THE IMPACT OF THE EURO ON DOMESTIC SAVING AND INTERNATIONAL CAPITAL FLOWS

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ABSTRACT

We examine a panel data set comprised of 12 European Union countries to assess the impact of the euro common currency on the saving-investment relationship (specified by the Feldstein-Horioka puzzle). In addition, to better assess the true differences among the causal relationships, the panel data has been separated into pre-euro (1970-1998) and post-euro periods (1999-2015), respectively. The empirical framework used consists of a variety of cross-sectional dependency tests; a Pesaran panel unit-root test, a Westerlund panel cointegration test, the Dynamic OLS method, and a Dumitrescu- Hurlin Granger causality test. The main results indicate a declining trend in savings retention coefficients after the elimination of exchange-rate risk and the initiation of Euro, which validates the argument that the saving-investment correlation has become useful for explaining intranational capital mobility and current account dynamics.

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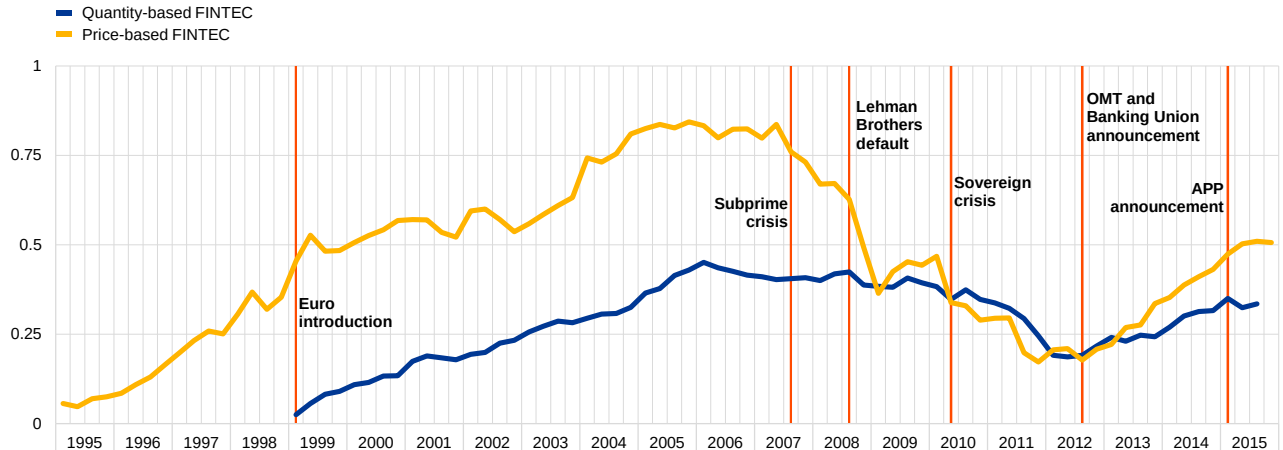
1. INTRODUCTION

Financial integration is an evolutionary process that strengthens the market and institutional interconnections across a set of regions or countries. Clearly the European Union serves as one of the primary examples of concerted efforts on a related set of policy initiatives spanning several decades in order to greatly enhance financial integration. The freer movement of capital and increased competition across the financial services sector has been expected to improve investment opportunities, produce better risk-return tradeoffs, and result in a convergence of prices of financial assets.

In these efforts toward the goal of a single market in financial services, the longest term and most important unifying element has been the development of the single currency as the centerpiece of the Economic and Monetary Union (EMU). The elimination of exchange rate risk among an increasing number of members of the Eurozone has been the largest contributor to reducing barriers to financial integration. The European Central Bank has developed separate price- and quantity-based indices of financial integration. The price-based FINTEC aggregates indicators of the degree of financial asset price dispersion across Eurozone countries based on the law of one price holding in perfectly integrated markets. Explanations for price differentials lie in differences in liquidity and credit risks in addition to barriers to cross-border asset trading. The quantity-based FINTEC relies on indicators of intra-Eurozone cross-border holdings expressed as a percentage of Eurozone total holdings. The scaling factor, which is based on the theoretical benchmark for the share of cross-border security holdings is assumed that, in a perfectly integrated market, all agents invest in an identical market portfolio. This implies that all investors should hold a portfolio whose assets are proportional to their total supply in the economy.

Price-based and quantity-based Financial Integration Composites (FINTECs)

(percentages per annum)



Sources: ECB and ECB calculations.
Notes: The FINTEC is bounded between zero (full fragmentation) and one (full integration). Increases in the FINTEC signal higher financial integration. For a detailed description of the FINTEC and its input data, see the Statistical Annex in Financial Integration in Europe, ECB April 2016.

By construction the two indices range from 0 to 1 with 1 representing perfect financial integration where the law of one price holds and all agents invest in the identical market portfolio. The chart on the previous page shows a rapid rate of increase in price convergence in the run-up to the start of the euro in 1999. There is also a significant convergence in portfolio holdings within the Eurozone to a plateau level just prior to the financial crisis. During the global crisis there was a rapid realignment of the FINTEC price and quantity indicators and following the prolonged banking and sovereign debt turmoil, the financial integration process was restarted. But without a satisfactory implementation of a full Banking Union and significant progress on a Capital Markets Union we are unlikely to see a return of the financial integration indicators on the price-based side to even the pre-crisis level.[3]

We wish to explore the degree of financial integration in the Eurozone by an alternative method based on simple principles of international finance. We will assess the relationship between domestic saving and domestic investment, and examine its sensitivity to the introduction of a common currency, the euro, in European Union countries. The high correlation between domestic saving and investment is well known as the Feldstein–Horioka puzzle (henceforth FHP). In the original study by Feldstein and Horioka (1980), they have shown that investment and saving ratios are highly correlated using cross-sectional data of 16 OECD countries for the period 1960–1974. They argued that domestic saving is the main source of finance for domestic investment, which in turn implies, low capital mobility. Hence, they concluded that even with the increase in

[3] In contrast to the FINTEC indicators the ECB has developed a Composite Indicator of Systemic Stress (CISS) which is a contemporaneous indicator. For details on the development of the CISS see Hollo, et. al. (2012).

globalization and the rise in foreign direct investment (FDI) and foreign portfolio investment (FPI) one cannot conclude that the capital mobility has increased internationally.

Let *I*, *S*, and *Y* denote national investment, national saving, and gross national product, respectively. Feldstein and Horioka (F-H) estimated the following cross-sectional regression:

$$\left(\frac{I}{Y}\right)_i = \alpha + \beta\left(\frac{S}{Y}\right)_i + \varepsilon_i \qquad (1)$$

where $\varepsilon_i \sim i.i.d.\ N(0, \sigma^2)$. F-H interpreted β, the regression coefficient (also called the saving-retention coefficient), as a measure of international capital mobility. With perfect capital mobility, an increase in the saving rate in country *i* would cause an increase in investment in all countries (henceforth, β close to 0). On the contrary, estimates of β close to 1 would indicate that most of the incremental saving in each country remains to be invested there.

Assessment of the degree of capital mobility can be built on price or quantity indicators. One argument in this regard is that in integrated financial markets rates of return on identical financial assets must be the same. The second perspective presented by F-H is based on the idea that in integrated financial markets domestic investment should not be constrained by the supply of domestic saving. Bayoumi (1998) suggests that price measures show a greater degree of economic integration between European countries than quantity measures. The European Central Bank (ECB) has since 2005 recorded a set of financial integration indicators. These FINTEC price and quantity indices cover money, bond, equity, and banking markets and are detailed in the Statistical Annex of the ECB (2016) publication *Financial Integration in Europe.*

Outside of European countries no region in the world has done more to integrate its economies. The European Union initiated free movement of goods and services, capital, and labor after the Second World War (Bekaert et al. 2011). Blanchard and Giavazzi (2002) argue that due to increased trade and cross border investment among EU member countries, the association between national savings and investment has declined at a relatively higher rate than other industrialized countries. In this paper, the main objective is to empirically examine the impact of the introduction of the euro on the degree of capital mobility, and relate the findings with the period before the common currency was introduced. On the technical side, we have evaluated the empirical puzzle of saving-investment correlation using recent advanced econometric techniques on dynamic panel data models and panel cointegration methods suggest by Pedroni (1999, 2004), Westerlund (2007) and others.

The outline of the remainder of the paper is as follows. Section 2 briefly highlights the relevant literature on FHP. In Section 3, the empirical methodology and data description are specified. Section 4 presents the estimation results for cross-sectional independence tests, panel unit-root tests, panel cointegration tests, DOLS long run elasticity estimates and Granger causality tests. Section 5 concludes.

2. THEORETICAL FRAMEWORK

Feldstein and Horioka`s hypothesis remains a puzzle despite a number of empirical studies using alternative specifications, datasets, and estimation methods. Apergis and Tsoumas (2009) comprehensively surveyed the vast empirical literature related to FHP. They concluded that the majority of the empirical findings do not support the original results of F-H but found that saving-investment correlation still exists in a weaker form, i.e., the saving-retention coefficient seems to

have decreased and is significantly less than unity. Consequently, a large body of literature also shows substantial disagreement about the implications of F-H`s hypothesis. The potential concerns highlighted in these studies are related to four issues: The intranational argument, current account dynamics, the country-size argument, and the estimation problem.

2.1. THE INTRANATIONAL ARGUMENT

The first criticism evident in the previous studies is related to the intranational argument. The studies by Sinn (1992) on states within the US; Bayoumi and Rose (1993) on the UK; and Helliwell and Mckitrick (1999) on provinces of Canada, indicate that the saving-investment relationship is useful to explain intranational regional data, which signifies that the F-H condition is related to explaining capital mobility across international borders, as well as within intranational regions.

2.2. CURRENT ACCOUNT DYNAMICS

The second disagreement specified in the previous studies indicates that the saving retention coefficient is inappropriate to the analysis of international capital mobility. For example, Obsfeld (1986) claims that the saving-investment relationship is useful to assess the growth rate of income and to examine the productivity shocks in an economy. Coakley et al. (1996) maintain that since the cross-sectional regression use by F-H measures the average long-run coefficient, which tends to capture the unit coefficient implied by the current-account solvency condition. The current account balance (saving minus investment) as a share of GDP should be integrated of order zero, *I(0),* otherwise the saving-retention coefficient result would be spurious. Likewise, Sachsida and Caetano (2000) argue that the saving-retention coefficient merely reflects the variability between

domestic savings within a country and domestic residents' savings abroad. Thus, $\boldsymbol{\beta}$ cannot be interpreted as the measure of international capital mobility.

2.3. THE COUNTRY-SIZE ARGUMENT

The third disagreement is related to the country-size argument. Murphy (1984) explains that F-H`s interpretation of the saving-retention coefficient as a rationale for perfect capital mobility alone does not essentially imply that investment and saving relationship is not sensitive to other common factors. The additional assumption that country size is small in relation to world capital markets is needed, which suggests that the estimated saving-retention coefficient is sensitive to country-size. Baxter and Crucini (1993) applied a general equilibrium model to explain that if country-size is considered in evaluating the correlation between saving and investment rates then high correlation can be evidence for high capital mobility, as the world interest rate is more affected by high income countries. Baxter and Crucini also highlighted that their model cannot be used in the small country case. Similarly, Ho (2003) using a panel threshold model for 23 OECD countries found that the saving-retention coefficient increases with a relative increase in GNP share, thus suggesting that the saving-retention coefficient varies with country-size.

2.4. *THE ESTIMATION PROBLEM*

The econometric aspect of cross-sectional regression and time series analysis indicates the possibility of endogeneity (simultaneity bias) as a potential problem when dealing with estimating the saving and investment relationship (Tobin 1983). Sinn (1992) and Krol (1996) criticize the use of time-averaged data, in the sense that it leads to outcomes biased against capital mobility. If saving and investment rates follow a random walk behavior, integrated of order one *I(1)*, then the

saving-retention coefficient will be spurious (only if saving and investment are not cointegrated) according to the Engle and Granger (1987) procedure.

STUDIES FOCUSING ON THE EU AND OECD COUNTRIES

Feldstein and Horioka`s empirical finding that $\boldsymbol{\beta}$ is close to one (between 0.85 and 0.95) indicates an exceedingly low level of capital mobility for 16 OECD countries. Following F-H a majority of studies have focused on OECD countries applying different panel data estimation methods to reassess the FHP. Coakley et al (2004) employed a panel data technique to examine the FHP for a panel of 12 OECD countries using quarterly data for 1980-2000. Their saving-retention coefficient ($\boldsymbol{\beta}$ around 0.32) indicates high capital mobility as compare to the F-H estimates. Christopoulos (2007) examined the FHP for 13 OECD countries using the Panel Dynamic Ordinary Least Squares (DOLS) method. For the entire sample period of 1885–1992, a saving-retention coefficient ($\boldsymbol{\beta}$ around 0.5) indicates fairly high capital mobility. However, for subsample periods (pre-Maastricht periods, i.e. 1921–92 and 1950–92) he found low capital mobility ($\boldsymbol{\beta}$ between 0.79-0.9). Using panel bootstrap tests, Di Iorio and Fachin (2007) examined 12 EU countries over the period 1960–2002. They found that bootstrap panel tests led to the more plausible conclusions in the long-run, where saving and investment possibly has a causal relationship. Whereas, an individual stability test shows that in almost all cases saving and investment was stable. Reexamining the FHP for 25 OECD countries over 1986-2002, Katsimi and Moutos (2007) included human capital investment in the model as an explanatory variable. Their analysis found that the degree of international capital mobility has increased significantly since the mid-1970s (saving-retention coefficient over 1997-2002 is around 0.26).

Giannone and Lenza (2009) used the Factor Augmented Panel Regression technique (which allows for heterogeneous responses of saving and investment to global shocks) to study the FHP for 24 OECD countries for the period 1970–1999. Their finding shows a decrease in the saving-retention coefficient to 0.18 after the relaxation of the homogeneity assumption for the subsample period 1990–1999. Pelgrin and Schich (2008) applied panel error-correction techniques to data for 20 OECD countries from 1960 to 1999. Regarding short-term adjustment, they found that the parameter estimated for the error-correction term is always highly significant. Moreover, the parameter estimated for the error-correction term (i.e., the speed of adjustment to the long-run equilibrium) varies with the sample period considered and is consistent with the interpretation that a long-run solvency constraint is binding for each individual country. Using a Panel Smooth Threshold Regression Model for 24 OECD countries from 1960–2000, Fouquau et al. (2008) use three additional variables (ratio of current account balance to GDP, trade openness, and the size of the country) to test the validity of FHP. Their estimates of the saving retention coefficient indicate low capital mobility ($\boldsymbol{\beta}$ between 0.5-0.7).

Kumar and Rao (2011) used time-series based panel data methods and data from 13 OECD countries from 1960-2007. Their results indicate that F-H findings might be valid for their sample period of 1960s up to the Bretton Woods's agreement in early 1970s; consequently the turmoil caused by the collapsed fixed exchange rate system and the economic uncertainties of the 1970s seems to have improved capital flows globally. However, the Maastricht Treaty has significantly improved international capital mobility ($\boldsymbol{\beta}$ less than 0.25). Jun (2011) utilized panel cointegration techniques to test and estimate the long-run relationship between saving and investment rates for 30 OECD countries over 1960-2006. His finding shows a substantial increase in international capital flows in the 1990s and 2000s. Moreover, the original 21 OECD member countries had a

much greater effect on capital flows than the new member countries over 1990-2006. Focusing on the effects of global factors on the saving-investment relationship, Costantini and Gutierrez (2013) show that if global shocks are taken into account through common factors, the estimated saving-retention coefficient is close to zero for 21 OECD countries over the period 1970-2008. The common findings related to studies on OECD countries show that the saving-investment correlation has improved since the Bretton Woods`s agreement in the mid-1970s and provide some support for the existence of FHP in a weaker form.

Given that some major international agreements have been negotiated and resulted in increasing trade and capital flows, it is likely that the introduction of the common currency might have significantly affected the correlation between saving and investment rates. In other words, the saving-retention coefficient is subject to change under a change of currency regime such as the introduction of a common currency. Therefore, this paper contributes to the empirical literature on FHP by investigating the effect of change in currency regime on the saving-retention coefficient.

3. EMPIRICAL METHODOLOGY

We use annual data on 12 European Union countries[4] from 1970-2015 to evaluate the relationship between the domestic saving and the investment rates. For this study, the sample is divided into two parts: (a) 1970-1998 (period before the Euro was initiated) and (b) 1999-2015 (period after the exchange rate was fixed). The FHP savings-investment equation can be represented as the following standard panel regression equation:

[4] Countries included are: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, and Spain.

$$\left(\frac{I}{Y}\right)_{it} = \beta_1 + \beta_2 \left(\frac{S}{Y}\right)_{it} + \beta_3 EG_{it} + \varepsilon_{it} \quad (2)$$

$$\varepsilon_{it} = u_i + v_{it}; \qquad i = 1,\ldots, N; t = 1,\ldots, T$$

where, subscripts *i* and *t* indicate country and time period, respectively. The dependent variable *I* is the gross fixed capital formation (gross capital formation minus inventory investment), *S* is gross domestic saving and *Y* stands for gross domestic product for each country. *EG* is the KOF economic globalization index compiled by Dreher (2006). It is the weighted index of actual economic flows (both capital flows and trade), and the index for restrictions on trade and capital flows. The error term ε_{it} is composed of unobservable country specific effects u_i and the disturbance term v_{it}. The data for *I*, *S* and *Y* are taken from the World Bank Development Indicators (WDI, 2017).

3.1. Cross-Sectional Dependence and Panel Unit Root

The empirical methodology used in this paper models the dynamic relationships of both domestic investment and domestic saving utilizing multiple tests controlling for cross-sectional dependency. Due to the sensitivity of the traditional unit-root test for panel data set, the empirical framework of this paper first utilizes multiple tests including the Breusch and Pagan (1980) Lagrange multiplier (LM) test, the Pesaran (2004) scaled LM test, the Baltagi et al., (2012) bias-adjusted LM test and the Pesaran (2004) cross-sectional independence (CD) test.

Within each of the cross-sectional dependency test, $\hat{\eta}_{st}$ is the correlation coefficient derived from each residual, $\hat{\mu}_{Tsj}$ is the mean and σ_{Tsj}, is the variance. For the remaining empirical framework used in this paper, $s = \{1,2,\ldots,S\}$, is the cross-sectional dimension, and $t = \{1,2,\ldots,T\}$ is the time-series dimension. Equation 3 identifies the first test of cross-sectional dependency proposed

by Breusch and Pagan (1980). Within Equation 3, we calculate the Breusch and Pagan LM test and determine whether cross-sectional dependency exists for small *S* and large *T*.

$$\boldsymbol{LM_1 = T \sum_{s=1}^{S-1} \sum_{j=s+1}^{S} \hat{\eta}_{sj} \rightarrow X^2 \left(\frac{S(S-1)}{2} \right)} \quad (3)$$

Equation 4, represents the Pesaran (2004) scaled LM test, which is used to determine the cross-sectional dependency for both large *S* and *T*.

$$\boldsymbol{LM_2 = \sqrt{\frac{1}{S(S-1)}} \left(\sum_{s=1}^{S-1} \sum_{j=s+1}^{S} \left(T\hat{\eta}_{sj}^2 - 1 \right) \right) \rightarrow N(0,1)} \quad (4)$$

Equation 5 represents the bias-adjusted *LM* test that determines if an average panel is zero and the average state is not, therefore having bias present (Baltagi et al., 2012).

$$\boldsymbol{LM_3 = \sqrt{\frac{2}{S(S-1)}} \sum_{s=1}^{S-1} \sum_{j=s+1}^{S} \left(\hat{\eta}_{sj}^2 \frac{(T-K-1)\hat{\eta}_{sj} - \hat{\mu}_{Tsj}}{\sigma_{Tsj}} \right) \rightarrow N(0,1)} \quad (5)$$

Equation 6 is the final test used in this paper to identify whether cross-sectional dependency exists in large *S* and fixed *T*, was proposed by Pesaran (2004). However, this test is a weak indicator of determining interdependence at the existence of either large positive and negative correlations within residuals.

$$\boldsymbol{CD = \sqrt{\frac{2T}{S(S-1)}} \left(\sum_{s=1}^{S-1} \sum_{j=s+1}^{S} \hat{\eta}_{st} \right) \rightarrow N(0,1)} \quad (6)$$

The next step in the empirical framework used in this paper continues its strong emphasis of examining for cross-sectional dependency by utilizing Pesaran's (2006) cross-sectional dependent (CIPS) panel unit roots test in Equation 8. However, first we need to determine the average of the state specific cross-sectional dependent Augmented Dickey-Fuller (ADF) test statistic in Equation 7 where unobservable common effects are identified as P_t. Once the state-specific CADF test statistic has been obtained, we are then able to determine the CIPS panel unit-root test statistic in

Equation 8 and assess whether a unit root does indeed exist while controlling for cross-sectional dependency among each state.

$$\boldsymbol{CADF} = \Delta\boldsymbol{\zeta_{st}} = \boldsymbol{\omega_s} + \boldsymbol{\psi_s}\boldsymbol{\zeta_{s,t-1}} + \boldsymbol{\vartheta_s}\mathbf{P_t} + \boldsymbol{\epsilon_{st}} \quad (7)$$

$$\boldsymbol{CIPS}(\boldsymbol{S},\boldsymbol{T}) = \boldsymbol{S^{-1}}\sum_{\boldsymbol{s=1}}^{\boldsymbol{S}}\boldsymbol{CADF_s} \quad (8)$$

3.2. PANEL COINTEGRATION

The next step in the empirical framework of this paper is to test for the presence of a long-run relationship among all variables with *I*, *S* and *EG*. To do this, we make use of the Westerlund (2007) panel cointegration test that controls for cross-sectional dependence based on the error-correction process written below in Equation 9[5].

$$\boldsymbol{\Delta y_{st}} = \boldsymbol{\delta'_s d_t} + \boldsymbol{\alpha_s}\left(\boldsymbol{y_{s,t-1}} - \boldsymbol{\beta'_s}\vec{\boldsymbol{x}}_{\boldsymbol{s,t-1}}\right) + \sum_{\boldsymbol{k=1}}^{\boldsymbol{p_s}}\boldsymbol{\alpha_{sk}}\boldsymbol{\Delta y_{s,t-k}} + \sum_{\boldsymbol{-q_s}}^{\boldsymbol{p_s}}\boldsymbol{\gamma_{sk}}\boldsymbol{\Delta}\vec{\boldsymbol{x}}_{\boldsymbol{s,t-k}} + \boldsymbol{e_{st}} \quad (9)$$

Where, $\hat{u}_{st} = \sum_{-q_s}^{p_s}\gamma_{sk}\Delta\vec{x}_{s,t-k} + \hat{e}_{st}$

3.3. LONG-RUN PANEL ELASTICITY

If cointegration is determined to exist, we will utilize the Dynamic Ordinary Least Squares (*DOLS*) estimation technique to determine long-run elasticities between domestic investment, saving, and globalization index[6]. This paper begins by regressing Equation 2 in order to obtain the long-run elasticities denoted as $\hat{\rho}_{DOLS}$.

[5] This paper uses the Stata command 'xtwest' that was defined in Persyn and Westerlund (2008) to estimate Westerlund's (2007) panel cointegration test.

[6] This paper does not utilize the Fully Modified OLS estimation technique used in multiple second generation studies due to the substantial potential to exhibit small sample bias (Kao and Chiang, 1999).

$$[\boldsymbol{I},(\boldsymbol{S},\boldsymbol{EG})]_{\boldsymbol{st}} = \boldsymbol{c_s} + \boldsymbol{\Theta'_{at}\rho} + \sum_{\boldsymbol{j=-q1}}^{\boldsymbol{j=p2}} \boldsymbol{m_{sj}\Delta\Theta_{s,t+j}} + \boldsymbol{g_{st}} \quad (10)$$

$$\hat{\rho}_{DOLS=}\sum_{s=1}^{S}\left(\sum_{t=1}^{T} z_{st}z'_{st}\right)\sum_{t=1}^{T} z_{st}\hat{y}^{+}_{st}$$

For simplification purposes we will assume $\Theta = [(S; EG); Y]$ where $I_{it} = \left(\frac{I}{Y}\right)$; $S_{it} = \left(\frac{S}{Y}\right)$ and EG_{it} = KOF economic globalization index, and the variables *Y*, *I*, and *S* represent gross domestic product, domestic investment and domestic saving for each of the 12 European Union countries, *i*, at time, *t*, respectively.

3.4. GRANGER CAUSALITY TEST

The final step of the empirical framework employed presents a Granger causality test for panel data to determine the direction of causality between both investment, saving and the economic globalization index for each countries. Furthermore, we propose a linear model denoted below, as it utilizes the recently developed Dumitrescu-Hurlin (2012) version of the Granger causality test for panel data. Recent literature has shown it to be a very robust test when using heterogeneous panel data.

$$Y_{st} = \Gamma_s + \sum_{k=1}^{\mathrm{K}} \phi_s^k Y_{s,t-k} + \sum_{k=1}^{\mathrm{K}} \Omega_s^k (R, NR)_{s,t-k} + \chi_{st} \quad (11)$$

Given all the countries observed, regardless of the specific subpanel for pre-euro and post-euro periods being tested, we propose that the null hypothesis to be determined ensures no homogenous Granger causality exists in any countries. Under the alternative hypothesis, we assume that for each subpanel there will exist various states where no causal relationship between domestic investment, domestic saving and economic globalization index hold. Therefore, causality must be present for at least one state within each panel. for each country.

4. RESULTS

Equation (2) constitutes the basis for this empirical study examining the performance of the saving-retention coefficient (the Feldstein-Horioka puzzle). Graphs of investment and saving rates for each of the 12 European Union countries over 1970-2015 are shown in the Appendix (pages 28-30). The movements of saving and investment rates for all countries show changes in patterns for both the variables after euro exchange rates were fixed in 1999. The graphs also indicate more dispersion in saving and investment rates after 1999 and further expansion in domestic investment and saving after the circulation of euro became operational in 2002, consistent with increased capital flows. Large increases in domestic saving can be observed in Austria, Belgium, Germany, Ireland, Luxembourg and the Netherlands since 1999. Domestic investment in each of these countries has declined from the time when the exchange rates were fixed followed by the circulation of Euro, indicating a substantial increase in capital outflows from these countries. After an initial increase in domestic savings in Finland, France and Italy between the mid-1990s and mid-2000s the overall saving rate has declined since the 2008 economic recession. However, domestic investment in these countries has increased over the same period, reducing the gap between domestic saving and domestic investment.

The capital flows in Greece, Portugal and Spain were restricted till 1992 (Portugal and Spain) and 1994 (Greece) respectively, indicating these countries had the least degree of openness for foreign capital prior to their agreement to join the EU. For Greece, Portugal and Spain a current account deficit is also persistent, where foreign capital inflows have filled the gap resulting from higher investment and lower savings. While Spain has imported the least foreign capital (where at times the country has also been the exporter of capital), Portugal has attracted the largest capital inflows.

Nevertheless, in recent years Portugal`s saving and investment gap has also declined significantly. Blanchard and Giavazzi (2002) highlighted the unusually large current account surpluses for high income countries while surprisingly large current account deficits existed for low income countries in the eurozone. They suggested that relative income disparities for euro-zone countries have become more correlated over time, where the trade and allocation of investment and consumption is assisted by more dispersion in current account balances. The behavior of saving and investment rates after the launch of the euro currency is consistent with the argument made by Blanchard and Giavazzi (2002).

4.1. Cross-Sectional Dependency and Unit Root Results

The Breusch and Pagan (1980) LM test, the Pesaran (2004) scaled LM test, the Baltagi et al., (2012) bias-adjusted LM test and the Pesaran (2004) cross-sectional independence test are reported in Table 1 (Appendix page 24). The results for each of the four cross-sectional dependence tests indicate strong evidence rejecting the null hypothesis of cross-sectional interdependence. Furthermore, these results imply that the CIPS panel unit root test proposed is an appropriate choice for testing the stationarity within each variable. The results for the CIPS panel unit root test are presented in Table 2 (Appendix page 24). The finding shows that all the variables are non-stationary throughout. Therefore, the remainder of the analysis assumes that all variables are non-stationary in level and stationary when first-differenced.

4.2. Cointegration Results

Table 3 (Appendix page 25) presents the Westerlund (2007) panel cointegration test results between domestic saving and domestic investment with and without including the economic globalization index. The finding indicates no long-run relationship exists when the economic

globalization index was included in any of the panels, consequently failing to reject the null hypothesis of no cointegrated relationship. However, the long-run relationship was found to exist between domestic investment and domestic saving within each panel; rejecting the null hypothesis of no cointegration at the 5-percent significance level.

The saving-retention ratio and 95% confidence interval for country specific Westerlund ECM for the post-euro period are reported in Table 4 (Appendix page 26). As no cointegration was found for any panel when the economic globalization index was included (Table 3: Appendix page 25), a country specific long run relationship was computed without including the economic globalization index for the post-euro period (1999-2015). The main motivation behind calculation of the country specific long-run behavior was to analyze the saving-retention coefficient for every European Union country included in the analysis. Based on the findings, the saving-retention coefficients for Luxembourg, Netherlands and Spain were found to be significant at a 5% level. For Luxembourg, the results indicate that a significant volume of domestic saving tend to be invested abroad indicating very high capital mobility. On the contrary, in the Netherlands substantial amount of domestic savings were found to be invested locally signifying very low capital mobility. On the other hand, in Spain domestic investment tends to increase by approximately 0.5% when the domestic saving increases by 1% in the post-euro period. Among all the 12 European Union countries, Luxembourg had the lowest saving-retention coefficient, whereas, the Netherlands had the largest saving-retention coefficient. When considering the practical significance, high capital mobility was apparent when analyzing the saving-retention coefficient and 95% confidence interval for Austria, Belgium, France, Germany, Greece, Ireland, Italy, and Portugal. However, in Finland low capital mobility was found as the saving-retention coefficient was closer to one.

4.3. LONG-RUN ELASTICITY RESULTS (DOLS)

Table 5 (Appendix page 27) presents the estimated results for long-run elasticity of domestic investment with respect to domestic saving and the economic globalization index. The outcome for the full panel data from 1970-2015 and pre-euro period from 1970-1998 indicate a significant long-run elasticity running between domestic saving, the globalization index and domestic investment. However, the result for globalization index was found insignificant for the post-euro period. Overall, based on the DOLS results we can concluded that the impact of domestic saving on domestic investment was greater before the exchange rate was fixed in 1999. Specifically, domestic investment was increased by 0.5% each time domestic saving increased by 1% in the pre-euro period. Whereas, the magnitude of domestic investment responding to the change in domestic saving was found to be below 0.25% after 1999. The elimination of exchange-rate risk and moving toward a common currency reduced the saving-retention coefficient, hence contradicting the finding of FPH. We can conclude that if the common currency trends continue in a similar fashion, capital mobility for the 12 European Union countries will significantly increase, and the relationship between domestic investment and domestic saving will weaken considerably.

4.4. CAUSALITY RESULTS

The results for Dumitrescu-Hurlin (2012) Granger causality test are reported in Table 6 (Appendix page 27). All the panels are listed along the left side. The null hypothesis is that no causal relationship exist between each of the respected variables. The results indicate a bi-directional causality between domestic investment and domestic saving. Uni-directional causality was evident for pre- and post-euro periods for domestic investment, indicating that investment tends to cause

domestic saving; however, the magnitude of causality has decrease after 1999. Furthermore, uni-directional causality was found from domestic investment to the economic globalization index before 1999 suggesting that domestic investment plays a pivotal role in further integration of the global economy. As for domestic saving, the results indicate that no long-run relationship was found to exist with respect to the globalization index.

5. CONCLUSION

We have analyzed both the long-run elasticities and impact of the common currency on international capital flows for 12 European Union countries. For this purpose, data from 1970 to 2015 was examined to evaluate the behavior of saving-retention coefficient, while controlling for economic globalization. In order to examine the effects of fixing the exchange rate and common currency, the data was further divided into pre-euro (1970 to 1998) and post-euro (1999 to 2015) periods. Overall, the findings of this study are significantly different from the conclusions of Feldstein and Horioka (1980). The saving-retention coefficients indicate high capital mobility when controlling for globalization for the entire panel (1970-2015). The DOLS results for the post-euro period provide compelling evidence for increases in capital flows after the initiation of euro. This study is fairly consistent with the predictions made by Blanchard and Giavazzi (2002). They argued that due to the introduction of the euro, euro-zone countries would have increased intranational capital mobility, and in the future each member country of the eurozone will act more like individual states. From the findings of this study one can conclude that in the future the correlation between saving and investment for countries using the euro will be closer to zero. Moreover, the results show some evidence for saving-investment correlation to be related to intranational capital mobility (Sinn (1992) on states within the US; Bayoumi and Rose (1993) on the UK; and Helliwell and Mckitrick (1999) on provinces of Canada) and sheds light on the

dynamics of the current account solvency condition (Obsfeld, 1986; Coakley et al, 1996). Our results based on the longer term study of intranational capital flows, treating the Eurozone as the 'nation', are supportive of the central role the single-currency project has played in augmenting financial integration. As for this study, we propose a different conclusion (when compared to FPH), but also suggest that in the near future, based on the long-run elasticity and cointegration, more and more countries using common currency will have insignificant relationship between domestic investment and domestic saving similar to Luxembourg. However, following the example of the Netherland where low capital mobility was evident, countries can adopt policies where additional economic opportunities are created to invest domestic saving locally.

5.1. FUTURE RESEARCH

To further evaluate the impact of the common currency on the FHP, an exploratory control to add would be to model the effects of the European debt crisis, and analyze any evidence of a resurgence in saving-retention coefficient. In further evaluate the impact of euro it would be informative to investigate the credibility and reliability of the Euro currency in promoting market confidence. Our study does not take into account any structural breaks which might occur for the 12 EU countries over the 1970-2015 period. The use of panel cointegration methods accounting for potential structural breaks in the series might produce improved precision in the estimation results.

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APPENDIX

Table 1.
Estimates of Cross-sectional Dependency Tests

Tests (1970-2015)	*I*	*S*	*EG*
Breusch-Pagan LM	798.53***	926.29***	1955.48***
Pesaran scaled LM	63.76***	74.87***	164.46***
Bias-corrected scaled LM	63.62***	74.74***	164.32***
Pesaran CD	14.84***	28.24***	43.69***

Note: *I* = Domestic Investment (*% of GDP*), *S* = Domestic Saving (*% of GDP*) and *EG* = Globalization Index.
******* indicates statistical significance at 1% level of significance
****** indicates statistical significance at 5% level of significance
***** indicates statistical significance at 10% level of significance

Table 2.
Results for Panel Unit Roots Test

Panel	*Test*	*I*	*S*	*EG*
Full (1970-2015)	*CIPS (0)*	-3.178***	-2.571*	-6.068***
	CIPS (1)	.	-2.759***	.

Note: *I* = Domestic Investment (*% of GDP*); *S* = Domestic Saving (*% of GDP*) and *EG* = Globalization Index.
******* indicates statistical significance at 1% level of significance
****** indicates statistical significance at 5% level of significance
***** indicates statistical significance at 10% level of significance

Table 3.
Results for Panel Cointegration Test using Westerlund's ECM Method

	I = S			*I = S + EG*		
Tests	*Full panel 1970 - 2015*	*Pre-Euro 1970 - 1998*	*Post-Euro 1999-2015*	*Full panel 1970 - 2015*	*Pre-Euro 1970 - 1998*	*Post-Euro 1999-2015*
Gt	-2.621 (0.126)	-2.572 (0.175)	-3.301*** (0.000)	-2.322 (0.802)	-2.238 (0.884)	-1.562 (0.999)
Ga	-13.191 (0.25)	-11.423 (0.598)	-10.022 (0.836)	-10.107 (0.952)	-6.788 (0.999)	-1.313 (0.999)
Pt	-9.371*** (0.008)	-9.096** (0.019)	-9.229** (0.013)	-8.407 (0.296)	-7.708 (0.595)	-3.573 (0.999)
Pa	-12.637** (0.016)	-11.249* (0.092)	-12.002** (0.039)	-9.812 (0.635)	-7.185 (0.955)	-1.560 (0.999)

Note: *I* = Domestic Investment (*% of GDP*); *S* = Domestic Saving (*% of GDP*) and *EG* = Globalization Index. Numbers in the parentheses are the *P*-values. The Westerlund four test statistics are based on 'group mean' and 'pooled mean' groups. *Gt* and *Pt* are based on *t*-ratios whereas; *Ga* and *Pa* are coefficient statistics. Tests are estimated with a constant and deterministic trend. For further discussion on ECM panel cointegration test see Westerlund (2007), Persyn D., and Westerlund (2008), and Chang (2004).

******* indicates statistical significance at 1% level of significance

****** indicates statistical significance at 5% level of significance

***** indicates statistical significance at 10% level of significance

Table 4.
Results for Country Specific Panel Cointegration Test using Westerlund's ECM Method Post-Euro period (1999-2015)

Countries	*S*	*95% C.I*
1. Austria	0.023	[-1.3199 1.3670]
	(0.973)	
2. Belgium	-0.141	[-0.9227 0.6394]
	(0.722)	
3. Finland	0.625	[-1.0248 2.2752]
	(0.458)	
4. France	-0.342	[-1.0788 0 .3935]
	(0.362)	
5. Germany	0.025	[-0.7885 0.8389]
	(0.952)	
6. Greece	-0.176	[-0.7693 0.4166]
	(0.560)	
7. Ireland	-0.322	[-0.8510 0.2070]
	(0.233)	
8. Italy	0.270	[-0.2368 0.7773]
	(0.296)	
9. Luxembourg	-2.774***	[-4.5794 -0.9689]
	(0.003)	
10. Netherlands	1.317***	[0.4125 2.2213]
	(0.004)	
11. Portugal	-0.317	[-1.0855 0.4507]
	(0.418)	
12. Spain	0.423***	[0.1237 0.7217]
	(0.006)	

Note: Numbers in the ( ) parentheses are the *P*-values, and [ ] are the 95% confidence interval, respectively. Based on the Westerlund ECM result (Table 3.), the country wise saving-retention coefficient is calculated without incorporating economic globalization index (*EG*).

******* indicates statistical significance at 1% level of significance

****** indicates statistical significance at 5% level of significance

***** indicates statistical significance at 10% level of significance

Table 5.
Tests for long-run elasticity using DOLS

Variables	*Full panel 1970 - 2015*		*Pre Euro 1970-1998*		*Post Euro 1999-2015*	
S	0.416***	0.341***	0.532***	0.486***	0.24***	0.221**
	(4.405)	(3.580)	(3.672)	(3.562)	(3.214)	(2.580)
EG	.	0.063***	.	0.089***	.	-0.005
		(3.319)		(3.469)		(-0.411)

Note: The dependent variable is Investment. Numbers in the parentheses are the *t*-statistics. *S* = Domestic Saving (*% of GDP*), and *EG* = Globalization Index.
******* indicates statistical significance at 1% level of significance
****** indicates statistical significance at 5% level of significance
***** indicates statistical significance at 10% level of significance

Table 6. Dumitrescu-Hurlin Panel Causality Tests

Panel	*S does not cause I*	*I does not cause S*	*EG does not cause I*
Full panel 1970-2015	2.173**	4.000***	0.414
Pre Euro 1970-1998	0.195	4.212***	0.084
Post Euro 1999-2015	1.677*	2.523**	-1.283
	I does not cause EG	*EG does not cause S*	*S does not cause EG*
Full panel 1970-2015	1.553	-1.278	-0.738
Pre Euro 1970-1998	3.021***	-1.276	-0.013
Post Euro 1999-2015	-1.086	-1.233	0.914

Note: *I* = Domestic Investment (% of GDP), *S* = Domestic Saving (% of GDP), and *EG* = Globalization Index.
Z-bar statistics are reported
******* indicates statistical significance at 1% level of significance
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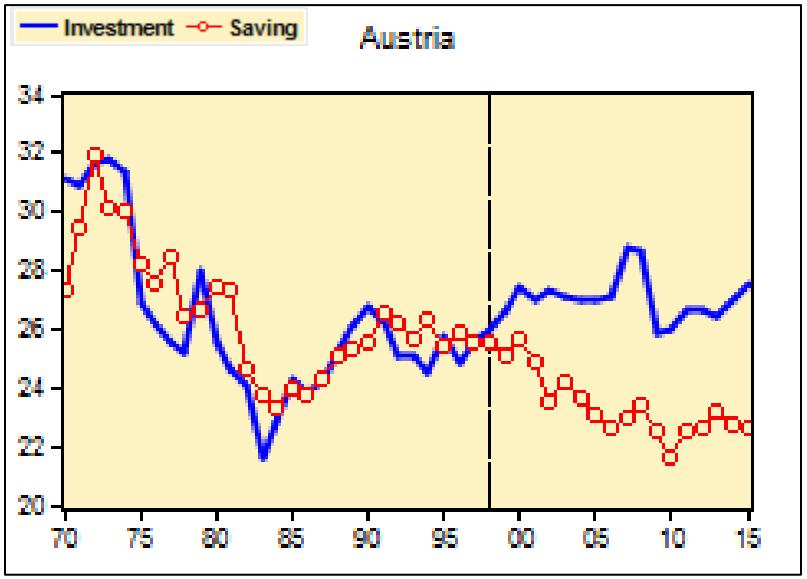
APPENDIX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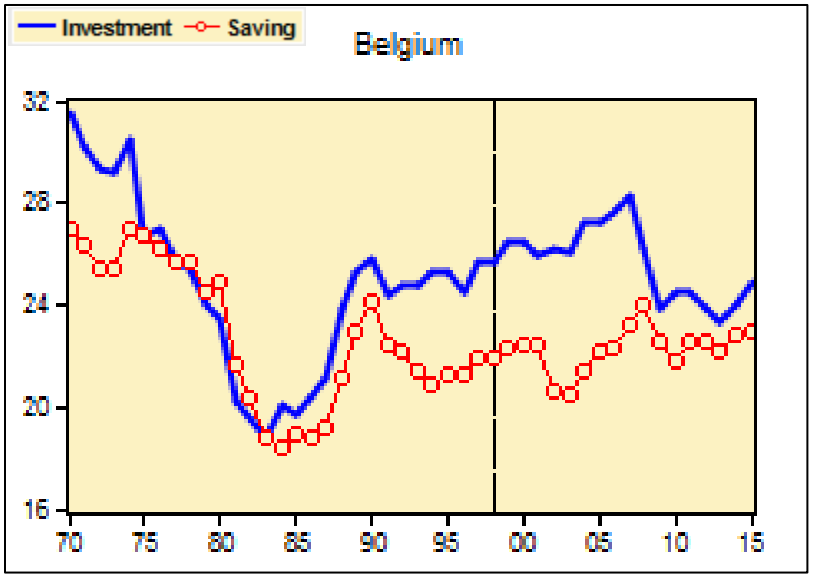
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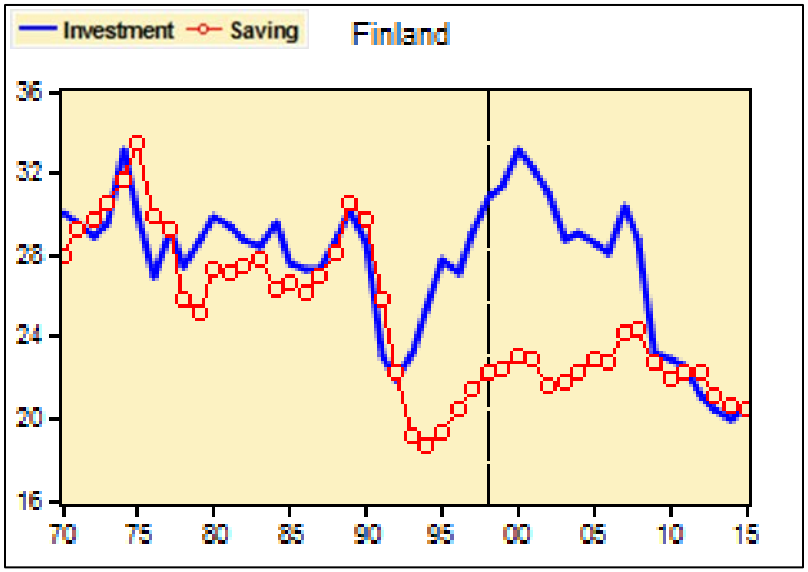
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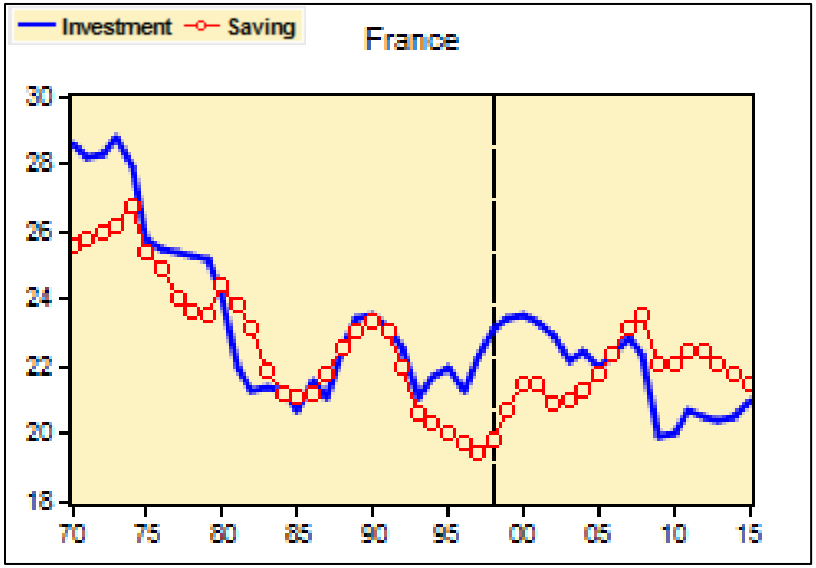
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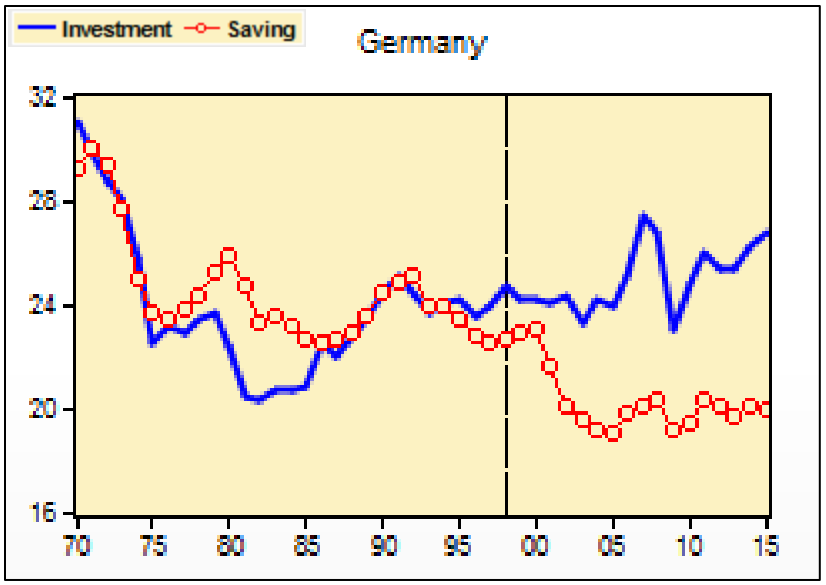
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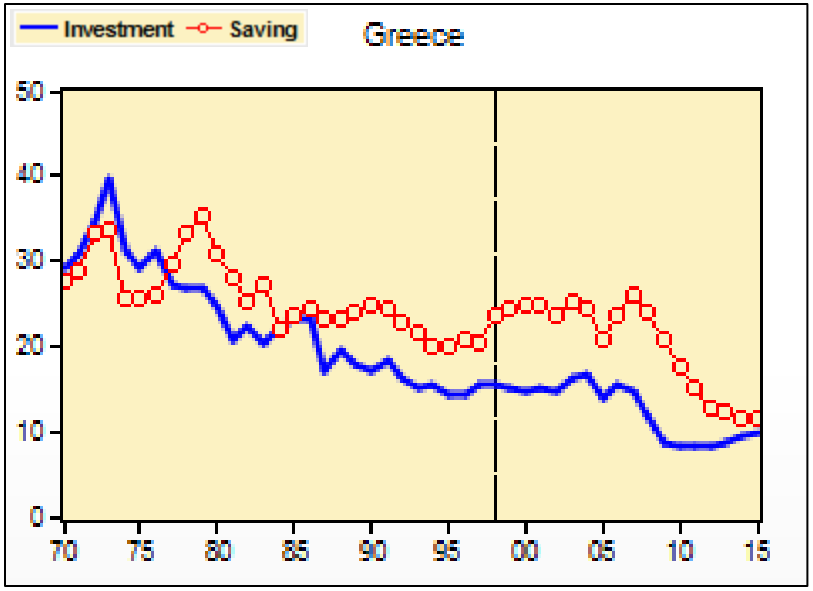
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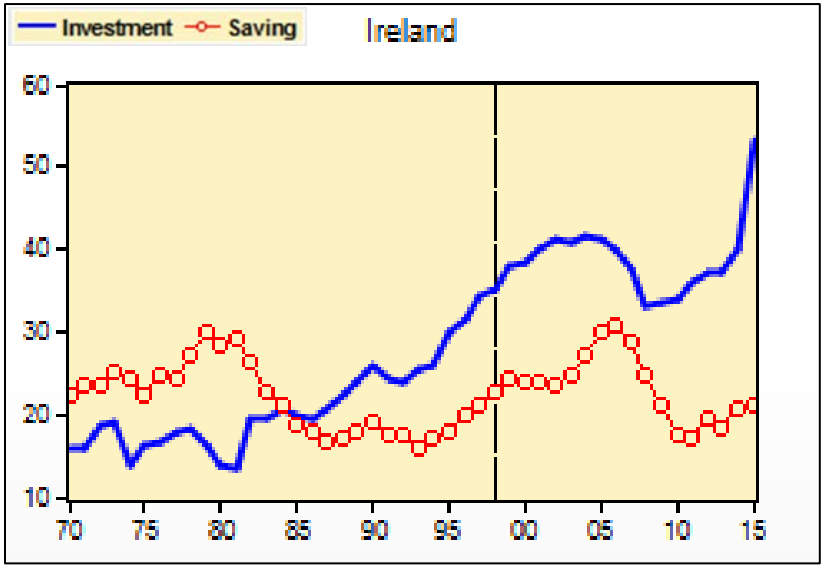
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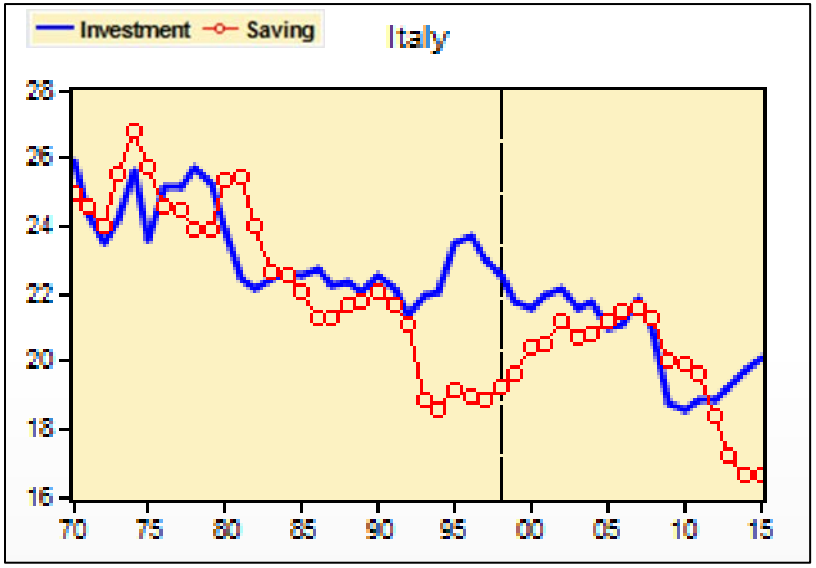
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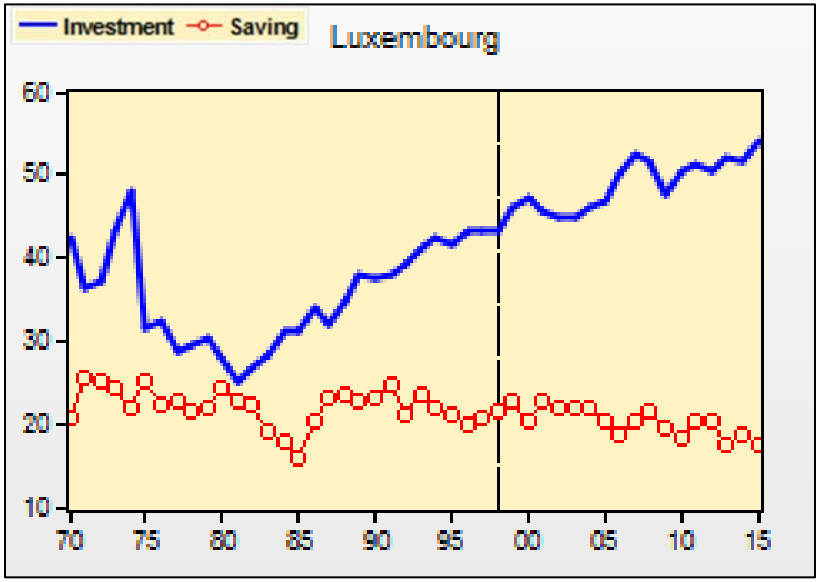
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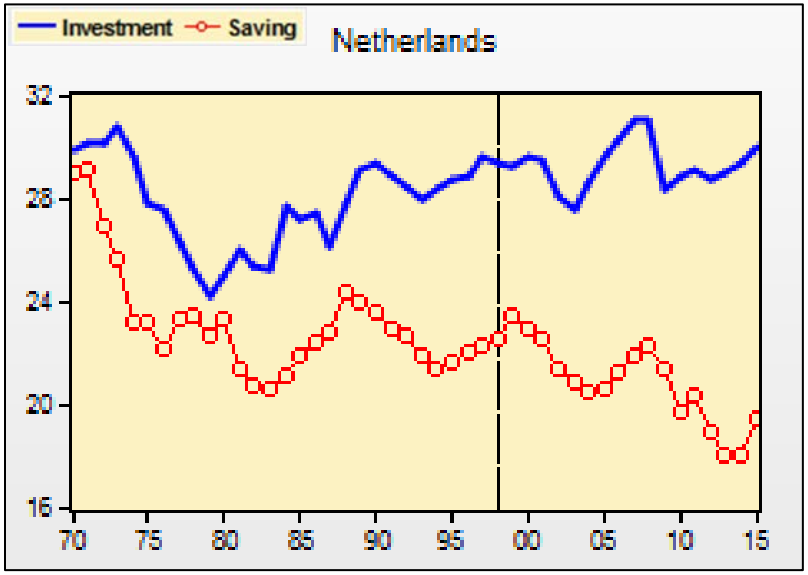
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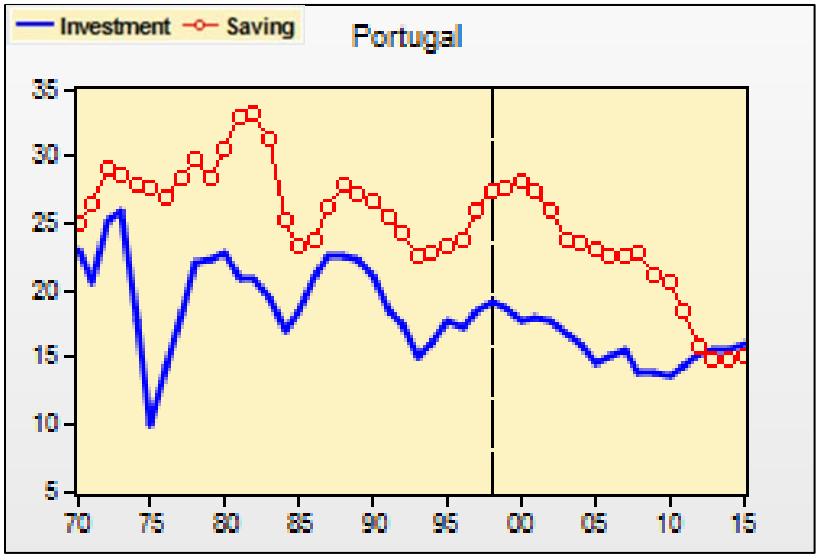
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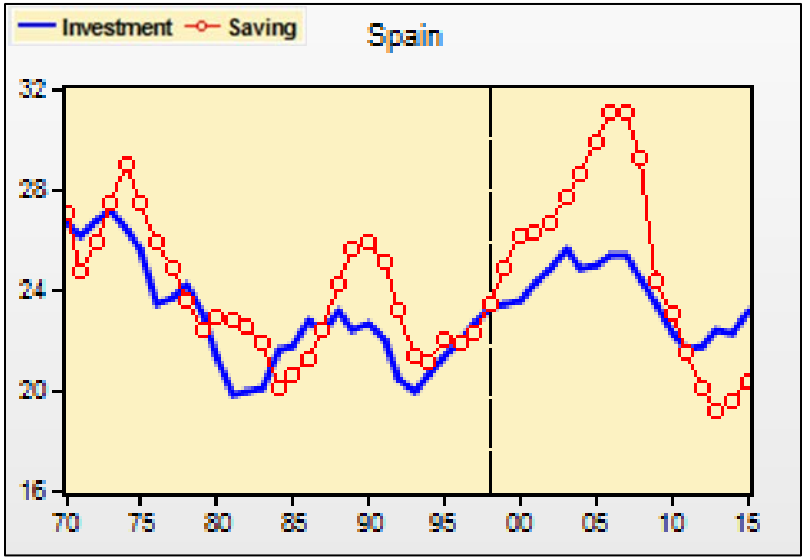
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