_j is the dummy variable which represents one of estimated periods of the global financial crisis year, where *j* refers to the crisis period. The purpose of this study is to measure the saving retention coefficient β employing the GMM approach. It is supposed that developed countries have high international capital mobility that refers to low correlation between investments and saving flows. Therefore, it is expected that the value of β is close to 0.

To establish the robustness of the GMM results, alternatively, the Ordinary Least Squares (OLS), the Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS) panel estimation techniques were employed. Kao and Chiang (2000) found that the OLS is biased in finite samples for heterogeneous panels, the FMOLS is biased in the homogenous panel, while the DOLS performs better in both heterogeneous and homogenous panels. The DOLS estimator outperforms both the OLS and the FMOLS; however three of them are employed in this study for the comparison reason.

3. Empirical Results

3.1 Unit root tests

GMM estimations require stationary data, so it is necessary to investigate the integration order of the panel series. Five alternative unit root tests, consisting of the IPS, ADF, PP, Hadri and CIPS tests, were employed. The IPS, ADF, PP and CIPS tests each test for the presence of individual unit root process in series. The Hadri test's hypothesis has no unit root in the common unit root process. The results of the unit root tests are presented in Table 1. Both series, Investments and Savings, demonstrated the absence of the unit root in levels and in their first differences except the Hadri test in level estimations. The IPS, ADF, and PP tests rejected the hypothesis of the unit root presence in levels and first differences of both series. The Hadri test accepted the hypothesis of stationarity in both series in their first differences, but rejected the hypothesis of stationarity on their levels. The results of the Hadri test indicate the non-stationarity of variables; however, this might have been due to the fact that in the presence of high autocorrelation, the size distortion takes place in the Hadri test and the null hypothesis of stationarity may be over-rejected. Therefore, it is important to interpret these results with caution. The results for the CIPS test are presented for no lag and for the one lag cases. In both cases the test statistics rejects the null hypothesis of the CIPS test of the unit root presence. The results of the CIPS test are consistent with the first generation panel unit root tests, IPS, ADF and PP, and support the result on the absence of the unit root in series' levels and in their first differences. Based on the results of these alternative unit root tests, it is reasonable to conclude that series are generated by a stationary process; therefore, series may be estimated by the GMM approach.

Table 1: Panel Unit Root Tests

Variables	Tests	Level	Difference
Investments	IPS[a]	-3.19**	-9.63**
	ADF[a]	71.84**	200.54**
	PP[a]	364.07**	425.23**
	Hadri[b]	6.45**	0.14
	CIPS[a] (0)	-3.547**	-6.101**
	CIPS[a] (1)	-2.754**	-5.932**
Savings	IPS[a]	-1.96*	-13.42**
	ADF[a]	58.68'	281.41**
	PP[a]	363.33**	427.92**
	Hadri[b]	15.25**	-1.96
	CIPS[a] (0)	-4.150**	-6.120**
	CIPS[a] (1)	-2.809**	-4.320**

*Notes: In panel unit root tests, probabilities are computed assuming asymptotic normality. (a) tests the hypothesis of the presence of the individual unit root process, and (b) tests the hypothesis of no unit root in the common unit root process. * and ** denote the rejection of the null hypothesis at the 5 and 1 percent significance level, respectively. Number in brackets of the CIPS test indicates lags allowed in the regression.*

3.2 GMM estimations

Table 2 presents the results of the panel estimations of equations 1 and 2 employing the GMM and the dynamic GMM methods, respectively. Additionally, the OLS, the FMOLS and the DOLS panel estimation results of equation 1 are provided in the table to verify the robustness of conclusions. The results of the diagnostic tests suggest that all models are relatively well specified. The Sargan test does not reject the over-identification restrictions. The lagged dependent variable in equation 2 is statistically significant, indicating the reliability of the results of the specified dynamic model. The values of the saving retention coefficient appeared to be higher when the GMM and the dynamic GMM method were employed, illustrating slightly lower level of capital mobility in the estimated panel compared to the OLS, FMOLS and DOLS estimations. Even though the estimated saving retention coefficient by employing the GMM and the dynamic GMM methods is slightly higher compared to alternative estimations, but is still at a low level and indicates a high level of capital mobility in EU member countries. The low saving retention coefficient indicates high capital mobility in the panel sample, providing evidence for the argument against the Feldstein Horioka Puzzle. The estimation results indicate a significant dependence of investments on its past values. The results of the dynamic estimations provide evidence of the presence of restrictions for capital mobility in terms of the past values of investment flows.

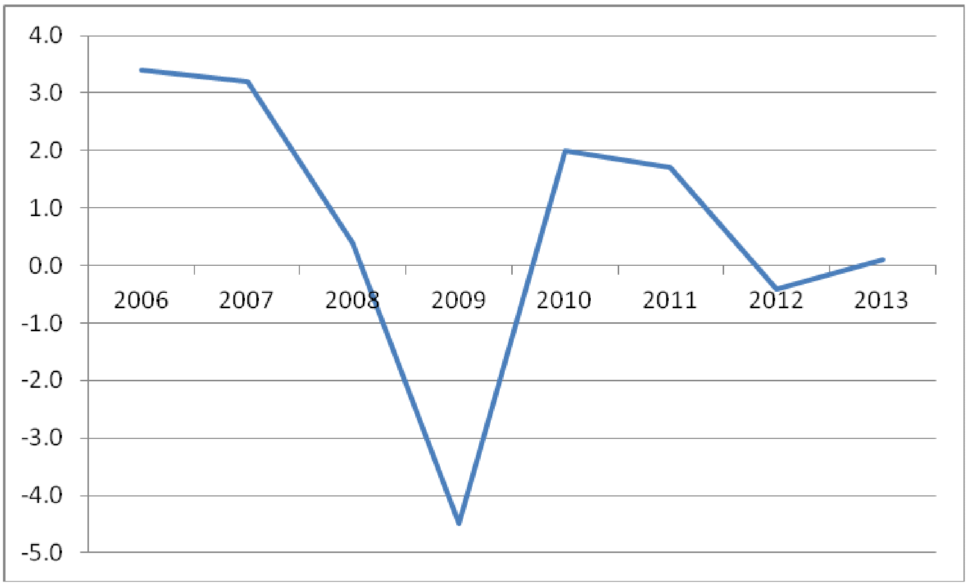
Table 2: GMM Estimations, panel

Dependent variable	**Investments**	**NOI**	**ST**
GMM		10	0.25
α_0	-		
ß	0.215** (0.004)		
GMM dynamic		11	0.28
α_0	-		
α_1	-0.317** (0.005)		
ß	0.167** (0.012)		
OLS			
α_0	19.358** (0.381)		
ß	0.104** (0.016)		
FMOLS			
α_0	-		
ß	0.140** (0.036)		
DOLS			
α_0	-		
ß	0.122** (0.047)		

*Notes: ** and * indicate significance level at 1 and 5 percents, respectively. Standard errors for the coefficient estimates are given in parentheses. Sargan p values are reported. a0, a1 and ß coefficients are from equations 1 and 2. NOI: Number of instruments, ST: Sargan test.*

Figure 1 presents real GDP growth rates of the EU for the period of 2006-2013. The figure illustrates that the deepest decline of GDP of the EU occurred in 2009 and composed 4.5%. Year 2009 was the only year since the start of the global financial crisis when the EU experienced deep decline in the GDP. The choice of dummies is based on the EU economy performance since the global financial crisis has started. Four quarters of year 2009 are evaluated in estimations by individual dummies, D09-1, D09-2, D09-3 and D09-4, respectively. In addition five different dummies are employed, three of them are dummies that determine separate years of the global financial crisis, D07, D08 and D09. Years 2007, 2008 and 2009 are chosen due to the worst performance of the EU economy during these years. Other two dummies, Dfull1 and Dfull2 present more extensive periods, 2007-2009 and 2007-2013. The period 2007-2009 is characterized by lowest growth of the GDP since the crisis has started, and in many studies period of the global financial crisis is referred to these years, 2007-2009, see for example Chudik and Fratzscher (2011), Wang (2014). However in some studies it is discussed that the global financial crisis has not finished yet and continues negatively to affect world economies, see for example Bienkowski et al. (2014), Choudhry and Jayasekera (2014), . Therefore the period 2007-2013 was evaluated in this study as well.

Figure 1: EU GDP real growth rates.



Source: Eurostat

Table 3 presents results for the panel sample of the GMM and the dynamic GMM estimations with the inclusion of dummy variables to examine the impact of the global financial crisis on the capital mobility of the EU member countries. D09-1, D09-2, D09-3, and D09-4 present dummy variables that correspond to the quarters of 2009, respectively. D07, D08 and D09 are dummy variables related to years 2007, 2008 and 2009, and finally Dfull1 and Dfull2 are dummy variables that represent periods 2007-2009 and 2007-2013 respectively. The estimated coefficients for dummy variables are presented with a_2 coefficients. In both models, estimates of dummy coefficients were found to be highly significant. The dummy coefficients were found negative in the first and third quarters of 2009 in the GMM model estimations, indicating a significant decrease in investment rates, particularly in the first quarter. Estimates of dummy coefficients were found positive in the second and fourth quarters, indicating an increase in investment rates in these periods; however, the estimated rise in investments in second quarter was relatively low compared to the fourth quarter. Next three dummies illustrate effect of individual years of the crisis on investments flow. Estimations for the 2007 dummy illustrate a significant fall in investments rate with consequent recovery in years 2008 and 2009. Period 2007-2009 did not negatively affect the investment rate, although the positive effect is not considerably high. Estimations for more extended crisis period of 2007-2013 indicated a highly disruptive effect on investment rate.

Table 3: GMM Estimations, panel, with the financial crisis dummy variable.

GMM	**D09-1**	**D09-2**	**D09-3**	**D09-4**	**D07**	**D08**	**D09**	**Dfull1**	**Dfull2**
ß	0.109** (0.017)	0.224** (0.004)	0.217** (0.006)	0.191** (0.039)	0.232** (0.004)	0.225** (0.07)	0.229** (0.007)	0.218** (0.004)	0.169** (0.014)
α_2	-21.214** (6.304)	3.103** (0.213)	-1.268** (0.282)	28.927** (1.793)	-14.917** (0.489)	8.387** (1.183)	3.137** (0.067)	1.113** (0.149)	-23.506** (0.861)
NOI	*10*	*11*	*10*	*10*	*11*	*7*	*11*	*10*	*10*
ST	*0.21*	*0.30*	*0.26*	*0.30*	*0.30*	*0.28*	*0.24*	*0.22*	*0.28*
Dynamic GMM									
α_1	-0.259** (0.012)	-0.319** (0.017)	-0.321** (0.015)	-0.371** (0.038)	-0.339** (0.019)	-0.342** (0.030)	-0.324** (0.004)	-0.326** (0.008)	-0.301** (0.013)
ß	0.103** (0.021)	0.114** (0.031)	0.164** (0.08)	0.045 (0.082)	0.169** (0.034)	0.147** (0.058)	0.171** (0.011)	0.166** (0.018)	0.132** (0.019)
α_2	-13.675** (0.994)	1.684** (0.023)	2.015** (0.239)	25.419** (4.087)	-21.634** (1.543)	9.093** (2.596)	3.351** (0.083)	3.042** (0.151)	-20.962** (1.053)
NOI	*11*	*9*	*11*	*9*	*11*	*7*	*11*	*11*	*11*
ST	*0.21*	*0.24*	*0.20*	*0.23*	*0.31*	*0.22*	*0.23*	*0.23*	*0.28*

*Notes: ** and * indicate significance level at 1 and 5 percents, respectively. Standard errors for the coefficient estimates are given in parentheses. Sargan p values are reported. NOI: Number of instruments, ST: Sargan test.*

The estimations of the dynamic panel GMM method provided a negative sign for dummy variables in the first quarter, while in next consequent quarters the coefficient of the dummy variable was found positive. The estimations results illustrate the deeply negative impact of the global financial crisis on investment rates in the first quarter followed by a strong recovery, particularly in the fourth quarter. The dynamic panel GMM estimations results are in line with the standard GMM estimation results for individual years, and crisis periods dummies. Thus estimations for dummies of individual years illustrate a significant drop in investment rate in 2007, followed by increase in 2008 and 2009. Similar to the standard GMM estimations the dynamic panel estimations detected positive but not high effect of the period 2007-2009 on investment rate and strong negative effect of period 2007-2013.

The estimation results of the panel sample illustrate the presence of the effect of the inclusion of dummy variables on capital mobility level. In both the GMM and the dynamic GMM estimations, the saving retention coefficient was found to be at a lower level in the first quarter of 2009 compared to the estimations without dummies. In both models, the saving retention coefficient was found to be at a higher level in the consequent three quarters. The estimation results for individual years' dummies do not demonstrate divergence between saving retention coefficients indicating on similar level of capital mobility throughout these years. However inclusion of two crisis dummies reveals lower level of the saving retention coefficient for period 2007-2013 compared to period 2007-2009. These results illustrate the higher level of capital mobility for the period 2007-2013 compared to period 2007-2009. Thus the GMM estimations revealed high level of capital mobility in the EU member countries which contradicts to the Feldstein Horioka Puzzle. The consideration of dynamic nature of capital flows in estimations provided lower level of the saving-retention coefficients in all different regressions, indicating on an even higher level of capital mobility.

4. Conclusion

This paper investigated the level of international capital flows in the panel sample of the EU27 members except Greece, Ireland, Malta, and Romania. Estimations were made for the period from 1995 to the end of 2013 on the quarterly basis. The study applied the GMM framework developed by Hansen (1982). In order to examine effect of the global financial crisis on the level of capital mobility in the selected country sample, dummy variables were employed for crisis periods.

The estimation results in Table 2 rejected the existence of the Feldstein Horioka Puzzle in EU countries and provided enough evidence to conclude that the capital mobility level was relatively high in the selected panel sample. The estimation results revealed a significant dependence of investments on past values, indicating the presence of restrictions for capital mobility in terms of the past values of investment flows. Even in countries with high levels of capital mobility, investments are influenced by interest rate levels as well as by various obstacles. The results indicated that the investment flows of the previous quarters play a significant part in determining current capital flows and obstruct the level of perfect capital mobility.

In order to investigate the impact of the global financial crisis on the capital mobility in the EU member countries dummy variables for different years and periods of the recent global financial crisis were employed. The estimated coefficients for dummy variables were represented by a_2 coefficients in Table 3. The coefficients of the dummy variables were found highly significant, indicating the presence of an effect of the global financial crisis on the level of capital mobility in the selected panel. The results of the estimates of dummy coefficients in the GMM model reveal a significant decrease in investment rates in 2007 with consequent increase in following two estimated years. Additionally estimations illustrated deep decline in investment rates during period 2007-2013. The estimations of the dynamic panel for the GMM approach provided results similar to those of the GMM model, illustrating the deeply negative impact of the global financial crisis on investment rates for the year 2007 and for the extended estimated period 2007-2013, while period 2007-2009, which is characterized by deterioration of the EU's GDP, was estimated with slight positive effect on investment rates.

The estimation results of the saving retention coefficient indicated that the level of capital mobility was higher in the first quarter of year 2009 compare to following three quarters. Level of capital mobility during years 2007, 2008 and 2009 was staying almost at the same level, however period 2007-2013 is characterized by higher level of capital mobility. At the same time estimations for dummy variable of the period 2007-2013 illustrate significant decline in investment rate for this period and at the same time increase in capital mobility. Increase in capital mobility and decrease in investments rate during the crisis period may indicate on capital repatriation that is related to high level of risk in the international market. The global financial crisis induced investors to move away from high-risk projects to safer assets, decreasing interest in new foreign direct investments abroad (Poulsen and Hufbauer, 2011). For example, Fratzscher (2011) states that the global financial crisis triggered a reallocation of capital flows from emerging market economies to advanced economies. Even after detecting the negative impact of the global financial crisis on the capital mobility of the European countries, the results of this study still illustrate a high level of capital mobility, rejecting in this way the presence of the Feldstein-Horioka Puzzle hypothesis in the European countries.

Previous studies on the EU capital mobility, Feldstein and Bachetta (1991), Artis and Byoumi (1991), Kollias et al. (2008), Ketenci (2013) found higher degree of the capital mobility in the EU compared to OECD members. The saving retention coefficient for OECD countries is generally estimated at level around 0.8, however the coefficient for EU members is generally estimated at level around 0.2. This study's findings are in line with previous studies on the EU capital mobility illustrating low level of the saving retention coefficient. Additionally this study reveals even higher level of the capital mobility in the EU when the dynamic nature of capital flows is allowed in estimations. This study showed that the higher level of capital mobility in the EU during the recent global financial crisis is accompanied by decline in investments rate which may be explained by reallocation of capital from international to the EU market. Despite of decline in investment rate the capital mobility increased. The policy implication here is that single currency increases capital mobility in Eurozone and positively affects the capital mobility in other European countries. Because of high risk at international markets, capital flow moves to regional markets. Therefore stabilization of domestic financial markets of the Eurozone has to be a focus for the government, particularly during external shocks, because it creates highly positive impact on other European countries' financial markets and consequently on their economies as well. The main difference between OECD and EU countries is level of integration in different areas, particularly single currency area that allows to capital to move considerably more free compared to a group of other developed countries. Increase in capital mobility is easier to reach within the single currency countries, which in turn creates confidence for neighboring European countries.

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