THE REVIVAL OF THE FELDSTEIN-HORIOKA PUZZLE AND MODERATION OF CAPITAL FLOWS AFTER THE GLOBAL FINANCIAL CRISIS (2008/09)*

Hasan Engin Duran†
Izmir Institute of Technology, City and Regional Planning Department

Alexandra Ferreira-Lopes‡
Instituto Universitário de Lisboa (ISCTE - IUL), ISCTE Business School Economics Department, and BRU-IUL

Abstract

This study investigates the recent trend of the Feldstein-Horioka puzzle and the underlying reasons for moderation in capital flows. This issue is analysed quite inadequately for the period after the Global Financial Crisis, which represents a crucial turning point for economic climate and policies. The Feldstein-Horioka Puzzle is estimated using the World's 13 largest economies, with panel GMM regression, between 1996 and 2016. We uncover that the Global Financial Crisis had a persistent detrimental effect on capital liberalization, after which the Feldstein-Horioka puzzle has revived and capital mobility has decreased. We suggest two possible explanations for such moderation in capital flows: the increasing risk perception and risk aversion behaviour of fund supplying countries, which increases the home bias, and capital controls against free flow of capital that have been applied after the Global Financial Crisis of 2008/2009.

Keywords: Capital Mobility, Feldstein-Horioka Puzzle, Panel GMM.

JEL Codes: F41, F21, F32.

* Alexandra Ferreira-Lopes would like to thank the Portuguese National Science Foundation (FCT), through grant UIDB/00315/2020.

† Izmir Institute of Technology, City and Regional Planning Department, Izmir (Turkey). E-mail: enginduran@iyte.edu.tr, Address: IYTE kampusu, Gulbahce Koyu, 35430, URLA-IZMIR-TURKEY, Tel:+905068455983, fax: +90 232 750 70 12

‡ Instituto Universitário de Lisboa (ISCTE - IUL), ISCTE Business School Economics Department, BRU - IUL (BRU - Business Research Unit), Lisboa, Portugal. E-mail: alexandra.ferreira.lopes@iscte-iul.pt, Address: Av. Forças Armadas 1649-026, Lisboa, Portugal.

1. Introduction

In a perfectly open international macroeconomic setting (without frictions and interest rates disparities) domestic savings are expected to flow freely to any country in order to seek for the highest return (Debarsy and Ertur, 2010; Raza *et al.*, 2018). [4]In such a case, capital should become perfectly mobile across countries. Indeed, related exchange rate models (i.e., Mundell-Fleming), presumably accept full capital mobility (Fleming, 1962; Mundell, 1963; Dornbusch, 1991; Taylor, 1995; Coakley *et al.*, 1998). However, a controversial finding by Feldstein and Horioka (1980) has introduced a puzzle: in their study on 16 OECD economies over the period betwen 1960 and 1974, investments have been found closely related to domestic savings, opposing to the proposition of perfect capital mobility.
From a policy standpoint, capital mobility might bring both benefits and problems to countries. The benefits rely on a neoclassical perspective, such that it may rise economic welfare as the capital is allocated more efficiently and, therefore, provides consumption smoothing (Koepke, 2015; Hannan, 2018). Moreover, FDI inflows may stimulate productivity by financing investment projects, by triggering knowledge transfers, transmission of new products, processes and adoption of novel management methods (Unctad,1999). However, there are also disadvantages - sudden capital surges and rapid outflows may cause serious boom-boost cycles and macro-financial instability, particularly in emerging economies (i.e. currency crisis, devaluation, hyperinflation, like in the case of Turkey in 1994 and 2001 and Argentina in 2001). Moreover, FDI inflows might lead to collapse of many domestic companies due to increased competition (Moosa, 2002; Hunya and Geishecker, 2005) Hence, given its political importance, it is important to investigate/understand the nature and evolution of capital mobility and its relationship with the FH puzzle.

This issue has important linkages with international financial flows. The Global Financial Crisis in 2008/2009 is known to have significant effect on international financial markets (Caporale *et al.*, 2017; Dang and Nguyen, 2020; Xiaoye and Ximeng, 2016; Luchtenberg and Vu, 2015).

It is known that during crisis times, corporations are often willing to possess liquidity in order to keep it as a buffer and to avoid cash imbalances and operative problems (Faulkender and Wang, 2006; Opler *et al.*, 1999; Allen and Gale, 1994; Brown, 2000; Pulvino, 1998; Shleifler and Wishny, 1992). Due to the liquidity possession, during the Global Financial Crisis, many firms have tended to cut the corporate dividend pay outs in Western and developing economies (Huang *et al.*, 2021; Bliss *et al.*, 2015). Additionally, a pressure on asset selling in stock markets was observed (Anton and Polk, 2014). Consequently, due to the high costs and uncertainty (volatility), external funding opportunities of firms in Western economies (i.e., the US and the EU) have been constrained during the Global Financial Crisis (Faulkender and Wang, 2006; Opler *et al.*, 1999; Campello *et al.*, 2010). This has pushed many firms to rely more on domestic/internal credits and savings. (Opler *et al.*,1999; Almeida *et al.*, 2011)

All these financial circumstances might have changed the linkage between investments and domestic savings, i.e., the Feldstein Horioka puzzle and capital liberalization tendencies during

[4] The empirical analyses done in this paper is pursued in Eviews.

and after the Global Financial Crisis. Hence, the Global Financial Crisis experienced in 2008/09 might have significant impact on the evolution of the Feldstein Horioka puzzle. Moreover, the more recent developments in the World markets, which are considered to slow down/hamper the economic globalization, (such as Covid-19, Brexit, etc.), might have accelerated the attention to the topic.

From an economic policy perspective, the relationship between domestic savings and investments might have been stronger since GFC. This might be due to the fact that many countries have revised their trade and finance policies. The capital account stance, cross banking transactions and other international financial relationships have been changed substantially. They possibly became more precautionary. Moreover, investors risk perception has increased over this period. All these may have changed the evolution of FH puzzle.

The theoretical reasons of why such an FH puzzle occurs have heatedly been debated by scholars. Firstly, ***home bias*** is claimed as a major reason. It arises when fund managers are reluctant to invest in foreign securities due to fear from exchange rate volatility, political risks, and asymmetric information. (Niehans, 1992; Tesar and Werner, 1995; Obstfeld and Rogoff, 2000). Second, ***capital controls,*** regulatory and macro-prudential policies imposed by countries are put forward as another reason behind low capital mobility (Feldstein (1983; 1992). Controls on capital and macro-prudential policies include restrictions against the uncontrolled free flow of financial capital that may cause artificial asset bubbles and over/under valuation of financial assets.

Third, the existence of ***tight monetary policy,*** significant disparities in interest rate across countries are likely to cause less mobility (Frankel, 1991; Raza et al. 2018).

Regarding previous results, the initial findings of Feldstein and Horioka (1980) indicate a high savings retention coefficient of 0.88. Saving retention coefficient is the parameter that shows the strength of the relationship between savings and investments. In studies with more recent data, it has generally been found lower levels for this coefficient, pointing to a greater capital mobility. Some examples of these studies are Feldstein and Bachetta (1991) who analyzed OECD countries for the period between 1960- and 1989, Caprio and Howard (1984) who analyzed 23 economies for the 1961-1981 period, Tesar (1991) who analyzed 23 OECD countries, Blanchard and Giavazzi (2002) who analyzed the Eurozone, Amirkhalkali *et al.* (2003) who analyzed 19 OECD countries for the 1971-1999 period. Overall, the common result obtained is that capital mobility shows a tendency to increase since the 1970s that is an observation supporting the view that the FH puzzle is not strongly valid as in the past.

Our contribution to the literature is four-fold. First, there is a limited number of studies that investigate the evolution of the FH hypothesis in the era post 2008/2009 (Ma and Li, 2016). However, since the GFC has had a destroying effect on markets, increased risk perception by investors and regulatory policies imposed by countries, might have altered significantly the direction and magnitude of the global capital flows. Moreover, researchers claimed that the FH puzzle was solved during the period 2000-2007, as the savings retention coefficients were found low in several studies. Is it still the case? Or the paradox has revived after the Global Financial

Crisis? One exceptional study that analyze the post crisis era is implemented by But and Morley (2017) who analyzed 27 countries over the period 1980-2012. They found that the savings retention coefficient has declined before the crisis and risen afterwards, validating the revival of the FH puzzle most recently. Our study departs from the referred one, by analyzing the more recent period (1996-2016) and by cross-validating the evolution of the FH puzzle with corresponding rises/stops in FDI and portfolio investments data. There are some other studies that analyze the same issue for a single or a restricted group of countries, for example Johnson and Lamdin (2014), for European countries, Phiri (2019), for South Africa, Kaur and Sarin (2019), for Asian economies, but they do not provide evidence on global trends, which we intend to do, since the countries in our dataset cover about 80 % of the World GDP.

Our second contribution is to analyze the following research questions: have these flows re-surged in the post era of the crisis? Or the decline in capital mobility is persistent even after the Global Financial Crisis? There is quite limited evidence on this issue. While some studies find an inadequate recovery of capital flows (McQuade and Schmitz, 2016; IMF, 2016; Bordo, 2017; Hannan, 2017; 2018), the results are mixed and depend largely upon the choice of the set of countries and the time period. We try to provide more generalized results in that sense by adopting an extended dataset and cross-validated evidence.

Third, the reasons why capital flows have declined is another open question in the literature. Three main hypotheses have been put forward. First, *capital controls,* stringent regulatory policies, financial protectionism, and macro/micro prudential applications are argued to reduce cross-bank lending and capital flows (Lane; 2013; Barth *et al.*, 2015; Cerutti *et al.*, 2015; Beck *et al.*, 2015; McQuade and Schmitz, 2016). As a second hypothesis, rising *risk perception* on investments is referred to as key explanation (Milesi-Ferreti and Tille 2011; Lane 2013). Low economic growth in emerging economies, high public debt, increased exchange rate volatility, number of bank interrupts have created a perception of danger, which has created reluctant foreign investors. As a third argument, it is claimed that inopportune *monetary policy* actions may have created such a pattern. However, interest rates have considerably decreased after the Global Financial Crisis, creating high money supply and liquidity, which contrasts with this hypothesis (Giambacorta *et al.*, 2014; Ahmed and Zlate, 2014; Bremus and Fratzscher, 2015). We try to shed light also into this issue by providing descriptive evidences on the validity of these hypotheses.

The fourth contribution regards a methodological improvement. In the literature, it has been discussed that the connection between Investment (I) and Savings (S) is endogenous, due to simultaneity or omitted variables such as exogenous global shocks, heterogeneity across countries in market size and level of development. (Harberger, 1980; Obsfeld, 1986; Finn, 1990; Levy, 1990; Apergis and Tsoumas, 2009). To overcome such a problem, we use a GMM technique, which is superior, compared to other methods. We also instrument the variables by using a proper set of exogenous variables.

Hence, the aim of this work is to investigate the evolution of capital mobility and to test the FH puzzle for a panel of the World's largest (13) economies over a very recent period 1996-2016.The reason why it starts from 1996 but not earlier is due to data unavailability.

This work is divided in 5 sections. In section 2, we show empirical evidence on capital flows movements. In section 3 we present the empirical approach of our work, namely data, statistical tests and econometric method. In section 4 we present and analyze the results and section 5 concludes.

2. The Evolution of Capital Flows

From an historical perspective, financial globalization has followed a U-shaped pattern since1870 to 2008. During this period, integration of capital markets had four different episodes (Bordo *et al.*, 2004; Bordo, 2017). From 1870 to the beginning of the World War I in 1914, the classical era of the gold standard ensured stable exchange rates and highly mobile capital (Obsfeld and Taylor, 2004; Bordo and Rockoff, 1996). The Interwar period, between 1914 and 1945, is a period that globalization had come to a halt due to capital restrictions and the Great Depression in 1929 (Reinhart *et al.*, 2016). From 1945 to 1973, the Bretton Woods system enabled exchange rate stability and trade volume has resumed. However, Keynesian policies, based on strong domestic demand and capital restrictions, hampered the free flow of capital (Reinhart *et al.*, 2016). From 1973-2008, increasing access to information and communication (ICT) technologies, technological improvements in computer systems, removal of tariff/non-tariff barriers against the flow of goods and capital, and the emergence of multinational investment funds, have intensified the globalization process. After 1973, capital mobility has followed an upward long-term trend (Reinhart *et al.*, 2016). It has risen during the times of high growth expectations in emerging economies and lowered during the times of negative economic shocks, such as the cases of the Latin American Debt Crisis (1975-1981), the Asian Crisis (1997), and the Russian Crisis (1998) (Hannan, 2017; 2018).

Capital mobility has fallen significantly during the GFC (Milesi-Ferretti and Tille, 2011; Lane 2013; IMF 2016) as capital flows are known as pro-cyclical in nature (Broner *et al.*, 2013; 2014), but the pattern is still being observed and questionable for the post era of the Global Financial Crisis.

We depict in Figure 1 the evolution of FDI flows and Portfolio Investment flows (in percentage of GDP) and their long-term trends. (Zhou et al., 2011). [5] The data refers to the world data.

(Figure 1 About Here)

Regarding FDI flows depicted in Figure 1, it may be inferred that strong growth prospects in Emerging markets has attracted capital inflows during the 1970s. This in line with the Portfolio Theory that points to the importance of expected returns and risk premium in determination of the capital flows and their direction. (Ahmed and Zlate, 2014). Sudden stop and surges have been observed before and after the oil shock, which interbank lending had increased. Fast

[5] The long-term trends are estimated by the help of Hodrick-Prescott (1997) filter.

adoption/spillover of technology and increased volume of trade has contributed to the capital markets' integration process. The debt crisis in Latin American countries occurred in 1975-1981, which has slowed down partially capital flows (Hannan, 2017; 2018). In the mid-1980s, it has accelerated again until 1990. In early 1990s, a restrain in financial flows has been observed, due possibly to the Gulf War and political instability.

Afterwards, total FDI flows/GDP has risen from 0.6 % in 1992 to 4.3 % in 2000 (Figure 1). The reasons of such an increase may be related to strong growth and high returns in emerging markets, loose monetary policies applied by advanced countries, end of the Cold War, and increasing trade deficits. The foundation of the TWO and removal of tariffs and quotas, the emergence of the NAFTA, the MAI (Multilateral Agreement on Investments), and productivity increase driven by the invention of internet systems, are also among the factors that contributed to this process. However, a tendency to decline has been observed from 4.3 % in 2000 to 1.8 % in 2003. Capital flight in this period might have happened due to several regional crises in emerging markets (e.g., Russia in 1998, Turkey in 1999 and 2001, Argentina in 2001)

From 2003 to 2007, capital integration has risen sharply again from 1.8 % to 5.4 %. The majority of the Central Banks, FED, BoJ, ECB, have followed expansionary policies in this period, hence global liquidity has risen. Credit volume has increased sharply and subprime lending in US has been very frequent. Interbank lending and exchange of mortgage-backed securities have increased. Emerging markets have followed quite stable growth patterns. Introduction of artificial intelligence systems, e-commerce and related technological advancements have been influential on the productivity increase. All these have created highly mobile capital in the world. During this period, portfolio flows have risen from about 8 % in 2005 to about 17 % of GDP in 2008.

However, the picture has completely changed by the Global Financial Crisis. FDI flows/GDP has fallen sharply from 5.4 % in 2007 to 2.2 % in 2009. Portfolio investments/GDP have declined even more seriously, from 17 % in 2008 to 3 % in 2011. Similar results have been found in the literature as well. (Hannan, 2018; Milesi-Ferretti and Tille, 2011; Lane, 2013; IMF, 2016, and Broner *et al.*, 2013, 2014).

More importantly, capital mobility has not recovered well in the period of post Global Financial Crisis. The long-term trend of FDI flows has been declining since 2008 until 2016. Similarly, portfolio investments have been decreasing as well, even at a faster pace. To be able to document the severity of the moderation, we calculate for each country the ratio of FDI and portfolio flows (scaled to GDP) between selected years, presented in Table 1. The first (upside) panel shows the corresponding results for FDI flows, while the second panel (located at the bottom) displays the results for portfolio flows. Regarding the results for FDI, it is first calculated the ratio of the period of 2016 to 2007 for each country, and some aggregate groups such as total, developed, and emerging economies. 2007 is widely recognized as the economic peak year before the crisis, which is why we select it as a reference year. The calculated ratio is 0.52 for the total of countries, 0.53 for developed and 0.74 for emerging economies. Hence, it means that by 2016, FDI flows have declined significantly, almost to its half level compared to peak year. The decrease is more pronounced in the developed world than in emerging economies. When we look at the result for each country, the ratio ranges between 0.46 (Eurozone) and 2.06 (Japan). In only 3 (out of 13)

countries (Japan, Brazil, and South Korea), this ratio is above 1, indicating an increase in FDI flows. Furthermore, we calculate the same ratios by dividing 2016 value to 2006, the pre-peak year. At the aggregate level, the decline is confirmed by the ratio of 0.67.

An even more seriously decreasing trend is observed for portfolio flows, as can be seen in the right-hand side of Figure 1 and in Table 1. We calculate the ratio of 2016 to 2007, which is 0.32 at the aggregate level, 0.30 for advanced countries, and 0.32 for emerging economies. Hence, portfolio flows have declined greatly to almost one-third of their level after the GFC Then, we calculate the same ratios by dividing the 2016 value by the 2006 level. At the aggregate level, it is 0.29.

(Table 1 About Here)

In order to be able to cross verify the trends, it is illustrated in Figure 2, the evolution of capital flows (FDI and Portfolio) and its subparts (out- and inflows) in developing (emerging) and in developed economies. In the first two graphs (Figures 2a and 2b), the sum of absolute value of FDI or Portfolio inflows and outflows are scaled with respect to GDP.

(Figure 2 About Here)

Portfolio flows in the developed world, displayed in Figure 2a, have fallen from about 32 % of GDP in 2008 to about 4 % in 2011 and rebounded to 8 % in 2016. In emerging economies, they have fallen from about 8 % in 2008 to 2 % in 2011 and increased only to 3 % in 2016. As for the FDI flows in advanced countries, in Figure2b, it can be witnessed a decline from about 8 % of GDP in 2007 to 4 % in 2009 and rebounded to about 6 % in 2016. In the emerging world, these flows have decreased from about 5 % in 2007 to 3 % in 2016.

Figures 2c to 2f illustrate the evolution of detailed inflow and outflow patterns. It is clearly observed in Figure 2c that FDI inflows to emerging economies have been decreasing from the onset of Global Financial Crisis until 2016. Similarly, FDI outflows from developed economies have reduced considerably and not recovered adequately by 2016, as displayed in Figure 2d. Moreover, Figure 2e shows that portfolio inflows to emerging markets have been reduced in 2008, and although they recovered in 2009, they have been declining until 2016. Finally, portfolio investment outflows follow a very similar pattern in advanced economies, exhibited in Figure 2

3. Empirical Methodology

In this section we present the data, the statistical tests done to the data, namely structural break tests, panel unit root tests, co-integration tests, and the econometric approach of our work.

3.1. Data

The dataset covers a panel that includes the World's 13 largest countries (measured by GDP) over the period 1996-2016. These countries are Australia, Brazil, Canada, China, Eurozone, India, Indonesia, Japan, Mexico, the Russian Federation, Turkey, and the United States of America. US, Canada, Australia, Eurozone and Japan as assumed as developed economies, whereas China, India, Brazil, Russia, South Korea, Turkey, Indonesia and Mexico referred to as developing/emerging economies. These countries represent about 80 % of the World GDP, hence, the results obtained from the dataset are likely to give a general idea about the global patterns.

Variables and data sources are defined in Table 2. In our work we use the Share of Savings relative to Gross National Income (S/GNI), the Share of Investment relative to GDP (I/GDP), Total Real GDP (size), GDP *per capita* (dev) and growth of Real GDP are the variables adopted.

(Table 2 About Here)

3.2. Structural Break Tests

The idea that the GFC had a persistent and structural impact on the size of capital liberalization needs to be validated. To do so, structural break tests on FDI flows are applied. We were able to apply this test to FDI data only, as the time span is extremely short for portfolio data.
The variable tested in this case is the sum of FDI flows (in absolute value) scaled to GDP for each country (*fdi*), such that:

$$fdi_t = a + b\ time_t + e_t \qquad \textit{fdi=|FDI Inflows + FDI Outflows|/GDP} \quad (1)$$

Bai and Perron (1998)'s famous algorithm is widely used to detect multiple and unknown structural breaks in regression models. We regress each countries' *fdi* variable on a linear time trend and detect the breaks in *a* and *b.*

The detected break years are summarized in Table 3. The first column documents all break years detected, the second column focuses only the ones around 2008/09. For the aggregate series, it is detected "2009" as a structural break. The trend of *fdi*, following the global and country level break is also summarized in columns 3 and 4. It has been detected in 7 of the 13 countries a structural break that includes the Global Financial Crisis (between 2004 and 2010). In column 3, it is seen that in 7 countries *fdi* trend is downward following 2009 and only in 3 of them has an upward trend. In column 4, we can see that the *fdi* trend after the country-level break, indicates that only 1 country has an upward trend while in 6 countries the trend is downward after the Global Financial Crisis.

(Table 3 About Here)

3.3 Panel Unit Root Tests

In order to select the proper estimation method, there is the need to investigate the unit root features of the variables. To do so, we implement various tests to examine panel unit root processes (4 different types to ensure robustness). These tests are developed by Levin, Lin, and Chu (2002), Im, Pesaran, and Shin (2003), Augmented Dickey Fuller-Fisher (Fisher-ADF), and Philips Perron-Fisher (Fisher-PP) Chi-square tests (Madalla and Wu, 1999; Choi, 2001; Fisher, 1932). In detail, unit root tests take the following general form:

$$“y_{i,t} = \emptyset_i y_{i,t-1} + Z_{i,t}\partial_{i,t} + \exists_{i,t} “ \quad (2)^6$$

i represents the countries, *t* represents years. Z includes exogenous variables. $\exists_{i,t}$ denotes the identically, independent, and normally distributed random error terms. Hence, if $\emptyset_i = 1$, a nonstationary evolution is present in the form of a random walk. Thus, it means that exists a non-stationary process in the evolution of the variable of interest. If, however, $\emptyset_i < 1$ it indicates a stationary evolution around a constant.

The main distinction between the four tests arises in the assumption of unit processes, either common or individually varying ones. To start with, Levin, Lin, and Chu (2002) presume a unit root parameter $\emptyset_i$=$\emptyset$, constant across countries. In contrast, the remaining techniques, Im, Pesaran, and Shin (2003), Fisher-ADF and Fisher-PP, adopt a cross-varying unit root parameters ($\emptyset_i$) between countries.[7] Results are presented in Table 4. We observe that all our variables are found stationary in levels. Thus, we use the variables in levels in our estimations.

(Table 4 About Here)

3.4. Panel Cointegration Tests

Next, we investigate whether the two variables *(S/GNI* and *I/GDP)* have a cointegrating long-term relationship. We apply a Johansen (1988) cointegration test, which investigates stationarity of the random error terms. The combinations of different test specifications and corresponding results are in Table 5. An intercept term is always added to the test, except in the first specification. We also consider the no trend, linear trend, and quadratic trend options alternatively. The Eigen and Trace statistics help define how many cointegrating relationships are found. Critical values are determined on the basis of MacKinnon, Haug, and Michelis (1999)’s work at 5 %. According to the results, there is no cointegrating relationship, regardless of the specification. Hence, we can safely continue to the analysis with conventional panel data regression analysis.

[6]The formula has been adapted from http://www.eviews.com/help/helpintro.html#page/content/advtimeser-Panel_Unit_Root_Testing.html

[7] For further technical details, see Levin, Lin, and Chu (2002), Im, Pesaran, and Shin (2003), Fisher (1932), Madalla and Wu (1999), and Choi (2001).

(Table 5 About Here)

3.5. Econometric Model

A way of examining the degree of capital mobility and the Feldstein-Horioka puzzle is through the following equation:

$I/GDP = \alpha + \beta\ S/GNI + e$ *I: Investment, S: Savings* (3)

where β is referred to as the savings retention coefficient. If β=0, it is implied that investments are not related to domestic savings, which indicates the existence of perfect capital mobility. When β=1, it represents the case of no capital mobility, as the investment depends totally on domestic savings (Apergis and Tsoumas, 2009).

There is a wide range of regression techniques applied in the literature to estimate the savings retention coefficient. Initially, simple cross-sectional regressions were used (Feldstein and Horioka, 1980; Tesar, 1991), followed by time-series regressions (Jansen and Schultz, 1996; Coiteux and Olivier, 2000), and techniques targeted to explore cointegrating relationships among non-stationary variables (Vikonen, 1994; De Vita and Abbott, 2002). Over time, it has been understood that panel data models are useful in providing inferential reliability, both due to the high number of observations and solutions provided to endogeneity, driven by simultaneity or omitted variable bias (e.g., Coakley and Kulasi, 1997; Coiteux and Olivier, 2000; Cadoret, 2001; Coakley *et al.*, 2004). Both fixed/random effects panel data models (Baltagi, 2005) and non-stationary cointegrating panel techniques, like FMOLS or FMDOLS, as in the work of Pedroni (2001) are adopted by scholars (Kao and Chiang, 2001; Raza *et al.*, 2018).

The adopted panel data regression is the following:

$$(I/GDP)_{i,t} = \alpha + \beta\ (S/GNI)_{i,t} + \gamma\ (I/GDP)_{i,t-1} + \epsilon_i \quad (4)$$

First, we apply a Hausman test, which is useful in choosing the relevant model. It helps testing the following null hypothesis on the basis of a Chi-Square test statistic (Hausman, 1978):

Ho: Both Fixed Effects and Random Effects models have identical coefficient estimations; consistency in both models
Ha: Fixed and Random Effects models have different coefficient estimations; one model is inconsistent

If the null hypothesis is accepted, one may use either model since fixed or random effects estimators provide consistency. In contrast, if the alternative hypothesis is accepted, the fixed effects model should be preferred.

Results for the Hausman test are in Table 6. We observe that there is a large difference in coefficients between cross-sectional fixed effects and random effects estimations. However, no sizable difference between coefficients is observed when period fixed and random effects are compared. Overall, total effects suggest the rejection of the null and acceptance of the alternative hypothesis. Therefore, we use the cross-sectional fixed effects model, since it provides consistency.

(Table 6 About Here)

In terms of the estimation technique, we prefer the GMM rather than the OLS (Hansen, 1982; Hansen, Heaton, and Yaron, 1996). GMM is known to be superior in dealing with endogenous relationships. Indeed, in the literature about the FH puzzle, several factors causing endogeneity are discussed. First, common exogenous shocks and business cycles are likely to affect simultaneously both investment and savings decisions. For instance, in the case of an unanticipated negative change in expectations, a jump in commodity and energy prices or occurrence of political instability, both savings and investments will fall spontaneously, which will give rise to a strong association between investment and savings (Frankel and Razin, 1986; Baxter and Crucini, 1993). Second, the level of economic development might simultaneously affect both investment and savings (Apergis and Tsoumas, 2009; Obsfeld, 1986; Finn, 1990; Harberger, 1980; Levy, 1990). A developed country's saving and investment rate is expected to be different from an underdeveloped country. Third, the economic size of countries might create endogeneity, hence large countries can have an influence on investments and on the formation of prices (Apergis and Tsoumas, 2009; Obsfeld, 1986; Finn, 1990; Harberger, 1980; Levy, 1990). To account for these effects, we employ *dev, size* and *growth* variables as exogenous instruments. They represent the level of development, market size, and short-run economic growth respectively (as explained in Table 2).

4. Results

4.1. Panel GMM Fixed Effects Estimations

The results of GMM estimation are in Table 7. The savings retention coefficient is 0.56 for the aggregate dataset, which is significantly different from zero. Moreover, we apply a Wald Test and reject the hypothesis that saving retention equals to 1. The Jarque Bera test indicates the normally distributed errors. Thus, the main result is that capital mobility is not as restricted as found by Feldstein and Horioka (1980) but it is not as high as recent claims by economists. So, one may argue that the FH puzzle is still not solved.

Once we split our dataset in two parts - developed countries and emerging economies - and re-run the model, we obtain different results. The savings retention coefficient is observed to be smaller for developed countries (0.52) than emerging economies (0.57). It is observed that capital mobility is higher in advanced economies compared to emerging economies.

(Table 7 About Here)

Additionally, we investigate the timely evolution of the FH puzzle. To be able to investigate it, we estimate the GMM for rolling windows of 8 years, which is a sufficiently long period to capture at least one business cycle. We apply exactly the same estimation procedure as in Table 7. We present the evolution of the estimated savings retention coefficients in Figure 3.

For the aggregate dataset, initially capital mobility was low, as β is high, around 0.8 in the 1996-2003 period. However, β starts declining since the 1990s and hits the lowest level (0.39) in the period 2003-2010, representing a period before the economic peak. This had led to the claims that the FH puzzle was over, as the savings retention coefficient has decreased substantially. However, after 2010, β rises again, above 0.6, which indicates falling capital mobility in the most recent period. The pattern is quite similar for emerging economies - while initially the savings retention coefficient is found around 0.9 during the 1996-2003 period, it gets lower, about 0.35, in the period between 2003-2010, but rises towards 0.65 most recently in the period 2009-2016. In developed countries, β is low and fluctuates around 0.4 until the peak, before the Global Financial Crisis, but rises up to 0.5 most recently. Hence, it is credible to argue that the FH puzzle tends to revive after the Global Financial Crisis, as the savings retention coefficients have risen recently.

(Figure 3 About Here)

4.2. Discussion on the Causes of the FH Puzzle Revival and Moderation in Capital Mobility

The drivers of capital flows that are analyzed in the literature rely largely upon the Push/Pull side determinants. Push factors are the exogenous variables from a supply point of view that determine the extent of the global fund supply (Hannan, 2017; 2018). Some of the examples of these factors are global liquidity, risk perception, US interest rate and yield rates (IMF, 2016; Reinhart, Reinhart, and Trebesch 2016; Forbes and Warknock, 2012; Hannan, 2017; 2018). Pull factors are the domestic variables from a demand perspective that determines the attractiveness of the capital receiving country (Hannan, 2017; 2018). Some examples of these factors are the country's growth rate, interest rate, macroeconomic stability, creditworthiness, risk premium, trade openness, institutional quality, exchange rate volatility, market imperfections, and market size (Fernandez-Arias and Montiel, 1996; Ghosh *et al.*, 2014; Hannan, 2017; 2018).

Many empirical studies between 1980s and 2008, have been conducted to analyze the significance of Push/Pull variables as a set of determinants behind capital flows (Hannan, 2017; 2018). Push factors were found as dominant factor of inflows to emerging markets (e.g., Calvo *et al.*, 1993; Taylor and Sarno, 1997; Chuhan, Claessens, and Mamini, 1998; Albuquerque *et al.*, 2005; De Vita and Kyaw, 2008; Koepke, 2015). Nonetheless, pull factors are also found as crucial drivers of flows by Lopez-Mejia (1999), Ghosh and Ostry (1993), and the World Bank (1997). After the Global Financial Crisis, the debate on the push/pull framework has continued. The general finding is the co-influence of both factors (IMF (2014), Ghosh *et al.* (2014), Ahmed and Zlate (2014). For instance, Fratzcher (2012) has found that while push factors, such as global risk and liquidity are

the major reasons behind the moderation of equity flows across 50 economies, the domestic pull factors such as institutional quality, country risk profile, and stability were found important as well.

More hypotheses have been put forward in the literature, on the causes of the decrease of capital liberalization after the GFC.

The first hypothesis is the risk hypothesis. According to this hypothesis, capital mobility has declined since risk in emerging economies has risen. Global risk aversion behavior created a home bias; therefore, funds flow from the developed economies to emerging countries have slowed down. Milesi-Ferretti and Tille (2011) have emphasized the severity of the global risk perception (i.e., stressed banks), while Reinhart and Rogoff (2014) have emphasized the low economic growth rates in emerging countries as a risk factor along with high public debt (Niehans, 1992; Tesar and Werner, 1995; Obstfeld and Rogoff, 2000; McQuade and Schmitz, 2016).

We depict in Figure 4 the evolution of the annual economic growth rate (average of emerging and developed countries), in the left-hand side, and the evolution of the VIX SP500 volatility index and the volatility, measured by yearly standard deviation, of the MSCI Emerging Markets Index (Lane, 2013; Milesi-Ferretti and Tille, 2011; data source), in the right-hand side. The latter indicators represent the level of risk in developed and emerging economies.

(Figure 4 About Here)

It is clear that economic growth rebounded after the Global Financial Crisis, but tends to get lower afterwards. The annual growth rate in the developed world approaches 2 %, while in emerging economies to 3 %, far lower than the pre-crisis rates. The VIX and MSCI indexes increase sharply during the Global Financial Crisis, but gets lower afterwards, although it is still above the pre-crisis levels. Hence, one may argue that low economic growth rates and relatively higher risk indexes (compared to pre-crisis levels) validates the reality of this hypothesis, which might have created a home bias and the revival of the FH puzzle.

The second hypothesis is related to role of restrictive and macro-prudential policies - *capital controls* hypothesis. According to this hypothesis, regulations and controls on capital, such as on interbank lending and cross border exchange of securities, have lowered capital integration, giving rise to the FH puzzle, as investments are financed more by domestic savings (Lane, 2013; Barth, Caprio, and Levin, 2015; Bremus and Fratzscher, 2015; Cerutti, Claessens, and Laeven 2015). To evaluate this hypothesis, we depict in Figure 5 the evolution of Fernandez *et al.* (2016) and Schindler (2009)'s capital restrictions index, calculated for the exchange of all types of assets for the emerging and developed economies, indicating the level of restrictions on cross border capital flows. It is observed that it has been rising for emerging market economies, but stationary for advanced countries. Developing countries have introduced many restrictive policies after the Global Financial Crisis. Trade of mortgage backed securities, uncontrolled sub-prime credit lending is hampered. Hence, as a result, it is supportive of this hypothesis that moderation of capital integration might be associated with capital controls.

(Figure 5 About Here)

The final argument is the monetary policy hypothesis, which states that unconventional monetary policy might contribute to the capital account closeness. We depict the evolution of lending interest rates (cross-country average) (in Figure 6, on the left-hand side) and money supply (broad money/GDP) (in Figure 6, on the right-hand side) in the emerging and advanced countries.

(Figure 6 About Here)

It is observed that both developed and emerging market countries have adopted expansionary policies, since interest rates have declined substantially after the GFC. Accordingly, money supply has remarkably increased. Despite increasing liquidity, the downturn of capital flows contradicts the monetary policy hypothesis (Giambacorta, Hofmann, and Peersman, 2014).

Overall, increasing capital controls and risk perception seem to find support as two major hypotheses behind the moderation of capital flows.

5. Policy Discussion and Conclusions

This study has three major results. First, the FH puzzle is found increasingly evident, particularly after the Global Financial Crisis. Various arguments in the literature had claimed that the FH puzzle was over by the 2007 economic peak, when capital integration was very high and the savings retention coefficients was very low. Our findings contrast with this view and supports the revival of the puzzle, as the savings retention coefficients rise significantly after the GFC.

Second, consistent with the increase in the savings retention coefficients, FDI and portfolio flows have declined considerably during the GFC and were not able to recover afterwards. This decline is widespread for the majority of analyzed countries and particularly pronounced in portfolio flows. The impact of the GFC is persistent, since the structural breaks in FDI flows are observed for most of the countries around the years 2008/2009.

Third, the two main reasons behind such moderation seem plausible. The first one is the fear and *risk aversion* behavior of fund supplying countries that increases the home bias. Hence, developed countries tend to hesitate investing in emerging countries, as the increased risk in these countries during the GFC has not yet dropped to desired levels. Low economic growth in the emerging world after the GFC has also contributed to the moderation of flows. The second reason is the controls and restrictions on capital mobility that have increased following the GFC, especially in emerging markets. Such macro-prudential policies and stringent applications against interbank lending and uncontrolled trade of mortgage-backed securities played a major role.

These results raise a policy discussion about the status and future of financial globalization. From a perspective of capital receiving countries, increasing capital controls might limit the fund flows. It, thus, may create moderate economic growth, as observed recently, but in a more sustainable fashion as sudden capital in/outflows and related boom-boost cycles are avoided. Consistently, a more stable growth path is possible, as observed recently (2010-2016).

From a fund supplying countries' standpoint, increased financial risk during the Global Financial Crisis has elevated the VIX and the volatility of MSCI indexes. The risk level has lowered substantially, but it is still above the pre-crisis level. Hence, this has created a home bias and selective behavior.

The post crisis may be termed as "controlled globalization", which might be seen as a beneficial set of policies, as it helps smoothing output in both developed and emerging economies. These policies help avoiding artificially created asset bubbles, sudden drains/surges of capital, and boom-bust cycles. Moderate output growth in this system might be perceived as a major drawback, but it should be perceived as a more economically sustainable process.

Finally, as for future prospects, two questions arise: Will the FH puzzle end? Will financial globalization be over? Both seem unlikely. There are several reasons for this. The trade (input-output) linkages are much stronger in the world compared to the early periods of dis-globalization (1914-1945) (Bordo, 2017). Many countries have specialized in different goods and hence economies depend more on each other. Trade disputes can be more easily resolved as there are supranational bodies, such as the World Trade Organization (WTO) to help with the negotiations. Moreover, governments have learned how to apply stabilizing macroeconomic policies better.
As trade has an increasing trend, there will always be a need for external financing the trade deficits. Hence, capital flows will be need. However, this process might not be as significant as in the pre-crisis era and may be much controlled. Accordingly, the FH puzzle is expected to continue, as investment will still be largely financed by domestic savings, under limited cross border capital lending.

References

1. Ahmed, S., Zlate, A. (2014). Capital flows to emerging market economies: A brave new world? Journal of International Money and Finance, 48, 221-248.
2. Albuquerque, R., Loayzab, N., Servein, L. (2005). World market integration through the lens of foreign direct investors. Journal of International Economics, 66(2), 267-295.
3. Allen, F. and Gale, D. (1994). Liquidity preference, market participation and asset price volatility. American Economic Review, 84, 933–955.
4. Almeida, H., Campello, M. and Weisbach, M. (2011). Corporate financial and investment policies when future financing is not frictionless. Journal of Corporate Finance, 17, 675–693.
5. Amirkhalkhali, S., Dar, A., Amirkhalkhali, S. (2003). Saving-investment correlations, capital mobility and crowding out: Some further evidence. Economic Modeling, 20, 1137-1149. https://doi.org/10.1016/S0264-9993(02)00079-2
6. Antón, M. and Polk, C. (2014). Connected stocks. Journal of Finance, 69, 1099–1127.
7. Apergis, N., Tsoumas, C. (2009). A survey of the Feldstein-Horioka puzzle: What has been done and where we stand. Research in Economics, 63, 64-76. https://doi.org/10.1016/j.rie.2009.05.001

8. Bai, J., Perron, P. (1998). Estimating and Testing Linear Models with Multiple Structural Changes. Econometrica, 66, 47–78. DOI: 10.2307/2998540.
9. Baltagi, H. (2005). Econometric Analysis of Panel Data. 3rd Edition. ISBN 0-470-01456-3, John Wiley & Sons Ltd, England.
10. Barth, J. R., Caprio, G., Levine, R. (2015). Bank Regulation and Supervision in 180 Countries from 1999 to 2011. NBER Working Paper No. 18733.
11. Baxter, M., Crucini, M. J. (1993). Explaining saving/investment correlations. American Economic Review, 83, 416-436.
12. Beck, R., Beirne, J., Paternò, F., Peeters, J., Ramos-Tallada, J., Rebillard, C., Reinhardt, D.,Weissenseel, L., Wörz, J. (2015). The side effects of national financial sector policies: framing the debate on financial protectionism. ECB Occasional Paper No. 166.
13. Blanchard, O., Giavazzi, F. (2002). Current account deficits in the Euro area: The end of the Feldstein-Horioka puzzle? Brookings Papers on Economic Activity, 2, 147-209.
14. Bliss, B., Cheng, Y. and Denis, D. (2015). Corporate payout, cash retention, and the supply of credit: evidence from the 2008–2009 credit crisis. Journal of Financial Economics. 115, 521–540
15. Bordo, M.D. (2017). The Second Era of Globalization is not yet over: An Historical Perspective. NBER Working Paper Series, Working Paper 23786.
16. Bordo, M.D., Rockoff, H. (1996). The gold standard as a "good housekeeping seal of approval". The Journal of Economic History, 56(02), 389-428.
17. Bordo, M.D., Taylor, A.M., Williamson, J.G. (2004). Globalization in historical perspective. University of Chicago Press.
18. Bremus, F., Fratzscher, M. (2015). Drivers of structural change in cross-border banking since the Global Crisis. Journal of International Money and Finance, 52, 32-59.
19. Broner, F., Didier, T., Erce, A., Schmukler, S. (2013). Gross capital flows: Dynamics and crises. Journal of Monetary Economics, 60, 113-33.
20. Broner, F., Erce, A., Martin, A., Ventura, J. (2014). Sovereign debt markets in turbulent times: Creditor discrimination and crowding-out effects. Journal of Monetary Economics, 61, 114-42.
21. Brown, D. (2000). Liquidity and liquidation: Evidence from real estate investment trusts. Journal of Finance, 55, 469–485.
22. But, B., Morley, B. (2017). The Feldstein-Horioka puzzle and capital mobility: the role of the recent crisis. Economic Systems, 41(1), 139-150. https://doi.org/10.1016/j.ecosys.2016.05.008
23. Cadoret, I. (2001). The savings investment relation: A panel data approach. Applied Economics Letters, 8, 517-520. https://doi.org/10.1080/13504850010023107
24. Calvo, G. A., Leiderman, L., Reinhart, C. M. (1993). Capital Inflows and Real Exchange Rate Appreciation in Latin America: the Role of External Factors. IMF Staff Papers, 108–151.
25. Campello, M., Graham, J. and Harvey, C., 2010. The real effects of financial constraints: evidence from a financial crisis. Journal of Financial Economics, 97, 470–487.

26. Caporale, G.M., Lodh, S. and Nandy, M. (2017). The performance of banks in the MENA region during the global financial crisis. Research in International Business and Finance, 42(C), 583-590.

27. Caprio, G. A., Howard, D. H. (1984). Domestic saving, current accounts, and international capital mobility. International Finance Discussion Paper No. 244 Board of Governors of the Federal Reserve System.
28. Cerutti, C., Claessens, S., Laeven, P. (2015). The use and effectiveness of macro-prudential policies: New evidence. IMF Working Paper No. 16/61, International Monetary Fund, Washington.
29. Choi, I. (2001). Unit root tests for panel data. Journal of International Money and Finance, 20(2), 249-272. https://doi.org/10.1016/S0261-5606(00)00048-6.
30. Chuhan, P., Claessens, S., Mamingi, N. (1998). Equity and Bond Flows to Latin America and Asia: the Role of Global and Country Factors. Journal of Development Economies, 55, 439–63.
31. Coakley, J., Fuertes, A. M., Spagnolo, F. (2004). Is the Feldstein-Horioka puzzle history? The Manchester School, 72, 569-590. https://doi.org/10.1111/j.1467-9957.2004.00409.x
32. Coakley, J., Hasan, F., Smith, R. (1999). Saving, investment and capital mobility in LDCs. Review of International Economics, 17, 632-640. https://doi.org/10.1111/1467-9396.00188.
33. Coakley, J., Kulasi, F. (1997). Co-integration of long span saving and investment. Economics Letters, 54, 1-6. https://doi.org/10.1016/S0165-1765(96)00920-2.
34. Coakley, J., Kulasi, F., Smith, R. (1998). The Feldstein–Horioka Puzzle and Capital Mobility: A Review. International Journal of Finance and Economics, 3, 169–188. https://doi.org/10.1002/(SICI)1099-1158(199804)3:2<169::AID-IJFE74>3.0.CO;2-H
35. Coiteux, M., Olivier, S. (2000). The savings retention coefficient in the long run and in the short run: Evidence from panel data. Journal of International Money and Finance, 19, 535-548. https://doi.org/10.1016/S0261-5606(00)00014-0

36. Dang, T.L and Nguyen, T.M.H /2020). Liquidity risk and stock performance during the financial crisis, Research in International Business and Finance, 52(C).

37. De Vita, G., Abbott, A. (2002). Are saving and investment co-integrated? An ARDL bounds testing approach. Economics Letters, 77, 293-299. https://doi.org/10.1016/S0165-1765(02)00139-8
38. De Vita, G., Kyaw, K. S., (2008). Determinants of capital flows to developing countries: a structural VAR analysis. Journal of Economic Studies, 35(4), 304-322.
39. Debarsy, N., Ertur, C. (2010). Testing for spatial autocorrelation in a fixed effects panel data model. Regional Science and Urban Economics, 40, 453-470. https://doi.org/10.1016/j.regsciurbeco.2010.06.001
40. Dornbusch, R. (1991). National Saving and International Investment: Comment. in Bernheim B, Shoven J.B. (eds) National Savings and Economic Performance. NBER Report, University of Chicago Press, Chicago, pp. 220–226.

41. Faulkender, M. and Wang, R. (2006). Corporate financial policy and the value of cash. Journal of Finance, 61, 1957–1990.
42. Feldstein, M. (1983). Domestic saving and international capital movements in the long-run and the short-run. European Economic Review, 21, 129-151.
43. Feldstein, M. (1992). The budget and trade deficits aren't really twins. NBER Working Paper No. 3966.
44. Feldstein, M., Bachetta, P. (1991). National saving and international investment" In: Bernheim, D., Shoven, J. (Eds.), National Saving and Economic Performance. The University of Chicago Press.
45. Feldstein, M., Horioka, C. (1980). Domestic Saving and International Capital Flows. Economic Journal, 90, 314–329.
46. Fernández, A., Klein, M. W., Rebucci, A., Schindler, M., Uribe, M. (2016). Capital Control Measures: A New Dataset. IMF Economic Review, 64(3), 548-574.
47. Fernandez-Arias, E., Montiel, P. (1996). The Surge in Capital Inflows to Developing Countries: An Analytical Overview. World Bank Economic Review, 10(1), 51-77.
48. Finn, M. G. (1990). On savings and investment dynamics in a small open economy. Journal of International Economics, 29, 1-21. https://doi.org/10.1016/0022-1996(90)90061-P.
49. Fisher, R.A. (1932). Statistical Methods for Research Workers. Oliver & Boyd, Edinburgh, 4th Edition.
50. Fleming, J. M. (1962). Domestic financial policies under fixed and floating exchange rates. IMF Staff Papers, 9, 369–379. doi:10.2307/3866091
51. Forbes, K. J., Warnock, F. E. (2012). Capital Flow Waves: Surges, Stops, Flight, and Retrenchment. Journal of International Economics, 88(2), 235–251.
52. Frankel, J. A. (1985). International capital mobility and crowding out in the US economy: Imperfect integration of financial markets or of goods markets? In: Hafer R (Ed.) How Open is the US Economy? Federal Reserve Bank of St. Louis, Lexington Books, Lexington.
53. Frankel, J. A. (1991). Quantifying international capital mobility in the 1980s. In: Bernheim D, Shoven J (Eds.) National Saving and Economic Performance University of Chicago Press Chicago.
54. Frankel, J. A., Razin, A. (1986). Fiscal policies in the world economy. Journal of Political Economy, 93, 564-594.
55. Fratzscher, M. (2012). Capital Flows, Push versus Pull Factors and the Global Financial Crisis. Journal of International Economics, 88(2), 341–56.
56. Ghosh, A.R., Ostry, (1993). Do Capital Flows Reflect Economic Fundamentals in Developing Countries?" IMF Working Paper No. 93/34 (Washington: International Monetary Fund).
57. Ghosh, A.R., Qureshi, M.S., Kim, J., Zalduendo, J. (2014). Surges. Journal of International Economics, 92(2), 266–285.
58. Giambacorta, L., Hofmann, B., Peersman, G. (2014). The Effectiveness of Unconventional Monetary Policy at the Zero Lower Bound: A Cross-Country Analysis. Journal of Money, Credit and Banking, 46(4), 615-642.

59. Hannan, A.S. (2017). The Drivers of Capital Flows in Emerging Markets Post Global Financial Crisis. IMF Working Paper WP/17/52.
60. Hannan, A.S. (2018). Revisiting the Determinants of Capital Flows to Emerging Markets—A Survey of the Evolving Literature, IMF Working Paper WP/18/214.
61. Hansen, L.P. (1982). Large Sample Properties of Generalized Method of Moments Estimators. Econometrica, 50(4), 1029–1054.
62. Hansen, L. P., Heaton, J., Yaron, A. (1996). Finite-sample properties of some alternative GMM estimators. Journal of Business & Economic Statistics, 14(3), 262–280. DOI: 10.2307/1392442
63. Harberger, A.C. (1980). Vignettes on the world capital market. American Economic Review, 70, 331-337.
64. Hausman, J.A. (1978). Specification Tests in Econometrics. Econometrica, 46(6), 1251–1271.
65. Hodrick, R.J, Prescott, E.C. (1997). Postwar U.S. Business Cycles: A Empirical Investigation. Journal of Money, Credit and Banking, 29(1), 1-16.
66. Huang, W., Goodell, J.W. and Goyal A. (2021). In times of crisis does ownership matter? Liquidity extraction through dividends during the 2007–2009 financial crisis. Journal of International Financial Markets, Institutions & Money. 73, 101380
67. Hunya, G., Geishecker, I. (2005). Employment Effects of Foreign Direct Investment in Central and Eastern Europe. wiiw Research Report, The Vienna Institute for International Economic Studies, 321, 1-35.
68. Im, K. S., Pesaran, M. H., Shin, S. Y. (2003). Testing for Unit Roots in Heterogeneous Panels. Journal of Econometrics, 115(1), 53-74. https://doi.org/10.1016/S0304-4076(03)00092-7
69. IMF, (2016). Understanding the slowdown in capital flows to emerging markets. IMF Working Economic Outlook, Chapter 2, April 2016.
70. Jansen, W. J., Schultz, G. (1996). Theory-based measurement of the saving-investment correlation with an application to Norway. Economic Inquiry, 34, 116-132. https://doi.org/10.1111/j.1465-7295.1996.tb01367.x
71. Johansen, S. (1988). Statistical analysis of co-integration vectors. Journal of Economic Dynamics and Control, 12(2-3), 231-254.
72. Johnson, M.A, Lamdin, D. (2014). Investment and saving and the euro crisis: A new look at Feldstein–Horioka. Journal of Economics and Business, 76(C), 101-114.
73. Kao, C., Chiang, M. H. (2001). On the estimation and inference of a cointegrated regression in panel data. in Badi H. Baltagi, Thomas B. Fomby, R. Carter Hill (ed.) Nonstationary Panels, Panel Cointegration, and Dynamic Panels (Advances in Econometrics, Volume 15) Emerald Group Publishing Limited, pp.179 - 222
74. Kaur, H., Sarin, V. (2019). The Saving–Investment Co-integration Across East Asian Countries: Evidence from the ARDL Bound Approach. Global Business Review, 1-9. https://doi.org/10.1177/0972150918816149
75. Koepke, R. (2015). What Drives Capital Flows to Emerging Markets? A Survey of the Empirical Literature. Journal of Economic Surveys, 33(2), 516:540.

76. Lane, P.R. (2013). Financial Globalisation and the Crisis. Open Economies Review, 24, 555-80.
77. Levin, A., Lin, C., Chu, C. J. (2002). Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties. Journal of Econometrics, 108(1), 1-24. https://doi.org/10.1016/S0304-4076(01)00098-7.
78. Levy, D. (1990). Investment-saving co-movement, capital mobility, and fiscal policy. Irvine Economic Paper No. 90-91-04.
79. López-Mejía, A. (1999). Large Capital Flows: A Survey of the Causes, Consequences, and Policy Responses. IMF Working Paper No. 99/17, International Monetary Fund (IMF).
80. Luchtenberg, K.F. and Vu, Q.V. (2015). The 2008 financial crisis: Stock market contagion and its determinants," Research in International Business and Finance, 33(C), 178-203.
81. Ma, W., H. Li, (2016). Time-varying saving-investment relationship and the Feldstein-Horioka puzzle, Economic Modelling, 53, 166-178.
82. Maddala, G. S., Wu, S. (1999). A Comparative Study of Unit Root Tests with Panel Data and a New Simple Test. Oxford Bulletin of Economics and Statistics, 61(1), 631-652.
83. McQuade, P., Schmitz, M. (2016). The Great Moderation in International Capital Flows: A Global Phenomenon, ECB Working Paper Series no 1952.
84. MacKinnon, J., Haug, A., Michelis, L., (1999). Numerical Distribution Functions of Likelihood Ratio Tests for Co-integration. Journal of Applied Econometrics, 14(5), 563-177.
85. Milesi-Ferretti, G., Tille, C. (2011) The great retrenchment: International capital flows during the global financial crisis. Economic Policy, 66, 285-330.
86. Moosa, I. A. (2002). Foreign Direct Investment Theory, Evidence and Practice. New York: Palgrave Macmillan
87. Mundell, R.A. (1963). Capital mobility and stabilization policy under fixed and flexible exchange rates. Canadian Journal of Economics and Political Science, 29(4), 475–485. doi:10.2307/139336.
88. Niehans, J. (1992). The international allocation of savings with quadratic transaction (or risk) costs. Journal of International Money and Finance, 11(1), 222-234. https://doi.org/10.1016/0261-5606(92)90043-W
89. Obstfeld, M. (1986). Capital Mobility in the World Economy: Theory and Measurement. In: Carnegie-Rochester Conference Series on Public Policy, 24, 55-104.
90. Obstfeld, M., Rogoff, K. (2000). The six major puzzles in international macroeconomics: Is there a common cause? NBER Macroeconomics Annual, 15, 340-390.
91. Obstfeld, M., Rogoff, K. (2001). Perspectives on OECD Capital Market Integration: Implications for U.S. Current Account Adjustment. in Federal Reserve Bank of Kansas City Global Economic Integration: Opportunities and Challenges, March 2001, pp. 169-208.
92. Obstfeld, M., Taylor, A.M. (2004). Global Capital Markets: Integration, Crisis, and Growth. Cambridge: Cambridge University Pres

93. Opler, T, Pinkowitz, L., Stulz, R. and Williamson, R. (1999). The determinants and implications of corporate cash holding. Journal of Financial Economics, 52, 3–46.
94. Pedroni, P. (2001). Fully modified OLS for heterogeneous cointegrated panels, in Badi H. Baltagi, Thomas B. Fomby, R. Carter Hill (ed.) Nonstationary Panels, Panel Cointegration, and Dynamic Panels (Advances in Econometrics, Volume 15) Emerald Group Publishing Limited pp.93 - 130
95. Phiri, A. (2019). The Feldstein-Horioka Puzzle and the Global Financial Crisis: Evidence from South Africa using Asymmetric Cointegration Analysis. Economia Internazionale / International Economics, Camera di Commercio Industria Artigianato Agricoltura di Genova, 72(2), 139-170.
96. Pulvino, T. (1998). Do asset fire sales exist? An empirical investigation of commercial aircraft transactions. Journal of Finance, 53, 939–978.
97. Raza, H., Zoega, G., Kinsella, S. (2018). Asymmetries exist in the Feldstein–Horioka relationship. The Journal of International Trade & Economic Development, 27(6), 667-684. https://doi.org/10.1080/09638199.2017.1418412
98. Reinhart, C.M., Reinhart, V., Trebesch, C. (2016). Global Cycles: Capital Flows, Commodities, and Sovereign Defaults, 1815–2015. American Economic Review: Papers & Proceedings, 106(5), 574–580.
99. Reinhart, C., Rogoff, S. (2014). Recovery from Financial Crises: Evidence from 100 Episodes. American Economic Review, 104:, 50-55.
100. Shleifer, A. and Vishny, R. (1992). Liquidation values and debt capacity: a market equilibrium approach. Journal of Finance, 47, 1343–1366.
101. Schindler, M. (2009). Measuring Financial Integration: A New Data Set. IMF Staff Papers, 56(1), 222-238.
102. Taylor, M. P. (1995). The Economics of Exchange Rates. Journal of Economic Literature, 33, 13–47.
103. Taylor, M.P., Sarno, L. (1997). Capital Flows to Developing Countries: Long-and ShortTerm Determinants. The World Bank Economic Review, 11(3), 451-470.
104. Tesar, L. (1991). Saving, investment and international capital flows. Journal of International Economics, 31 (1–2), 55-78.
105. Tesar, L., Werner, I. M. (1995). Home bias and high turnover. Journal of International Money and Finance, 14, 467-493. https://doi.org/10.1016/0261-5606(95)00023-8
106. UNCTAD, (1999). World Investment Report 1999, Foreign Direct Investment and the Challenge of Development, United Nations Conference on Trade and Development .
107. Vikoren, B. (1994). Interest rate differentials, exchange rate expectations and capital mobility. Norges Bank Skriftserie, 1, 23-35.
108. World Bank, (1997). Private Capital Flows to Developing Countries: the Road to Financial Integration. World Bank Policy Research Report (Oxford: Oxford University Press).
109. Xiaoye, J. and Ximeng, A. (2016). Global financial crisis and emerging stock market contagion: A volatility impulse response function approach. Research in International Business and Finance, 36(C), 179-195.
110. Zhou,L., Biswas, B., Tyler Bowles, T., Saunders, P.J. (2011). Impact of Globalization on Income Distribution Inequality in 60 Countries. Global Economy Journal, 11(1), 1850216.

Electronic and Data Sources:

https://data.worldbank.org (last accession: 01.08.2019)

https://data.imf.org/?sk=388DFA60-1D26-4ADE-B505-A05A558D9A42 (last accession: 04.10.2019)

https://www.macrotrends.net/2603/vix-volatility-index-historical-chart (last accession: 11.11.2019)

https://tr.investing.com/indices/msci-emerging-markets-historical-data (last accession: 11.11.2019)

http://www.eviews.com/help/helpintro.html#page/content/advtimeser-Panel_Unit_Root_Testing.html(last accession: 12.12.2019)

Tables

Table 1 - Post Crisis/Peak in FDI and Portfolio Flows (in % of GDP)

FDI	Total	Developed	Emerging	Australia	Brazil	Canada	China	Eurozone	India	Indonesia	Japan	Korea	Mexico	Russia	Turkey	US
2016/2007	0.52	0.53	0.74	0.54	1.14	0.54	0.72	0.46	0.62	0.64	2.06	1.08	0.95	0.55	0.53	0.72
2010-2016/2007	0.51	0.50	0.82	0.64	1.03	0.51	0.81	0.44	0.63	1.16	1.32	1.08	0.85	0.62	0.57	0.69
2016/2006	0.67	0.70	0.78	0.51	1.16	0.79	0.65	0.57	0.59	0.83	3.22	1.37	1.46	0.63	0.50	1.03
2010-2016/2006	0.66	0.67	0.86	0.60	1.04	0.74	0.73	0.54	0.60	1.49	2.07	1.37	1.32	0.71	0.53	0.99
Portfolio																
2016/2007	0.32	0.32	0.30	0.14	0.42	1.18	0.21	0.28	0.05	0.78	1.22	0.44	0.72	0.73	0.10	0.28
2010-2016/2007	0.37	0.38	0.33	0.27	0.31	0.76	0.24	0.31	0.27	0.87	0.94	0.43	1.26	0.39	0.58	0.49
2016/2006	0.29	0.29	0.29	0.12	0.80	1.07	0.11	0.25	0.18	0.44	0.98	0.75	0.41	0.58	0.21	0.24
2010-2016/2006	0.33	0.35	0.32	0.24	0.60	0.69	0.12	0.27	0.93	0.49	0.76	0.72	0.72	0.31	1.25	0.42

Note: FDI and Portfolio ratios are calculated as (Inflows+Outflows)/GDP. Data Source: Own Calculation from World Bank Database.

Table 2 - Definition of the Variables

Variable Name	Definition	Data Source	Variable Type
S/GNI	Gross Savings/Gross National Income	World Bank Statistical database	Endogenous
I/GDP	Gross Fixed Capital Formation/ GDP	World Bank Statistical database	Endogenous
size	Total Real GDP	World Bank Statistical database	Exogenous-Instrument
dev	Real GDP *Per capita* (level of development)	World Bank Statistical database	Exogenous-Instrument
growth	(%) change of real GDP	World Bank Statistical database	Exogenous-Instrument

Table 3 - Structural Breaks Analysis of the *fdi* Variable

Country	Detected Breaks	Break of the Global Financial Crisis	*fdi* Trend after the Global Financial Crisis Break	fdi Trend after Local Break Year
Australia	2004	2004	Downward	Downward
Brazil	2001	none	Upward	no country specific break
Canada	none	none	Stationary	no country specific break
China	2005	2005	Downward	Downward
Euro area	2008,2005,2001	2008	Downward	Downward
India	2010,2006	2010	Downward	Downward
Japan	2010	2010	Upward	Upward
Korea, Rep.	none	none	Downward	no country specific break
Mexico	none	none	Upward	no country specific break
Russian Federation	2006	2006	Downward	Downward
Turkey	2005	2005	Downward	Downward
United States	none	none	Stationary	no country specific break

Data Source: Own Calculation/estimation from World Bank Database

Table 4 – Unit Root Analyses (Panel)

Variables:	Level	Variables:	Level
S/GNI (s)		*Dev*	
Levin, Lin and Chu (T-Stat)	-4,49***	Levin, Lin & Chu (T-Stat)	-3,520***
Im, Pesaran and Shin (W-stat)	-3,41***	Im, Pesaran and Shin (W-stat)	-1,999*
ADF - Fisher (Chi-square-Stat)	50,23***	ADF - Fisher (Chi-square-Stat)	59,360***
PP - Fisher (Chi-square-Stat)	33,18	PP - Fisher (Chi-square-Stat)	94,903***
I/GDP (i)		*Growth*	
Levin, Lin & Chu (T-Stat)	-2,84***	Levin, Lin & Chu (T-Stat)	-19,070***
Im, Pesaran and Shin (W-Stat)	-1,99**	Im, Pesaran and Shin (W-Stat)	-11,176***
ADF - Fisher (Chi-square-Stat)	41,91**	ADF - Fisher (Chi-square-Stat)	334,014***
PP - Fisher (Chi-square-Stat)	39,61**	PP - Fisher (Chi-square-Stat)	104,666***
Size			
Levin, Lin & Chu (T-Stat)	-4,334***		
Im, Pesaran and Shin (W-Stat)	-1,528*		
ADF - Fisher (Chi-square-Stat)	51,730***		
PP - Fisher (Chi-square-Stat)	53,252***		

Notes: Lags are determined according to SIC, max. lag = 4, *** 1%, ** 5 %, * 10 % denotes statistical significance. Data Source: Own Estimation

Table 5 - Panel Cointegration Test Results

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept	Intercept	Intercept	Intercept	Intercept
	No Trend	No Trend	No Trend	Trend	Trend
Number of Cointegrating Equations (Trace)	0	0	0	0	0
Number of Cointegrating Equations (Eigen)	0	0	0	0	0

Note: Critical values are determined on the basis of MacKinnon, Haug, and Michelis (1999) at 5 %.lag length=4, Data Source: Own Estimation

Table 6 - Hausman Test Results

Hausman Test		Fixed	Random	Var(Diff.)	Probability
Cross Sectional Effects		0.564433	0.381620	0.001641	
Period Effects		0.399707	0.381620	-0.000211	
Total Effects		0.495323**	0.381620	0.002183	0.0150

Note: The statistics in the table show the test indicators for β coefficients, where random effects model is run to apply the test. Data Source: Own Estimation

Table 7 - Results for the Panel GMM Fixed Effects Regression

Variables	Total		Developed Countries		Emerging Economies	
	Coefficients	**P-Values**	**Coefficients**	**P-Values**	**Coefficients**	**P-Values**
Constant	-3,461***	0,005	-2,878	0,157	-3,994**	0,015
S/*GNI*	0,564***	0,000	0,517***	0,000	0,567***	0,000
I/GDP (-1)	0,547***	0,000	0,619***	0,000	0,537***	0,000
Cross sectional Fixed Effects	yes		yes		yes	
Cross sectional Orthogonal Deviations	no		no		no	
Period Fixed Effects	no		no		no	
Random Effects	No		No		No	
Instruments	size, dev, growth, I/GDP(t-1), constant		size, dev, growth, I/GDP(t-1), constant		size, dev, growth, I/GDP(t-1),constant	
R-Square	0,94		0,88		0,88	
N	260		100		160	
Histogram JB Normality Test	29,01***		0,68		9,28***	
Chisqr (Wald Test)	37,87***		14,90***		24,15***	

Note: Data Source: Own Estimation

Figures

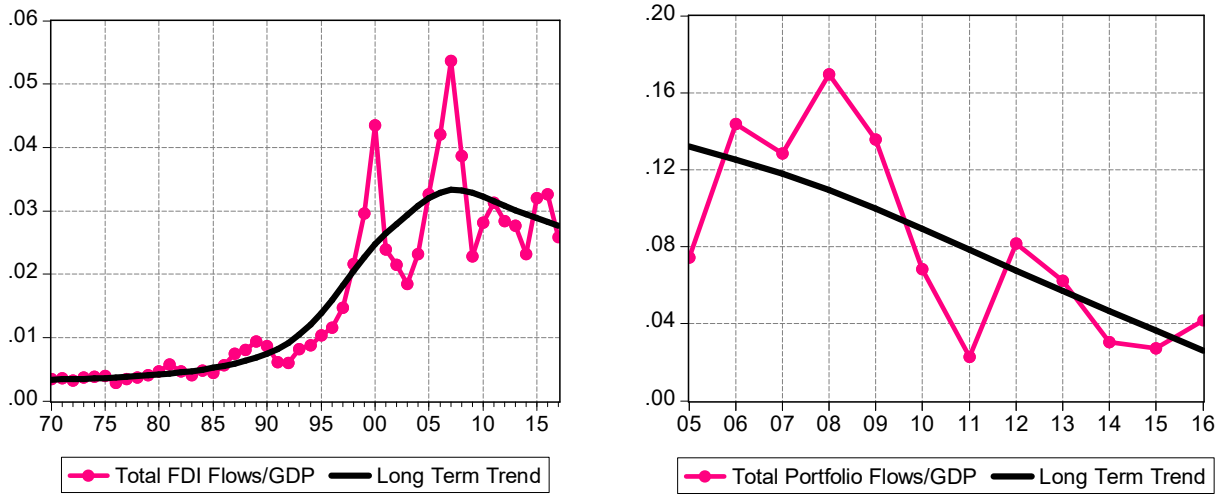

Figure 1 - Evolution of Capital Mobility

Note**: "***Total FDI Flows/GDP=|FDI inflows+FDI outflows|/GDP"***, "***Total Portfolio Flows/GDP=|Portfolio inflows+Portfolio outflows|/GDP"*** (Zhou et al. 2011)

Source Data: World Bank

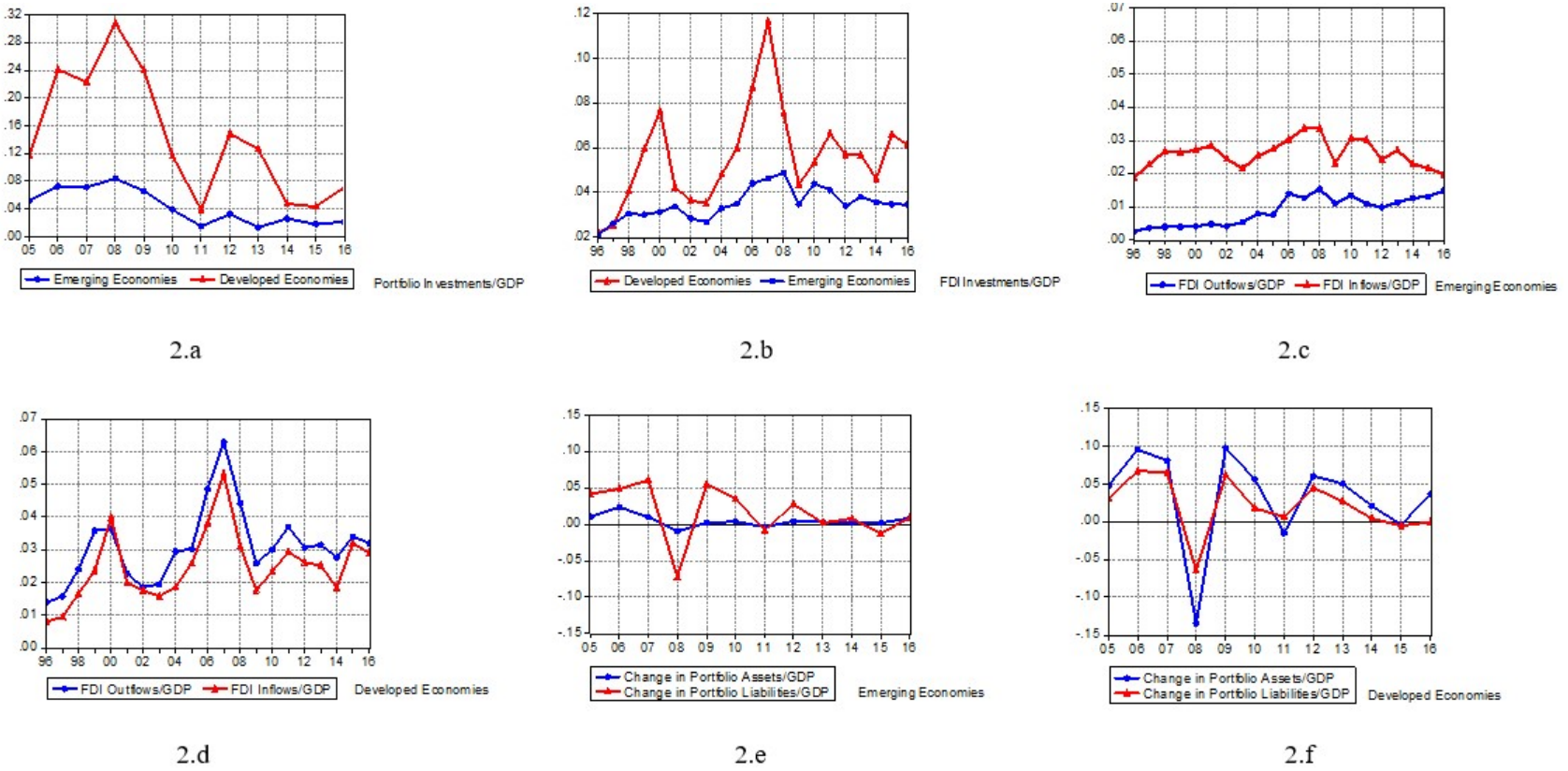

Figure 2. **Net Inflows and Outflows of FDI and Gross Portfolio Change in Assets or** Liabilities (all in % of GDP)

Note: Indonesia is excluded in 2.b and 2.d due to data unavailability, Data Source: World Bank Statistical Database, IMF Database

Figure 3 - Rolling Windows GMM Estimation (8 Years, Country Level)

Note: Data Source: Own Estimation

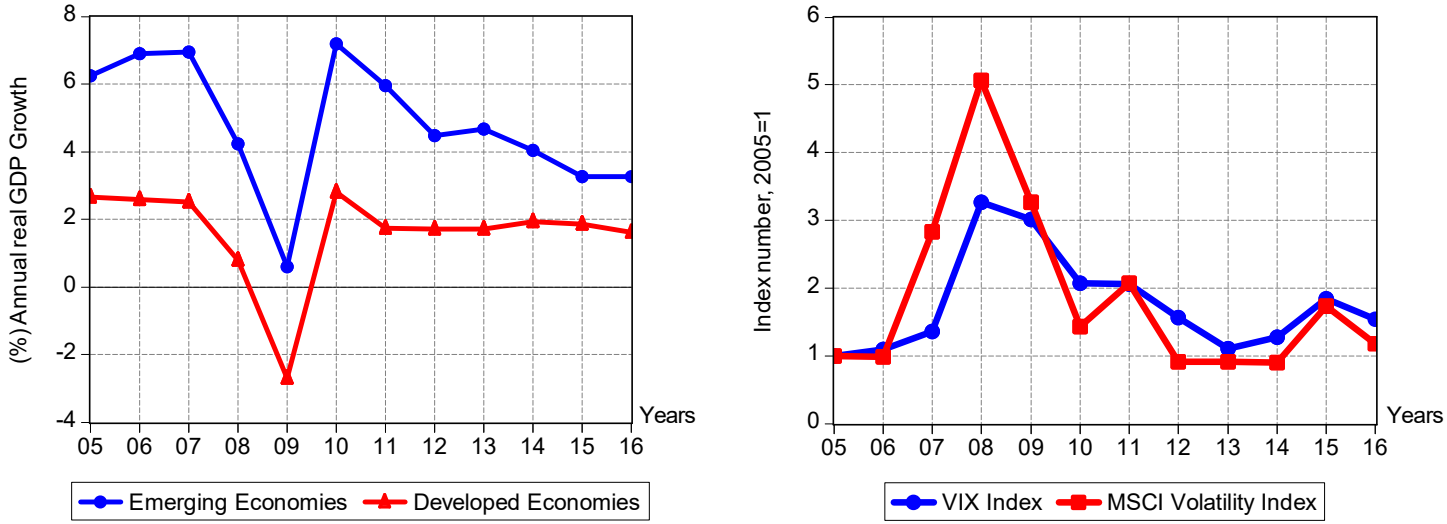

Figure 4. Evolution of Risk Indicators

Note: Data Source: Own calculation from World Bank Database, for VIX index: https://www.macrotrends.net/2603/vix-volatility-index-historical-chart, for MSCI volatility index: https://tr.investing.com/indices/msci-emerging-markets-historical-data

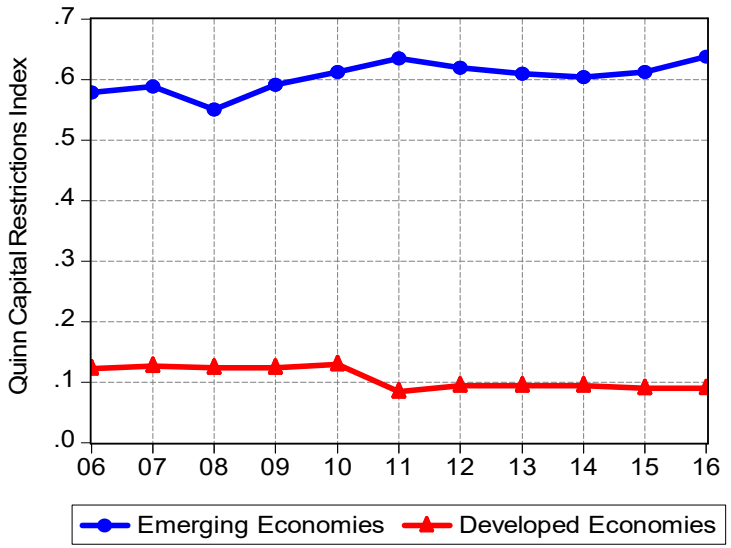

Figure 5. Evolution of Capital Restrictions Index

Note: Eurozone is represented by the average values of Germany, France, Italy, Spain. Source: Fernandez et al. (2016), Schindler (2009)

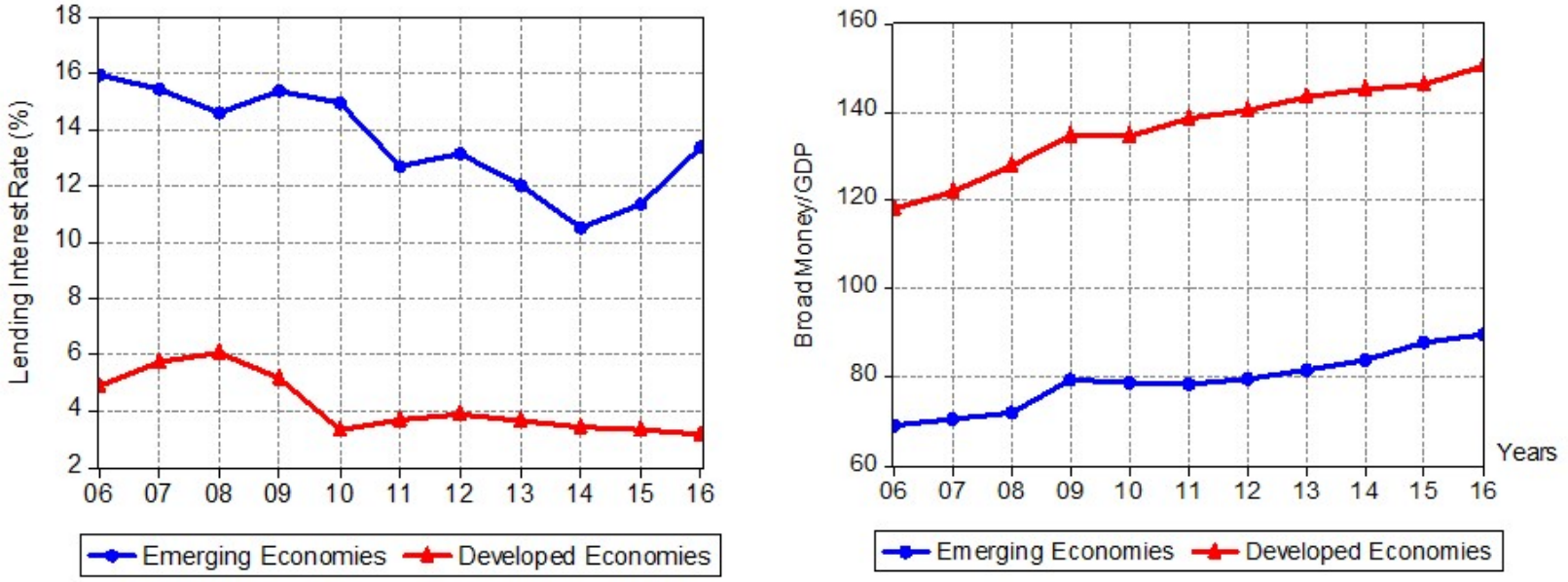

Figure 6. Evolution of interest rates and money supply

Note: In interest rate graph Turkey and Eurozone is not included due to data unavailability in World Bank dataset, in broad money/GDP graph, Eurozone and Canada is excluded due to data unavailability in World Bank dataset. Data Source: World Bank Database