DO PENSION FUNDS PROVIDE LIQUIDITY: LESSONS FROM EM COUNTRIES

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DO PENSION FUNDS PROVIDE LIQUIDITY: LESSONS FROM EM COUNTRIES

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To .....

ABSTRACT

In response to the financial crisis, there has been increased attention on the importance of the long-term investors for financial stability. We contribute to this literature by investigating the role of pension funds on stock market liquidity, using a data set covering 23 EM countries over the period 2004-2014. In particular, we focus on whether liquidity supply by pension funds are more pronounced in periods of market turbulence. We find strong evidence that pension funds, i) supply liquidity in stock markets, and ii) liquidity provision effect is stronger in financial crisis times. Our findings have key implications for both policymakers and global fund managers. As liquidity provision is an important function of financial markets both in general and periods of market stress, EM economies that are relying heavily on foreign investors should increase domestic and long-term investor base (pension funds) in their financial markets. Auto-enrollment reform may provide a viable solution to increase pension fund size in EM countries.

ÖZETÇE

Finansal istikrar için uzun vadeli yatırımcıların önemi, finansal kriz sonrasında artış göstermiştir. Bu çalışma, 2004-2014 arası, 23 gelişmekte olan ülke verisini kullanarak, emeklilik fonlarının hisse senedi piyasası likiditesine etkisini araştırmaktadır. Özellikle, emeklilik fonlarının likidite arzına olan etkisinin kriz zamanlarında artış gösterip göstermediği incelenmektedir. Ampirik çalışma sonucunda; emeklilik fonlarının, i) hisse senedi piyasası likiditesini arttırdığına, ve ii) bu etkinin kriz zamanlarında daha güçlü olduğuna ilişkin kanıtlar bulunmuştur. Bulgular, politika yapıcılar ve global fon yöneticileri için önemli çıkarımlar içermektedir. Likidite arzı özellikle kriz zamanlarında piyasaların önemli bir fonksiyonu olduğundan, yatırımcı tabanında yabancı yatırımcılara ağırlık veren gelişmekte olan ülkeler, finansal piyasalarında yerli ve uzun vadeli yatırımcıların (emeklilik fonları) oranını arttırmalıdır. Otomatik katılım sistemi, emeklilik fonlarının büyümesine önemli katkılar sağlayabilir.

ACKNOWLEDGEMENTS

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CHAPTER I

INTRODUCTION

During the last decade, financial markets have witnessed the spectacular growth of institutional investors in EM countries. The proportion of financial assets held in the form of pension funds and other major institutional investors grew almost three-fold (from $1.5 trillion to $4.1 trillion) in EM's over this period (IMF (2014)). This has led financial economists' to reconsider the relationship between institutional investors and financial markets.

Over the same period, many emerging markets have become increasingly financially integrated with the rest of the world, and increase their exposure to global financial shocks. A key feature of higher financial integration has been that both sides of EM's balance sheets - that is both foreign liabilities and asset holdings - have increased. Furthermore, foreign investors have become an important component of the investor base in stock markets, as shown in Figure I(a). By 2014, foreign investors share in stock trading volume reaching up to 50% in some EM countries. As a result, EM's have had at their disposal increasing resources to offset balance of payment pressures arising during episodes of retrenchment of foreign investors, often occurring at times of market turbulence in global markets.

In the wake of Global Financial Crisis (2008) and FED Tapering Tantrum (2013), EM countries have experienced with almost $150 billion dollar portfolio outflows which exacerbated financial market illiquidity (Institute of International Finance, (2015)). Figure I(b) shows that, stock market illiquidity peaked one month after the tapering announcement and increased by three times compared with pre-crisis levels. In response to these financial crisis, markets exposed to sharp changes in pricing

regimes which asset prices are determined by the amount of liquidity in financial markets (Allen and Carletti (2008)). At this point, domestic investors should potentially play a stabilizing role, by buying foreign assets, when foreign investors are liquidating positions in EM countries (Adler et al. (2015)).

Pension funds with their capital size and unique characteristics have been receiving increased attention to reduce dramatic financial market volatilities and provide liquidity among other institutional investors. Pension fund assets now exceeds $35 trillion dollar almost half of the size is U.S. pension assets, the world biggest institutional investors market. They have grown strongly in recent years in many developed markets as well as in emerging markets, both relative to GDP and compared to banks. As in Figure I(c), EM pension fund market average size has grown dramatically, (from 10% to 20%) compared with advanced economies, despite in the same period three more crises have affected the financial markets of these economies (Global Financial Crisis, Sovereign Debt Crisis and Fed Tapering) (OECD (2014)).

In essence, there are good reasons why pension funds may provide liquidity supplier role for financial markets. The existing literature establishes three sets of reasons about the stabilizing role of pension funds: i-) pension funds are market participants with long-term liabilities, and hence are unlikely to face substantial unanticipated short-term liquidity needs, ii-) they have predictable cash flows (employee and employer contributions are largely locked-in), and iii-) they are 'deep-pocket investors' who can buy securities when prices have dropped and can benefit from the price increases. Patient capital of pension funds allows investors to encourage countercyclical investment strategies and contribute to financial stability (Schembri (2014) and Blake et al. (2015)). Figure I(d) shows that, pension funds in several countries (e.g., Poland, Brazil, Colombia and Thailand) acted in a countercyclical manner during 2008-2009, by increasing their exposure to equity investments as markets tumbled in the financial crisis (OECD (2014)).

This paper presents one of the first empirical study that investigates the investment behaviour of pension funds on stock market liquidity in EM countries and makes a number of contributions to this literature. First, using a novel comprehensive dataset of individual PF assets we analyze the impact of domestic (pension funds) investors on stock market liquidity in 23 EM countries between January 2004 and December 2014. Second, we pay great attention to control for other risk factors (e.g; financial and macroeconomic) than PF's to properly identify the impact that is associated with PF assets. And finally, we take into account the impact of financial crisis episodes, and estimate the effect of pension funds on stock market liquidity also in sub-crisis periods.

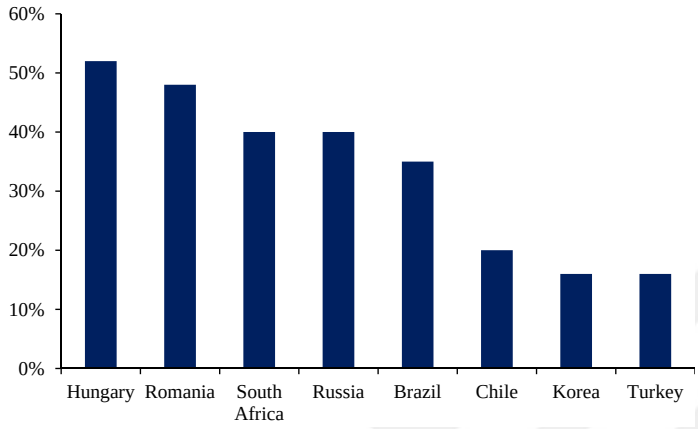
We find a number of novel results. First, we examine the impact of pension funds on market liquidity using Panel Vector Auto-Regression (P-VAR) methodology. We find that, %1 increase in pension funds assets increase stock market liquidity by %0.20. Second, we explore whether liquidity provision role of pension funds varies over crisis times. Indeed, we find that, pension funds provide more liquidity to stock markets during Global Financial Crisis and FED Tapering periods. Finally, as a robustness check, our results of the binary model further confirm the liquidity provider role of PF's in stock markets. The findings of our study is parallel with the findings of previous literature that pension funds provide stock market liquidity and contribute to financial stability (Anand et al. (2013); Thomas et al. (2014); Timmer (2016)).

We believe that our findings in this paper have very important implications for global fund managers and policymakers. According to our results pension funds provide liquidity in stock markets both in non-crisis and crisis periods. They could therefore be in a position to provide liquidity to financial markets at times when it is needed, thereby helping stabilize financial markets and earning a liquidity premium in return. Policymakers may find these findings to address the importance of pension funds (domestic investors) in order to contribute to financial stability. In particular

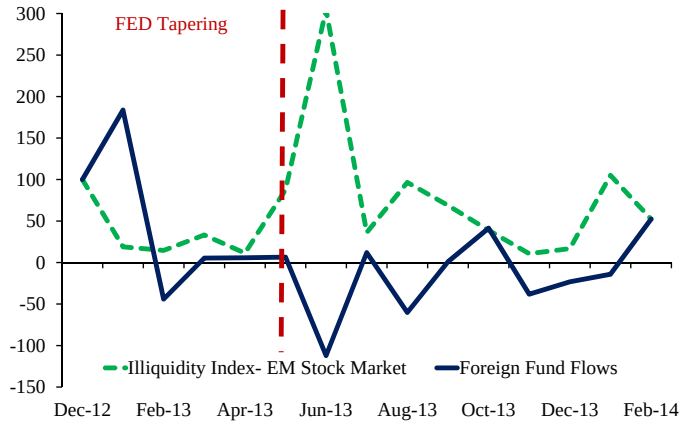
EM governments can try to automatically enroll new people in to pension plans to increase domestic and long-term investor base in their economies (Madrian and Shea (2001) and Choi et al. (2004)).

The rest of the paper is organized as follows: Chapter II describes the related literature and research hypothesis. In Chapter III, we explain the composition of our data set. Chapter IV presents the methodology and results. Chapter V discusses the auto-enrollment reform as a policy implication. Finally, Chapter VI concludes.

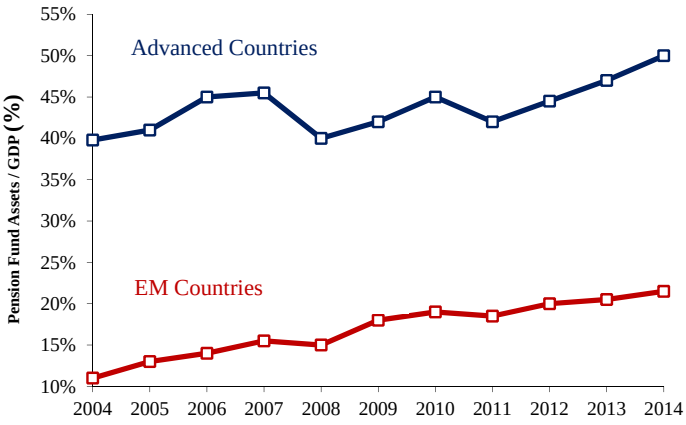
(a) Foreign Investors Share in Stock Trading Volume (%)



(b) Foreign Fund Flows and Illiquidity Index in EM's



(c) Pension Fund Assets / GDP (% in selected country groups)



(d) Pension Funds Equity Investments in GFC

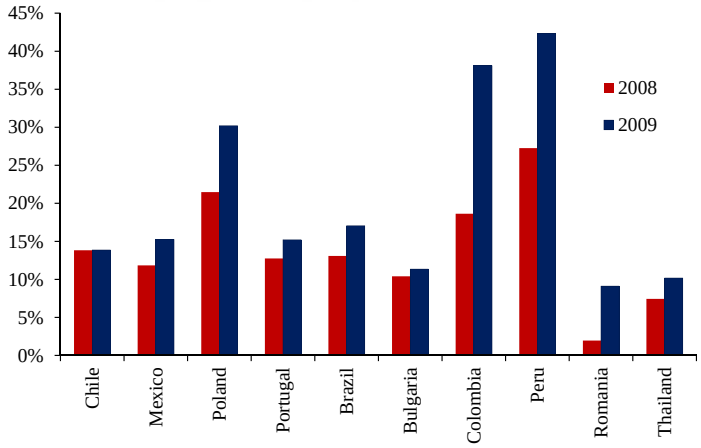


Figure I: Descriptive Charts
The top left panel (Panel A) display foreign investors share in stock trading volume in selected EM countries. Panel (B) shows foreign fund flows and EM stock market illiquidity index in FED Tapering. The bottom left panel (Panel C) displays pension fund size in selected country groups. The bottom right panel (Panel D) shows pension funds equity investments during Global Financial Crisis (OECD Pension Statistics, (2014)).

CHAPTER II

RELATED LITERATURE

In this section, we provide an overview of the literature and present the hypothesis we test in our research. Our approach is to examine the validity of specific arguments regarding the effect of pension funds on the EM stock market liquidity.

2.1 Pension Funds and Financial Stability

This paper is related to three streams of the pension funds and financial stability literature: (i) pension funds and financial market volatility, (ii) pension funds and capital market development, and (iii) pension funds and financial market liquidity.

The first stream of the literature studies the impact of PF's on financial market volatility. While, there exists a vibrant literature studying the stabilizing impact of PF's on U.S. stock market (Lakonishok et al. (1992); Dennis and Strickland (2002); Walker and Lefort (2002), and (Faugere and Shawky (2003)), in the wake of the financial crisis of 2008-2009, financial economists have displayed an increasing interest on EM countries (For Poland; Bohl et al. (2009), China; Li and Wang (2010), and OECD countries; (Thomas et al. (2014)). They find the evidence that, pension funds stabilize stock markets by acting in a counter-cyclical fashion and absorbing short-term volatility. [1]

A second stream of the literature examines the role of pension funds on capital market development. Several studies investigate the role of pension funds on the development of stock markets, (Chan-Lau (2004), Rocholl and Niggemann (2010),

[1] These findings are in contrast to the empirical results in, for example Sias and Starks (1997) and Dennis and Strickland (2002) which emphasizes that institutional investors trading has a destabilizing effect on stock returns via herding and positive feedback trading.

and Meng and Pfau (2010), and bond markets (Catalan et al. (2000), Raddatz and Schmukler (2008), and Liang and Bing (2010)). Their results conclude that, pension funds long-term horizon favors more efficient and innovative investment opportunities with positive impact on financial market depth.

A third stream of the literature that is pertinent to our research here is the work on the growing literature investigating the liquidity supplier role of pension funds in financial markets and its relation to with respect to financial stability (see, Anand et al. (2013) and Timmer (2016)). As noted by Blake et al. (2015), pension funds have predictable cash outflows and hence are unlikely to face substantial redemptions and short-term liquidity needs. Since early withdrawal of funds is usually restricted or forbidden in pension funds, their funding and rollover risk is relatively moderate and enable them to behave in a counter-cyclical fashion during market turmoil, i.e. increase holdings if the price dropped. Anand et al. (2013) study shows that, liquidity-supplying institutions, like pension funds, continue their role on providing liquidity in times of market turbulence in U.S. market. They are able to earn a positive long-run liquidity premium on their investments derived from exploiting the liquidity shortages of other investors, thereby helping stabilize financial markets (Davis (1996); Schembri (2014)).

We contribute to this literature by investigating whether the variation in stock market liquidity is systematically linked to changes in pension funds assets in EM countries, especially in times of market turbulence.

Summing up, these findings lead to our research hypothesis:

Hypothesis: *Pension funds supply liquidity in stock markets and their liquidity provision impact is stronger in financial crisis times.*

CHAPTER III

DATA DESCRIPTION

Our combined dataset includes 23 EM countries namely: Brazil, Chile, Colombia, Croatia, Czech Republic, Estonia, Hungary, Israel, Kazakhstan, Korea, Latvia, Lithuania, Mexico, Peru, Poland, Portugal, Romania, Russia, Slovenia, South Africa, Thailand, Turkey, and Uruguay, which alone account for over % 70 of pension fund assets in EM's. The sample covers the period between January 2004 to December 2014, but some series start later than others.

Our data are compiled from several different sources:

Pension Fund Assets Data: We collect monthly pension fund assets data from the following sources: Brazil, (ABRAPP), Chile, Superintendencia de Pensiones (SIP), Colombia, Superintendencia Financiera de Colombia (SFC), Croatia, The Croatian Financial Services Supervisory Agency (CFSSA), Czech Republic, Czech National Bank (CNB), Estonia, Hungary, Israel, Korea, Latvia, Lithuania, and Poland, (OECD Global Pension Statistics), Kazakhstan, (National Bank of Kazakhstan), Mexico, (CONSAR), Peru, (Superintendencia de Banca Seguros Y AFP), Portugal, (APFIPP), Romania (APAPR), Russia (OECD Global Pension Statistics), Slovenia, (Bank of Slovenia), South Africa, (South African Reserve Bank), Thailand, (Thai Provident Fund), Turkey, Pension Monitoring Center, (PMC), and Uruguay, (Banco Central Del Uruguay). We also work on monthly interpolated data for Czech Republic, Estonia, Hungary, Israel, Korea, Latvia, Lithuania, Poland, Russia, Slovenia and South Africa to match the frequency of the pension fund assets with other countries. All series are scaled by GDP.[1] Detailed description of pension fund assets data are

[1]Pension fund assets as a share of GDP is a commonly used measure of PF size (see, Impavido et al. (2003); Raddatz and Schmukler (2008); Meng et al. (2010)).

given in Appendix A.1.

Market Liquidity Measure: We consider liquidity proxy by Roll (1984), which intend to capture resiliency aspect of market liquidity. Our liquidity measure by Roll (1984) requires only price data to estimate market liquidity and this measure is available for all EM countries in our sample. We obtain daily stock market price data, denominated in dollars, from the Bloomberg database. Previous literature documents that Roll (1984) liquidity measure is effective in capturing stock market liquidity (Lesmond (2005)).

The Roll (1984) assumes that the subsequent prices arise from the bid-ask bounce. Thus, the bid-ask spread can be extracted from the covariance between consecutive returns as:

$$L^{(rl)} = 2\sqrt{-cov(\Delta p_t, \Delta p_{t-1})} \tag{1}$$

where Δp_t is the change in prices from t to t-1. Serially negatively correlated price movements and the strength of this covariation can be regarded as proxy for the market liquidity of stock market. [2] There will be no serial dependence in successive price changes (aside from that generated by serial dependence in expected returns).

Financial and Macroeconomic Data: The financial time series data used in the analysis include exchange rate (EXC) and 5Y Credit Default Swap (CDS), obtained from the Bloomberg database. To proxy for macroeconomic stability, we use inflation (INF) and Gross Domestic Product (GDP) from the OECD Global Statistics and the International Financial Statistics (IFS) database. Monthly series

[2]When the sample serial covariance is positive, we use a modified version of the Roll estimator:

$$f(x) = \begin{cases} L^{(rl)} = 2\sqrt{-cov(\Delta p_t, \Delta p_{t-1})} & \text{if } Cov(\Delta P_t, \Delta P_{t-1} < 0 \\ L^{(rl)} = -2\sqrt{cov(\Delta p_t, \Delta p_{t-1})} & \text{if } Cov(\Delta P_t, \Delta P_{t-1} \geq 0 \end{cases}$$

are obtained by linear interpolation of quarterly series.

There are two main advantages to using our combined data-set relative to those used in prior research: i-) very first in the literature, we analyze the liquidity of financial markets using data on individual pension fund assets, and ii-) our data set covers two major financial crises highly relevant for analyzing liquidity (Global Financial Crisis and Fed Tapering Tantrum) rather than just the relatively uneventful mid-decade period. Appendix A.2 offers descriptive statistics for all variables in our data-set.

CHAPTER IV

EMPIRICAL METHODOLOGY AND RESULTS

This chapter describes the methodology used to test whether pension funds provide liquidity in stock markets. We also present a robustness check section in order to test the validity of our results.

4.1 Interaction Effects between Pension Funds and Market Liquidity

In this section we test our hypothesis and assess the intertemporal associations between pension funds and stock market liquidity. While univariate relations between pension funds and market liquidity have been partially explored in earlier literature, an emerging literature in financial economics argues that there is good reason to expect bi-directional causality between institutional investors and financial stability (e.g, Chordia et al. (2003); Vagias and Van Dijk (2011)).

Following Love and Zicchino (2006), we use Panel Vector Auto-Regression (P-VAR) methodology to measure the relationship between pension funds and stock market liquidity. This methodology treats all variables in the system as endogenous, and allows for the unobserved individual heterogeneity.

Let us define $X_{it} = [L_{it}, PF_{it}]$ as the vector of the two variables namely liquidity and pension funds. We can represent their linear inter-relationships with the following Panel Vector Autoregression (P-VAR) model ;

$$X_{it} = A + B(L)X_{it} + f_i + \epsilon_t \tag{2}$$

where L is the lag indicator, $\epsilon_t \sim N(0; \Omega)$. We also add f_i as a $k \times 1$ vector of (unobserved) country effects.

Regarding the country-specific fixed effects, we apply Helmert transformation by Arellano and Bover (1995), which removes only the mean of all future observations available for each country-year. Helmert procedure allows us, to estimate the (P-VAR) by using GMM, since it preserves the orthogonality between the transformed variables and the regressors.

As in Love and Zicchino (2006), we first check the stability properties of the P-VAR model. The necessary and sufficient condition for stability is that all moduli of the all eigenvalues are less than one. The resulting table confirms our P-VAR estimation is stable. (see, Panel A in Table I). Second, in order to decide on the lag length, we use three Moment and Model Selection Criteria (MMSC) developed by Andrews and Lu (2001). Table I reports that the optimal lag-length is one lag (see, Panel B).

Table 1: Panel Vector Auto Regression Stability and Lag Length Tests

Panel A: Eigen Value Stability Condition		
Eigenvalue		
Real	Imaginery	Modulus
0.9876	0	0.9876
0.4061	0	0.4061

Panel B: Lag order selection statistics			
Lag	MBIC	MAIC	MQIC
1	-61.065	1.000	-16.285
2	-45.828	2.362	-15.974
3	-21.051	9.678	-6.125

We estimate Eq.(2) using system-GMM with the corresponding coefficents reported in Table 2. As expected, pension funds impact on stock market illiquidity is negative and significant in all sub-periods . We also report the results for the reverse causality between pension funds and stock market illiquidity. Our results show that, stock market illiquidity affect pension funds only in sub-crisis period- FED Tapering- at 5% significance level. In Panel B, we also present the results of Panel

VAR Granger Causality Wald test, which confirms the liquidity supplying behaviour of pension funds in stock markets in each sub-period.

In order to interpret the economic significance of the effect, we calculate the impulse response functions (IRF) between these two variables. Figure II summarizes the results, together with 95% confidence bands obtained using a bootstrap based on 200 iterations. As shown in Panel (a), a one-standard-deviation shock to the pension funds at time 0, leads to a negative change of 0.1% in stock market illiquidity in pre-crisis periods. However, the picture changes dramatically in crisis periods. In GFC and FED Tapering Tantrum, one standard-deviation shock to the pension funds affect market liquidity by 0.5% and 0.35% respectively. The effect is absorbed in Global Financial Crisis for 6 months, which is longer compared with pre-crisis period. Regarding the reverse causality, the IRF in Panel (b) shows that, one standard-deviation shock to the stock market liquidity affect PF's by 0.04% in FED Tapering period, which is the only significant sub-period with respect to the effect of stock market liquidity on pension funds.

Overall, our results is consistent with our hypothesis since pension funds supply liquidity in stock markets and their liquidity provision effect is stronger in crisis times. On the other hand, the results do not support the arguments of Vagias and Van Dijk (2011) that financial market illiquidity can have unintended spillover effects to the institutional investors flows.

Table II: Panel Vector Auto-Regression (P-VAR) Results

This table presents the results for the regressions of the monthly pension fund size (ΔPF) and stock market liquidity (ΔLiq) on the lagged terms of both variables in a P-VAR(1) setting. The top panel (Panel A) display panel vector auto-regression results and the bottom panel (Panel B) display Panel VAR Granger causality test results for i) pre-crisis period, ii) crisis period (GFC and FED Tapering), and iii) all-periods. The t-statistics and chi-square values are presented in paranthesis. Significance at 10% level is marked *, at 5% marked **, and at 1% marked ***.

$$\begin{bmatrix} \Delta Liq_{it} \\ \Delta PF_{it} \end{bmatrix} = \begin{bmatrix} c_{Liq} \\ c_{PF} \end{bmatrix} + \begin{bmatrix} a_{11}^1 & a_{12}^1 \\ a_{21}^1 & a_{22}^1 \end{bmatrix} \begin{bmatrix} \Delta Liq_{it-1} \\ \Delta PF_{it-1} \end{bmatrix} + \begin{bmatrix} f_i \end{bmatrix} + \begin{bmatrix} \epsilon_{Liq_t} \\ \epsilon_{PF_t} \end{bmatrix}$$

Panel A: Panel Vector Auto-Regression (P-VAR)								
	Pre-Crisis		Crisis Periods				All-Periods	
	(January 2004 - July 2007)		*(August 2007 - March 2009)*		*(May 2013 - February 2014)*		*(January 2004 -December 2014)*	
	ΔLiq	ΔPF	ΔLiq	ΔPF	ΔLiq	ΔPF	ΔLiq	ΔPF
ΔLiq_{-1}	-0,387***	0,008	0,516***	0,011	-0,386***	-0,184**	0,499***	0,019
	[-7,66]	[1,07]	[6,08]	[0,64]	[-3,72]	[2,35]	[7,74]	[1,90]
ΔPF_{-1}	-0,171**	-0,245***	-0,436**	0,630***	-0,341**	0,349***	-0,183***	0,358***
	[-2,36]	[-3,26]	[-2,38]	[3,67]	[-2,40]	[3,28]	[-2,83]	[3,81]
Panel B: Granger Causality Results								
Liq → PF	1,146		0,405		5,574***		3,621	
PF → Liq	5,575***		5,664***		5,542***		8,001***	

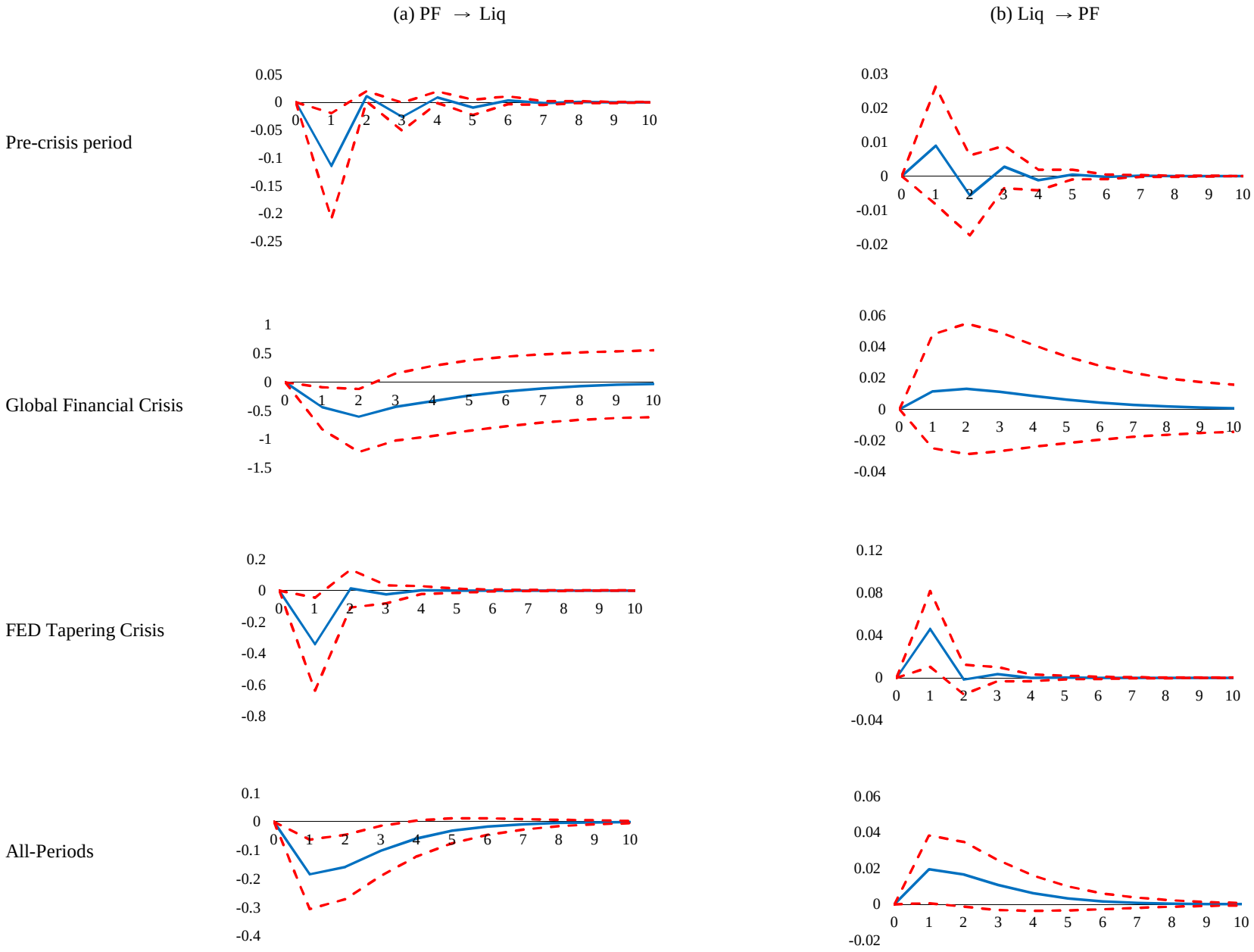


Figure II: Impulse Response Functions
This graph shows the evolution of the impulse response functions of pension funds to a shock in the stock market liquidity and of stock market liquidity to a shock in the pension funds in pre-crisis, crisis and all periods. The response functions (blue lines) from the P-VAR(1) is shown in each chart with 95% confidence intervals (red lines) which were were estimated by Monte Carlo simulations (200 iterations).

4.2 Robustness Check

As a robustness check of our results, we additionally estimate a binary model which tries to explain the differential variability over the cycle in EM countries. We check the results for both probit and logit regressions, since the latter does not require the assumption of normal distribution of error terms. We can represent non-linear relationship between stock market liquidity and PF Size with the following binary regression model:

$$Liq_{i,t} = \alpha + \beta_1 PFSize_{i,t} + \phi[ControlVariables_{i,t}] + \epsilon_{i,t} \tag{3}$$

where Liq_{it} = [1, if illiquidity (Roll measure) of a country i is bigger than the average illiquidity observed, 0 if lower], and t is time measured in months. Following previous literature, we also add $ControlVariables_{i,t}$: financial variables (credit risk via credit default swap and exchange rate risk) and macroeconomic variables (Gross Domestic Product and inflation). [1] The sample extends from January 2004 to December 2014.

We propose a likelihood ratio (L-R test) in order to check for overall variables significance. We find that LR (X^2)= 24.49 with prob >(X^2) =0.00, and LR (X^2)= 127.34 with prob >(X^2) =0.00, for probit and logit estimations respectively. Therefore the hypothesis that all parameters are equal to zero can be rejected at 1% level of significance.

In order to better measure the influence of the variables on the probability that Liq_{it} takes value 1, we also calculate the marginal effects of the variables in our sample. We use the following method to compute the marginal effects:

[1] For macroeconomic and financial variables (see, Ericsson and Renault (2006); Baumeister et al. (2008); Næs et al. (2011); Florackis et al. (2014)).

$$Average\ Marginal\ Effect = 1/n \sum_{i=1}^{n} \Omega(\overline{X}_i'\beta)\beta \tag{4}$$

The results are summarized in Table 3. Panel I covers the results for the probit regression and Panel II covers the results for the logit regression. We report the estimates of the coefficients for both regression types and present t-statistics in parentheses. According to our findings, the coefficient of the pension fund size is significant at 5% level showing an expected negative effect on stock market illiquidity. As can be seen in Table III, a %1 change in the unit measurement of PF Size decreases the probability of stock market illiquidity beyond average illiquidity, by 10.6% and 9.7% in probit and logit regressions respectively. Our results also show that, the coefficient of PF size is high and emerges as the most significant variable influencing stock market liquidity among other variables. Regarding the control variables, CDS (proxy for credit risk), is the most significant variable at 1% level, which shows a positive relationship with market illliquidity. Furthermore, GDP and inflation variables are significant at 5% and 1% levels in probit and logit regressions respectively.

By this result we further confirm and quantify the negative relationship between PF size and stock market illiquidity. Hence, in the light of our findings, we can conclude that the presence of pension funds in the stock markets is beneficial to the financial markets of EM countries, since these institutional investors provide liquidity and contribute to financial stability in stock markets.

Table III: Probit and Logit Regression Results

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This table presents the results for the probit and logit regressions of the pension fund size ($PFSize_{i,t}$) and stock market liquidity ($Liq_{i,t}$). The general regression specification is given in the equation below. Dependent variable, Liq = [1 if illiquidity of a country i is bigger than the average illiquidity observed, 0 if lower]. Control variables are financial variables (credit risk via credit default swap and exchange rate risk) and macroeconomic variables (Gross Domestic Product and inflation). The results of Pesaran (2004), and Bhargava et al. (1982) tests suggest that there is no cross sectional dependence and serial correlation in our model. The sample is January 2004 - December 2014. Panel I covers the results for the probit regression and Panel II covers the results for the logit regression. Two regressions for each probit and logit estimations are run; with coefficients and marginal effects are included. Significance at 10% level is marked *, at 5% marked **, and at 1% marked ***.

$$Liq_{i,t} = \alpha + \beta_1 PFSize_{i,t} + \phi[ControlVariables_{i,t}] + \epsilon_{i,t} \tag{5}$$

	Panel I: Probit Estimation		Panel II: Logit Estimation	
Variable	Coefficient	Marginal effects	Coefficient	Marginal effects
PF Size	-0,616** [-2,24]	-0,106**	-1,150** [-2,07]	-0,097**
CDS	0,282*** [3,14]	-0,048***	0,557*** [3,12]	0,046***
Exchange Rate	-0,061 [-1,50]	-0,010	-0,099 [-1,21]	-0,008
GDP	-0,096** [-2,31]	-0,016**	0,118 [-1,40]	-0,010
Inflation	-0,118 [-1,02]	-0,020	0,840*** [3,33]	0,070***

CHAPTER V

POLICY IMPLICATIONS

In the previous section, our results highlight the importance of domestic and long-term investor base (pension funds) in EM countries for financial stability. However, only two countries (South Africa and Chile) out of 23 EM countries in our dataset have pension fund assets-to-GDP ratios above OECD average (37.5%) (OECD (2014)). In this section, we discuss auto-enrollment policy option as an advise to increase the size of pension funds in EM countries.

5.1 Auto-Enrollment

To overcome lower participation rates in retirement systems, saving behaviour literature split into two camps : (i) financial education and (ii) auto-enrollment. While first one assumes that there is positive relationship between savings and financial education, latter one focuses on behavioral biases such as people's inertia and procrastination with proposing automatic enrollment as a nice middle course between fully voluntary saving arrangements and mandatory funded systems.

Although financial education is offered as a quite important solution for boosting retirement saving ratios, few studies have been able to actively demonstrate a compelling and direct relationship between financial education and savings behaviour (see, Choi et al. (2004) and Clark et al. (2012)). [1] [2] On the other hand, even the most financially literate countries among emerging markets (Mexico and Brazil) have

[1] Madrian and Shea (2001) estimates indicate that there are small but statistically significant effects of attendance at financial education seminars. Only 14% of attendees in financial education seminar tend to have increased rates of participation in the 401(k) plan.

[2] Bayer et al. (2009) estimate that financial education seminars was associated with a 12 percentage point increase in the participation rate of non-highly compensated workers and a six percentage point increase among highly compensated employees.

low participation rates in their retirement systems. [3]

In the second stream of the literature; behavioral economists have highlighted that the real issue is not just lack of financial knowledge, but a lack of action. While, there is some obligation to educate employees, there also has to be some acceptance that employees may not want to be educated, and that factors other than financial literacy (like behavioral tendencies) have a powerful impact on savings behaviour. In this field, behavioral economists introduce two underlying behavioral factors for explaining savings behavior; inertia and procrastination. To tackle with these two behavioral biases, automatic enrollment has become the most effective method to increase the participation rates. By changing the enrollment default from opt in to opt out, employees are automatically enrolled in the plan with a specified contribution rate and asset allocation, unless they actively choose not to participate (by opting out). A number of studies documented a dramatic increase in participation rates in retirement savings due to auto-enrollment practice and results indicate that; most of the members who are automatically enrolled tend to stay within the system. [4] [5]

In this section; we review the experiences of countries where automatic enrollment programmes were implemented at the national level: Italy, New Zealand, and United Kingdom, and in other countries where automatic enrollment applied to specific subsets of workers or plans: in Chile for self-employed workers, and in United States for certain occupational pension plans. Table IV provides a summary of the key features of auto-enrollment programmes in these countries.

In countries that have introduced automatic enrollment it is noted that design features differ by country as follows: (i) target population; while majority of the

[3]According to Visa and Magazine (2012); Brazil and Mexico having the most financially literate population among 28 nations. While, pension fund assets to GDP ratio is 13.3% for Brazil, it is 14.8% for Mexico.

[4]Madrian and Shea (2001) study shows that under auto-enrollment participation rates can increase from 36% to 86% for some companies.

[5]For other studies supporting the link between auto-enrollment and higher participation, see, Beshears et al. (2009), Choi et al. (2004), and Butrica and Karamcheva (2012).

working age-population covered in the auto-enrollment system for all countries, in U.S. only employees in 401(k) feature plans are enrolled in to the system, (ii) opting-out window; varies from 4 weeks (lowest- U.K.) to 3 years (highest- Chile) , (iii) default plan; majority of programmes include low-cost pension plans; (iv) contribution rates, all countries select contribution levels at different rates; (v) financial incentives; it's worth to mention the implementation of New Zealand here, with government fully matches up to NZD 10/week and kickstarts the account with NZD 1000, and vi) fund management fees; which U.S. have the lowest fund fee among other default plans. We summarize main parameters of auto-enrollment programmes in selected countries as below:

New Zealand: The highest coverage rate among voluntary pension systems observed in Kiwisaver pension scheme. Since the KiwiSaver was implemented in 2007, remarkable progress in membership has been achieved, with about 64.4% of the population under 65 being covered in 2013. We can introduce the financial incentives as one of most important underlying features behind the success of New-Zealand auto-enrollment experience. People decided to enter the Kiwisaver scheme because it was so heavily subsidised with government fully matches up to NZD 10/week and kickstarts the account with NZD 1000. Susan St John (2014).

U.K.: After the implementation of auto-enrollment system in U.K., 50% of employees were members of workplace pension schemes with opt-out rates below 10% as of 2013. While, all of the countries have a low-cost pension plan for auto-enrollment process, the most successful example can be considered as NEST plan. NEST has three significant advantages over other low-cost pension plans ; (i) NEST has a wider default fund choices compared with other pension plans; Higher Risk Fund, Lower Growth Fund, Ethical Fund, Sharia Fund and Pre-retirement fund selections with volatility targeting is available for every participant. (ii) it has the lowest charge among these plans with 0.40% total fee as of AUM. (NEST (2014)).

Italy: An automatic enrollment system into pension funds was introduced by law in Italy at the end of 2005 and implemented in the first half of 2007. However; Italy has achieved a limited success in auto-enrollment with a coverage rates; from 8.5% in 2006 to 15.9% in 2013. Rinaldi (2011) emphasizes 3 main arguments for explaining limited success of auto-enrollment : (i) mandatory payroll tax rates are high - 33% for employees, leaving little room for making additional contributions. (ii) all, the communication campaigns and education programmes promoted by public authorities, were deemed insufficient, and (iii) the way the default option was designed - (TFR, did not take into consideration the needs of the workers in different age categories (according to the life-cycle model)) (OECD (2014)).

These developed market examples show us that; besides determining contribution rate, target population, opt-out period and financial incentives; we should use 'sustainable default features' for savings and asset allocation for EM countries. Especially, as automatic enrollment makes use of the behavioral features of people's inertia and procrastination, default arrangements are a central element of the programme. Members tend generally to be passive and stay within the original fund and asset allocation (see, Thaler and Benartzi (2004)). [6] [7] In this aspect; 'Target Date Funds' can provide a good solution with de-risking asset allocation as retirement age approaches and take into consideration the needs of the workers in different age categories.

[6] Samuelson and Zeckhauser (1988) study reports that the median number of changes in the asset allocation over the lifetime was zero! They also tend to accept the initial contribution rate and asset allocation. That is why it is critically important for the governments to ensure that such default settings are appropriate, i.e. are cost effective and respond to the long-term saving needs of the members.

[7] This research also introduces auto-escalation programme- Save More Tomorrow- which increases default contribution rate as employees salary increase.

Table IV: Key Features of Auto-Enrollment Programmes

Auto- Enrollment Parameters						
	Non-financial Parameters			*Financial Parameters*		
	Target Population	*Opting-out window*	*Default Plan*	*Contribution Rate*	*Fin.Incentives*	*Fund Fee (%)*
Italy	All Empl.	6 months	TFR Plan	6.91%	Tax relief	-
New Zealand	New Empl.	6 weeks	Kiwisaver	3% up to 8%	NZD 10/week	0.55%
U.K.	22- State Pension Age	4 weeks	NEST	2% up to 8%	Tax relief	0.40%
Chile	Self-employed	3 years	-	10%	Tax incentives	0.41%
U.S.	401(k) plans	3 months	TSP	3%	Tax incentives	0.03%

Notes: This table introduces key features of auto-enrollment programmes in selected countries. (Italy, New Zealand, U.K., Chile and U.S.). We categorize auto-enrollment parameters into two types: Non-financial and Financial Parameters. Non-financial parameters include; target population, opting-out window and default plans. Financial parameters refer to; minimum contributon rates (% of salary), financial incentives, and default fund fees (% of AUM). Data is collected from OECD (2014), and Minifie (2014) sources. There is no example of auto-enrollment regimes at national-level for EM's. (Chile introduced auto-enrollment for only self-employed workers for a limited period of time.) Mexico and Turkey have policy implications on introducing auto-enrollment programmes.

CHAPTER VI

CONCLUSION

Financial markets have experienced substantial growth of foreign investor base in emerging market (EM) countries over the last decade. In the wake of financial crisis, large portfolio outflows by foreign investors exacerbated EM financial market illiquidity. At this point, financial economists has displayed an increasing attention on the importance of the long-term investors for financial stability. We contribute to this literature by analyzing the relationship between pension funds and stock market liquidity.

Using a panel data of 23 EM countries from 2004 to 2014, we perform a Panel Vector Auto Regression (P-VAR) analysis to measure the impact of pension funds on stock market liquidity, including sub-crisis periods (Global Financial Crisis and FED Tapering). We find that, while pension funds supply liquidity in stock markets, the provision of liquidity supply is stronger in crisis-periods. Furthermore, we also confirm the validity of our results with respect to other risk factors by employing a binary regression model.

Overall, our findings highlight the role of pension funds on financial stability, especially during times of market turmoil. Our results are in line with the previous literature that pension funds can play a stabilizing role in financial markets (Thomas et al. (2014); Bohl et al. (2009); Timmer (2016)). Policymakers may find these findings to address the importance of pension funds (long-term investors) in order to contribute to market liquidity and financial stability. Auto-enrollment reform may be perceived as an advice to increase pension fund size in EM countries.

APPENDIX A

A.1 Data Sources

The countries include Brazil, Chile, Colombia, Croatia, Czech Republic, Estonia, Hungary, Israel, Kazakhstan, Korea, Latvia, Lithuania, Mexico, Peru, Poland, Portugal, Romania, Russia, Slovenia, South Africa, Thailand, Turkey and Uruguay.

Table V: Data Sources of Pension Fund Assets

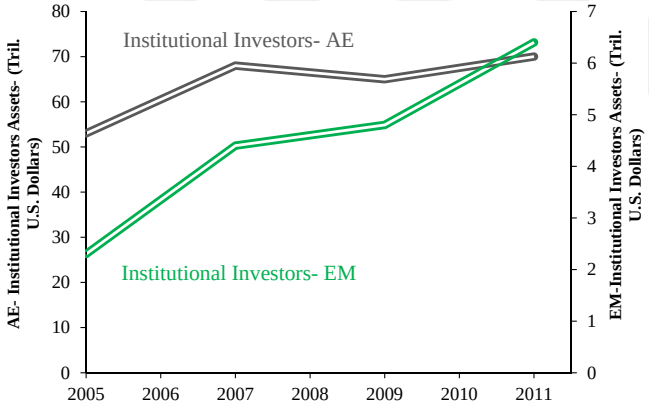
Country	Frequency	Source
Brazil	Quarterly-Monthly Interpolation	"ABRAPP"
Chile	Monthly	"Superintendencia de Pensiones"
Croatia	Monthly	"Croatian Financial Services Supervisory Agency"
Czech Republic	Quarterly-Monthly Interpolation	"Czech National Bank" (CNB)
Colombia	Monthly	"Superintendencia Financiera de Colombia"
Estonia	Quarterly-Monthly Interpolation	"OECD Global Pension Statistics"
Hungary	Quarterly-Monthly Interpolation	"OECD Global Pension Statistics "
Israel	Quarterly-Monthly Interpolation	"OECD Global Pension Statistics"
Kazakhstan	Monthly	"National Bank of Kazakhstan"
Korea	Quarterly-Monthly Interpolation	"OECD Global Pension Statistics"
Latvia	Quarterly-Monthly Interpolation	"OECD Global Pension Statistics "
Lithuania	Quarterly-Monthly Interpolation	"OECD Global Pension Statistics"
Mexico	Monthly	"CONSAR"
Peru	Monthly	"Superintendencia de Banca Seguros Y AFP"
Poland	Quarterly-Monthly Interpolation	"OECD Global Pension Statistics"
Portugal	Monthly	"APFIPP"
Romania	Monthly	"APAPR"
Russia	Monthly	"OECD Global Pension Statistics"
Slovenia	Quarterly-Monthly Interpolation	"Bank of Slovenia"
South Africa	Quarterly-Monthly Interpolation	"South African Reserve Bank"
Thailand	Monthly	"Thai Provident Fund"
Turkey	Monthly	"Pension Monitoring Center"
Uruguay	Monthly	"Banco Central Del Uruguay"

A.2 Descriptive Statistics

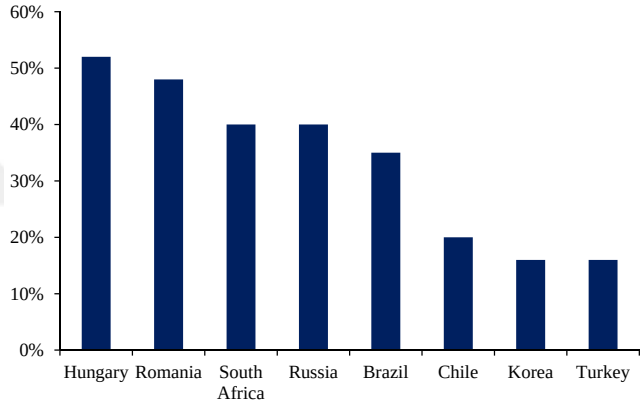
Table VI: Descriptive Statistics

Variable	Obs	Mean	Std	Min	Max
Stock Market Liquidity	2892	0,011	0,012	-0,054	0,086
Pension Fund Size (%)	2724	13,5	15,9	0,10	68,4
Credit Default Swap (CDS)	2131	152,38	142,59	4,09	1483,85
Exchange Rate	2904	214,26	487,04	1,175	2752,5
Inflation (%)	2904	5,2	3,3	1,1	20,2
GDP (billion USD dollars)	2904	392,284	519,773	7,172	2,815,75

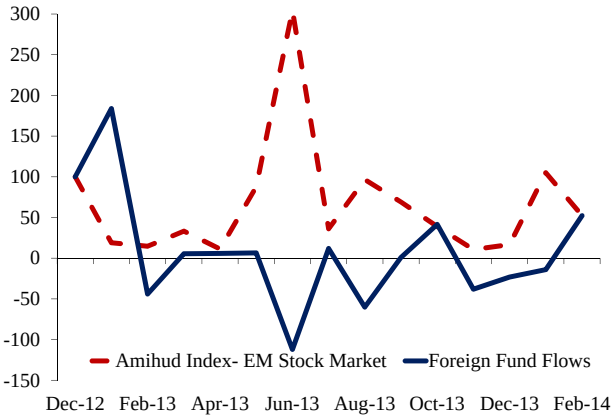
(a) Institutional Investors Assets in Advanced and EM Countries



(b) Foreign Investors Share in Stock Trading Volume (%)



(c) Foreign Fund Flows and Illiquidity Index in EM Stock Market



(d) Pension Funds and Foreign Fund Flows in FED Tapering

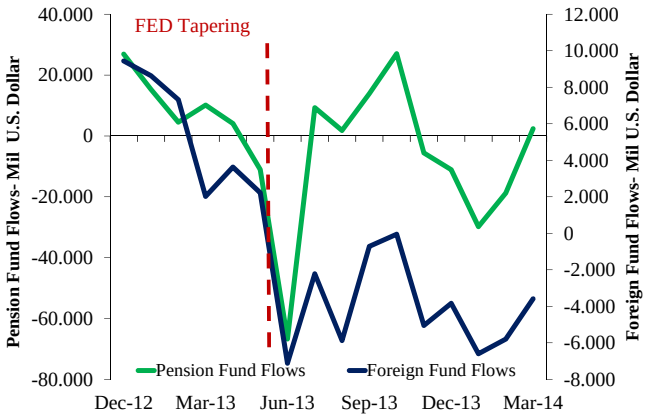
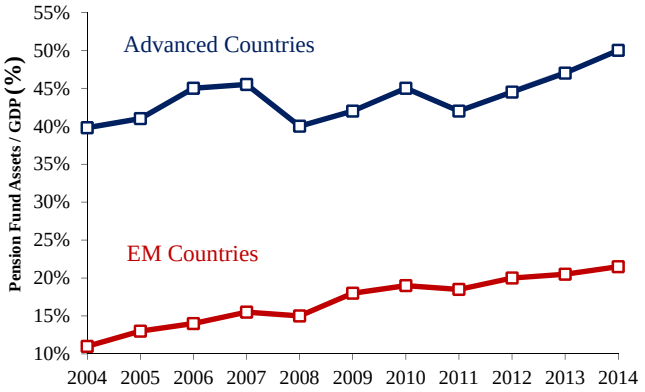
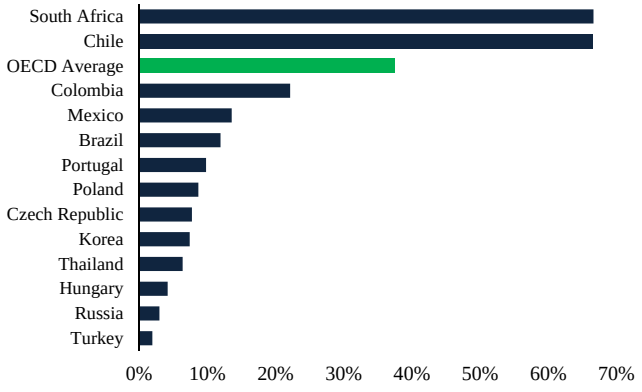


Figure III: Foreign Investors and Financial Crisis
The top left panel (Panel A) display total financial assets of institutional investors in AE and EM countries. Panel (B) shows foreign investors share in stock trading volume in selected EM countries. The bottom left panel (Panel C) displays relationship between foreign fund flows and EM stock market illiquidity index in FED Tapering. The bottom right panel (Panel D) shows pension fund flows and foreign fund flows during FED Tapering.

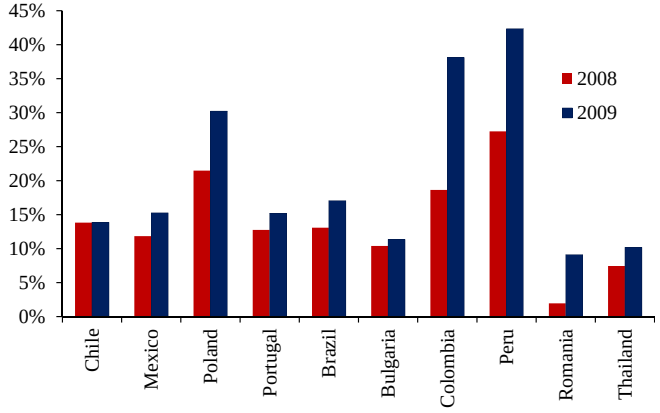
(a) Pension Fund Assets / GDP (% in selected country groups)



(b) Pension Fund Assets / GDP (% in selected EM Countries)



(c) Pension Fund Equity Investments in Global Financial Crisis (%)



(d) Pension Fund Equity Investments in Fed Tapering (%)

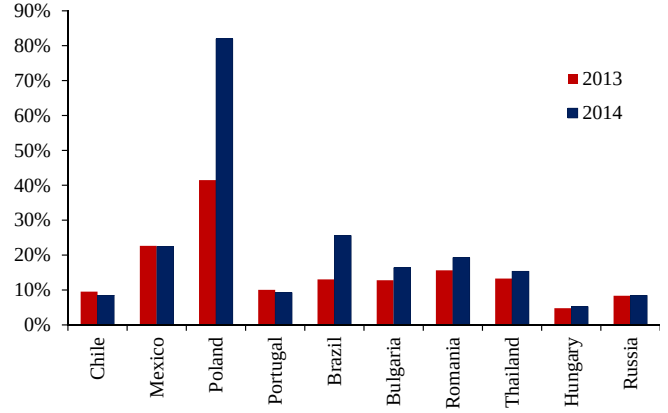


Figure IV: Pension Funds and Market Liquidity
The top left panel (Panel A) display pension fund assets to GDP ratio in in AE and EM countries. Panel (B) shows pension fund size in selected EM countries. The bottom left panel (Panel C) displays equity investments of pension funds before and after Global Financial Crisis. The bottom right panel (Panel D) shows equity investments of pension funds before and after Fed Tapering.

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