PENSION FUNDS AND STOCK MARKET LIQUIDITY

Evidence from Emerging Market Countries

By Seda Peksevim, PhD
The advantage of PFs over other institutional investors derives from the fact that their liabilities are long-term, i.e., their investments are funded by pensioners’ contributions. Because they also have predictable cash outflows, PFs are unlikely to face unanticipated short-term liquidity demands. These characteristics allow PFs to behave like deep-pocket investors who can buy a large amount of assets when prices drop and benefit from a subsequent price increase (Barajas and Catalan 2011; Schembri 2014). Therefore, the patient capital of PFs favors countercyclical investment strategies, i.e., buy low and sell high, particularly in times of crisis. They finance their investments with contributions and are not leveraged. In fact, PFs are major providers of liquidity and collateral to the financial system, even in times of market stress (Financial Stability Board 2014). According to OECD...
This study contributes to the existing empirical literature in the following ways. First, it complements the recent PFs and financial stability literature, which has focused mainly on the effects of PFs on financial market volatility and capital market development (Lakonishok et al. 1992; Rocholl and Niggemann 2010). This study presents evidence of market liquidity provision by PFs in EM countries, for which there exists only limited research (Walker and Lefort 2002; Bohl et al. 2009; Thomas et al. 2014).

Second, the reported findings add new evidence to the institutional investors and market liquidity literature focusing on financial crises (e.g., Anand et al. 2013; Ciarlone and Miceli 2016; Timmer 2018). Concurring with these papers, this study shows that PFs, as long-term investors, play a stabilizing role in stock markets during crisis periods.

Finally, these findings offer useful insights for policy-makers in EM countries in particular, implying that PFs are crucial for maintaining the liquidity of stock markets. To that end, EM governments can try to automatically enroll new participants in pension plans, i.e., use automatic enrollment to increase the size of PFs in their economies (Madrian and Shea 2001; Choi et al. 2004).

**LITERATURE REVIEW**

**PFs AND FINANCIAL STABILITY**

The relationship between PFs and financial stability received attention starting with Reilly and Wachowicz (1979) and Lakonishok et al. (1992), which noted that PFs may stabilize market prices by acting in a countercyclical way, i.e., buying low and selling high. According to such a view, these institutional investors bring market prices closer to their fundamentals by buying up fire-sale assets in anticipation of benefit from future price gains. The majority of empirical studies until the past decade focused on the U.S. market and analyzed PFs along with other institutional investors and market liquidity literature focusing on financial crises (e.g., Anand et al. 2013; Ciarlone and Miceli 2016; Timmer 2018). Concurring with these papers, this study shows that PFs, as long-term investors, play a stabilizing role in stock markets during crisis periods.

Given the growing presence of PFs, financial researchers started paying attention to their role in EM countries over the past decade. The existing literature in this area mainly consists of two groups of studies. The first group examines the effect of PFs on stock market volatility and concludes that given their long-term liability structure, PFs can absorb short-term market fluctuations and diversify financial risks over time (see table 1) (for Poland: Bohl et al. 2009; for China: Li and Wang 2010; for OECD countries: Thomas et al. 2014; for developing countries: Xue et al. 2021). For example, using a Markov-Switching GARCH model, Bohl et al. (2009) show that the volatility of the Polish stock market diminished after the first entrance of PFs.

The results indicate that the effect of PFs on liquidity measures is equally significant during crisis times.

The results reveal a robust negative relationship between PFs and two stock market illiquidity measures, Zeros and Amihud. Furthermore, the study explores whether the effect of PFs on market liquidity is time-varying, particularly during times of market stress, by focusing on two recent crisis periods: GFC and EDC. The results indicate that the effect of PFs on liquidity measures is equally significant during crisis times. Moreover, the results are robust to (1) a sample split, i.e., European Union (EU) versus non-EU countries, (2) excluding crisis periods, (3) alternative control variables, (4) outlier countries, and (5) endogeneity bias. Overall, the findings are consistent with the earlier literature documenting that PFs provide market liquidity and enhance financial stability (Anand et al. 2013; Timmer 2018).

This study investigates the effect of PFs on stock market liquidity using panel data for seventeen EM countries during 2006–2019. This effect is evaluated based on three measures—the Zeros measure of Lesmond et al. (1999), Roll’s measure of Roll (1984), and the Amihud illiquidity ratio measure of Amihud (2002)—capturing the resiliency, tightness, and depth dimensions of market liquidity (Lesmond 2005). The empirical analysis is performed using the Prais-Winsten fixed-effects regression with panel-corrected standard errors (PCSEs) and includes multiple robustness checks.

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into capital markets. Similarly, Thomas et al. (2014) find that PFs can dampen stock market volatility in thirty-four OECD countries over the period 2004–2014.

The second group of papers investigates the impact of PFs on capital market development (see table 2). Thanks to their long-term investment horizon, PFs can invest in illiquid assets and thereby provide a long-term supply of funds to capital markets (Impavido et al. 2003; Meng and Pfau 2010; Nageri et al. 2019). Additionally, they improve the depth of stock and bond markets by increasing the demand for financial assets and strengthening the domestic investor base (Walker and Lefort 2002; Raddatz and Schmukler 2008; Rocholl and Niggemann 2010). For example, using Granger causality tests, Walker and Lefort (2002) investigate the impact of pension reforms on capital markets in seven Latin American countries and find that the savings accumulated by PFs can promote development. Similarly, using a unique list of eighty-seven PF reforms in fifty-seven countries between 1976 and 2007, Rocholl and Niggemann (2010) find that stock and bond market capitalization increased after the reforms and relative to other countries with no reforms. Besides these quantitative effects, PFs also can enhance transparency in financial markets and improve corporate governance practices (Davis 2002).

**INSTITUTIONAL INVESTORS AND MARKET LIQUIDITY**

The GFC has highlighted the role of liquidity in the stability of financial markets (Allen and Carletti 2008; Brunnermeier and Pedersen 2009; Gorton and Metrick 2010). A growing number of empirical studies focus on the market behavior of institutional investors and their impact on liquidity during crisis periods. Most studies in this field examine the impact of leveraged institutional investors such as mutual funds, investment banks, and hedge funds on market liquidity. The common thread among these studies is the notion that due to their short-term liability structure, these financial institutions may be forced to sell their assets at fire sale prices to meet investor redemptions, thereby exacerbating market illiquidity (for mutual funds: Fratzscher 2012, Broner et al. 2013; for investment banks: Adrian and Shin 2010, Jotikasthira et al. 2012, Goldstein et al. 2017; for hedge funds: Aragon and Strahan 2012, Franzoni and Plazzi 2012).

In the past few years, additional research has been conducted on the stabilizing role of domestic and long-term investors that have the potential to exploit the liquidity shortage faced by other investors, mainly foreign and leveraged investors (Alberola et al. 2016; Adler et al. 2016). Considering structural characteristics, such as a long-term investment horizon and the absence of unexpected withdrawals, several studies focus on...
the behavior of long-term investors during the financial crisis. Manconi et al. (2012), Merrill et al. (2014), Ellul et al. (2014), Becker and Ivashina (2015), and Bijlsma and Vermeulen (2016) offer evidence confirming a countercyclical role of insurance companies, and Clark and Monk (2010), Raymond (2010), and Ciarlone and Miceli (2016) provide similar evidence regarding sovereign wealth funds. Although these studies reveal an important connection between long-term investors and market liquidity, their empirical evidence is based on a single country, mainly the United States.

First, it complements the PFs and financial stability literature by investigating the impact of PFs on market liquidity in EM countries. Second, it evaluates whether PFs, as long-term investors, provide liquidity to financial markets during financial crisis times.

To our knowledge, only a handful of papers examine the effect of PFs on market liquidity and financial stability. Furthermore, most of these studies focus on developed markets using trade-level data (see table 3) (for the United States: Anand et al. 2013; for the United Kingdom: Blake et al. 2017; for Germany: Timmer 2018). For example, Timmer (2018) uses unique security-level data from Germany and finds that, although banks and investment funds behave procyclically in financial markets, insurance companies and PFs act countercyclically. More importantly, from the point of view of the present study, none of the mentioned papers assesses whether the liquidity supplied by PFs varies during times of market stress.

This study contributes to the two streams of literature in the following ways. First, it complements the PFs and financial stability literature by investigating the impact of PFs on market liquidity in EM countries. Second, it evaluates whether PFs, as long-term investors, provide liquidity to financial markets during financial crisis times.

DATA DESCRIPTION
I construct a quarterly panel dataset for seventeen EM countries (Brazil, Chile, Colombia, Croatia, Czech Republic, Estonia, Hungary, Korea, Latvia, Lithuania, Mexico, Peru, Poland, Slovenia, South Africa, Thailand, and Turkey) over the period from 2006Q1 to 2019Q4. The number of countries and the time period depend mainly on the availability of the PFs’ equity investment data. Table 4 lists the variables employed in this study, along with definitions and sources.

PFs’ EQUITY HOLDINGS
To examine the relationship between PFs and stock market liquidity, I use the share of PFs’ assets invested in equities (PF) as an explanatory variable. The PFs’ equity allocation by country is collected mainly from the OECD Global Pension Statistics Database and the International Association of Pension Fund Supervisors (AIOS). For four countries, I use data from national supervisory authorities: ABRAPP (Brazil), South African Reserve Bank (South Africa), Thai Provident Fund (Thailand), and Takasbank (Turkey). The sample includes stocks in defined contribution (DC) pension plans, which can be both mandatory or voluntary. Overall, the data account for more than 70 percent of DC PF assets in EM countries.

To my knowledge, this is the broadest dataset of EM PFs’ equity holdings in terms of the number of countries and data frequency. Previous studies using the same data focused mostly on one-country analysis (for Poland: Zalewska 2006; for the United States: Mohan and Zhang 2014, Bradley et al. 2016; for developed markets: Dreassi et al. 2017, Boon et al. 2018). The closest dataset to this study is constructed by Thomas et al. (2014), which uses the annual share of PF assets invested in equities as an explanatory variable for OECD countries. Taking advantage of a quarterly panel dataset, this study examines the effect of PFs on stock market liquidity based on a higher number of observations.

Table 5 shows the snapshot picture of EM PF portfolios for the countries in the sample. Over the ten-year period 2009-2019, the average PF size (PF assets as a percentage of GDP) increased from 16.4 percent to 24.2 percent, but PFs’ share in equities declined from 15.6 percent to 13.6 percent. In terms of the PF size, the biggest PF market by the end of 2019 is reported in South Africa (95.1 percent) and Chile (80.8 percent). On the other hand, in Thailand, PF assets represent less than 10 percent of the GDP. Currently, the highest share of PF assets invested in stocks is observed in Poland (82.4 percent). On the other hand, Korea, Lithuania, and the
## VARIABLE DEFINITIONS AND SOURCES

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Source</th>
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</thead>
<tbody>
<tr>
<td>ZEROS</td>
<td>Quarterly Zeros measure: = (# of days with zero returns) / T where T is the number of trading days in a quarter.</td>
<td>Datastream</td>
</tr>
<tr>
<td>ROLL</td>
<td>Quarterly Roll measure: [ ROLL = \frac{2 \sqrt{-\text{cov}(\Delta P_t, \Delta P_{t-1})}}{\text{cov}(\Delta P_t, \Delta P_{t-1})} ] if [ \text{cov}(\Delta P_t, \Delta P_{t-1}) &lt; 0 ] [ ROLL = 0 ] if [ \text{cov}(\Delta P_t, \Delta P_{t-1}) \geq 0 ] where ( \Delta P_t ) and ( \Delta P_{t-1} ) are the changes in daily closing prices from ( t ) to ( t-1 ) and ( t-1 ) to ( t-2 ), respectively.</td>
<td>Datastream</td>
</tr>
<tr>
<td>AMIHUD</td>
<td>Quarterly Amihud measure: [ AMIHUD = \ln \left( 1 + \frac{</td>
<td>R_t</td>
</tr>
<tr>
<td>PF</td>
<td>The share of PFs’ equity investments in the total portfolio (%)</td>
<td>OECD Global Pension Statistics Database, International Association of Pension Fund Supervisors (AIOS), Associação Brasileira das Entidades Fechadas de Previdência Complementar (ABRAPP), South African Reserve Bank, Thai Provident Fund, Takasbank</td>
</tr>
<tr>
<td>CRISISGFC</td>
<td>A dummy variable equal to 1 for the crisis period (2008–2009) and 0 otherwise</td>
<td>The author</td>
</tr>
<tr>
<td>CRISISEDC</td>
<td>A dummy variable equal to 1 for the crisis period (2010–2011) and 0 otherwise</td>
<td>The author</td>
</tr>
<tr>
<td>PF*CRISISGFC</td>
<td>The interaction term between pension funds’ equity investments (PF) and a crisis dummy variable (CRISISGFC)</td>
<td>The author</td>
</tr>
<tr>
<td>PF*CRISISEDC</td>
<td>The interaction term between pension funds’ equity investments (PF) and a crisis dummy variable (CRISISEDC)</td>
<td>The author</td>
</tr>
<tr>
<td>RET</td>
<td>The quarterly percentage change in the average stock market index</td>
<td>Datastream</td>
</tr>
<tr>
<td>VOL</td>
<td>The quarterly standard deviation of returns on the average stock market index</td>
<td>Datastream</td>
</tr>
<tr>
<td>SMCAP</td>
<td>The natural logarithm of the quarterly stock market capitalization</td>
<td>Datastream</td>
</tr>
<tr>
<td>PFA/VO</td>
<td>The ratio of the PF assets to the volume of the stock market index</td>
<td>OECD Global Pension Statistics Database, International Association of Pension Fund Supervisors (AIOS), Associação Brasileira das Entidades Fechadas de Previdência Complementar (ABRAPP), South African Reserve Bank, Thai Provident Fund, Takasbank, and Datastream</td>
</tr>
<tr>
<td>INT</td>
<td>The quarterly interest rate on the 10-year government debt index</td>
<td>IMF International Financial Statistics</td>
</tr>
<tr>
<td>GDP</td>
<td>The quarterly growth rate of the real GDP</td>
<td>IMF International Financial Statistics</td>
</tr>
<tr>
<td>CPI</td>
<td>The quarterly percentage change of the consumer price index</td>
<td>IMF International Financial Statistics</td>
</tr>
</tbody>
</table>

Czech Republic allocate less than 1 percent of their assets to equities.

**STOCK MARKET LIQUIDITY MEASURES**

To calculate stock market liquidity measures for each country, I compile a list of stocks from major exchanges that have the largest total market capitalization for each country. I include only common stocks denominated in the local currency and discard other types of equity securities, such as exchange-traded funds (ETFs), real estate investment trusts (REITs), preferred shares, and closed-end funds. To avoid the survivorship bias, all data is extracted both for active as well as inactive stocks that have been merged or delisted throughout the sample period. Following this data screening procedure for each individual stock, I collect the daily total return index (\( R_I \)), the daily adjusted closing price denominated in the local currency (\( P \)), the daily turnover volume measured by the total number of shares traded (\( V_O \)), and the quarterly market capitalization at the beginning of each quarter in U.S. dollars (\( M^V \)) from Datastream.
Following Ince and Porter (2006), Griffin et al. (2010), and Schmidt et al. (2015), several data filtering steps are applied. First, any day is treated as a non-trading day in which more than 90 percent of stocks have zero returns for a given exchange. Second, individual stocks with a proportion of zero-return days higher than 80 percent in a given quarter are removed. Third, any daily observations are deleted if the total RI for either the current day or the prior day is less than 0.01. Fourth, stock-month observations in the upper and lower 0.1 percent of the cross-sectional distribution for a given country are eliminated. Finally, stock-quarter observations are discarded if the stock returns of firm i in quarter t or t-1 are greater than or equal to 300 percent.

This study examines three different dimensions of market liquidity proposed in the theoretical literature: resiliency, tightness, and depth (Kyle 1985). Based on daily data, I construct the following three quarterly illiquidity measures: the Zeros measure of Lesmond et al. (1999) that indicates the percentage of zero trading days (resiliency), Roll’s measure of Roll (1984) as a proxy of trading costs (tightness), and Amihud illiquidity ratio of Amihud (2002) that captures the price impact of trades (depth).

**Zeros measure**

Lesmond et al. (1999) introduce a market liquidity measure based on the proportion of zero-return days in a trading period. The economic intuition behind this measure is that a rational and informed investor will engage in trading activity only if the market transaction costs are less than the value of a new information signal. In the opposite case, where there is a net loss from trading, investors will choose not to trade, leading to a higher frequency of zero-return days. Therefore, the frequency of zero-return days implicitly indicates higher transaction costs from trading. I estimate the Zeros measure as follows:

$$\text{ZEROS} = \frac{\# \text{ of days with zero returns}}{T}$$

where $T$ represents the total number of trading days in a quarter.

This liquidity measure is computed for each quarter and every stock in the sample. Then the average value of all the stocks is estimated to obtain the aggregate liquidity measure for each country.

**Roll measure**

Roll (1984) proposes an effective bid-ask measure that addresses the tightness dimension of market liquidity. This measure is based on the insight that under the efficient market assumption and stationary price changes, transitory movements in asset prices arise from a bid-ask bounce, whereas random buy and sell orders cause transaction prices to fluctuate between bid and ask prices. A bid-ask bounce leads to negatively serially correlated price changes, so the effective bid-ask spread can be proxied by the covariance...
As the third group of variables in the dataset, I employ a set of financial and macroeconomic control variables. Following the existing literature on stock market liquidity determinants (Lee et al. 2016; Aouadi et al. 2018; Ma et al. 2019), I include quarterly stock market returns ($RET$), quarterly standard deviation, i.e., volatility, of daily stock market returns ($VOL$), the natural logarithm of the stock market capitalization ($SMCAP$), and PF assets-to-volume ($PF/VO$) variables.

All data is obtained from Datastream and regulatory agencies. Regarding the macroeconomic variables, I employ interest rate ($INT$), real GDP growth ratio ($GDP$), and inflation rate ($INF$) derived from the IMF International Financial Statistics (Debata et al. 2018; Lee and Chou 2018).

This study also aims to examine whether the liquidity supplier role of PFs differs in crisis and non-crisis times. To this end, I introduce two dummy variables, $CRISISGFC$ and $CRISISEDC$, that take the value of 1 for the years 2008–2009 (GFC) and 2010–2011 (EDC), respectively, and 0 otherwise. I use these dummy variables with PF equity investments ($PF*CRISISGFC$ and $PF*CRISISEDC$) to assess the additional impact of PFs on stock market liquidity during crisis times relative to non-crisis periods. Table 6 presents the summary statistics of all the variables used in this study.

### EMPIRICAL METHODOLOGY

I analyze the effect of PFs on stock market liquidity using the following panel regression model:

$$ Liq_{it} = a_1 + \beta_1 PF_{it} + \beta_2 CRISISGFC_{it} + \beta_3 CRISISEDC_{it} + \beta_4 PF_{it} \times CRISISGFC_{it} + \beta_5 PF_{it} \times CRISISEDC_{it} + \beta_6 X_{it} + \epsilon_{it}. $$

### CONTROL VARIABLES

As the third group of variables in the dataset, I employ a set of financial and macroeconomic control variables. Following the existing literature on stock market liquidity determinants (Lee et al. 2016; Aouadi et al. 2018; Ma et al. 2019), I include quarterly stock market returns ($RET$), quarterly standard deviation, i.e., volatility, of daily stock market returns ($VOL$), the natural logarithm of the stock market capitalization ($SMCAP$), and PF assets-to-volume ($PF/VO$) variables.
where \( LIQ_{it} \) is one of the three market illiquidity measures described earlier (Zeros, Roll, and Amihud) for country \( i \) at time \( t \); \( PF_{it} \) is PFs’ equity investments; \( X'_{it} \) is a matrix of control variables (financial and macroeconomic); \( a_i \) is the country \( i \) fixed effect and \( u_{it} \) is the error term.

In this panel regression framework, I use two crisis dummies: \( CRISISGFC_i \) and \( CRISISED_i \), where each dummy is equal to 1 during the 2008–2009 and 2010–2011 crisis years, respectively, and 0 for the other years. The crisis dummies model the difference in market liquidity between the crisis years and the average of the non-crisis years. I also use the crisis dummies with the PFs’ equity investments variable (\( PF_{it} \ast CRISISGFC_i \) and \( PF_{it} \ast CRISISED_i \)) to analyze whether PFs’ impact on stock market liquidity is different during crisis periods.

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Before moving to the results, the following panel regression tests are performed. First, I conduct a Hausman (1978) test to decide between fixed-effects and random-effects estimation methods. The test result favors the use of the fixed-effects approach for three illiquidity measures.1 Next, I use a number of diagnostic tests to identify potential serial correlation, heteroskedasticity, and cross-sectional dependence problems in the panel data. I employ a Wooldridge (2010) test to check the presence of first-order serial correlation in the residuals. The null hypothesis is rejected for all three liquidity measures.2 To account for the possibility of heteroskedasticity in the residuals’ distribution, I use a likelihood ratio (LR) test suggested by Wiggins and Poi (2003). The results provide evidence of heteroskedasticity for Zeros and Roll measures.3 Finally, I employ the test statistic proposed by Pesaran (2015) to check the cross-sectional dependence in the panel data. The results suggest the presence of cross-sectional dependence in the residuals for Zeros and Amihud measures.4

To summarize the test results, the data is prone to serial correlation, heteroskedasticity, and cross-sectional dependence. In order to address these issues, following the studies of Thomas et al. (2014) and Xue et al. (2021), I estimate a fixed-effects Prais and Winsten (1954) regression model with PCSEs.

**RESULTS**

Table 7 presents the results for the fixed-effects Prais–Winsten panel regression model with PCSEs. Overall, the results indicate that PF and stock market illiquidity are negatively correlated at the 1-percent level for Zeros and Amihud measures, whereas there is no significance for the Roll measure. Crisis dummies are insignificant because they are likely to be proxied by other variables such as GDP growth, and a crisis is defined as a contraction of the economy. The interaction terms \( PF \ast CRISISGFC \) and \( PF \ast CRISISED \) are not statistically significant, indicating that the effect of PFs on stock market liquidity does not differ between crisis and non-crisis times.

Stock market returns (\( RET \)) are statistically significant only for the Roll illiquidity measure, with the negative sign of the coefficient indicating that the markets are less liquid when stock prices are declining. Higher volatility (\( VOL \)) reduces the Zeros measure, because there is a higher probability that the prices will change when volatility is high. On the contrary, higher volatility, which is associated with the tendency of prices to oscillate around the mean, positively affects the Roll measure based on mean reversion. The Amihud illiquidity measure shows only a statistically weak correlation with volatility. Stocks with a higher capitalization demonstrate a higher liquidity captured by all three measures, as expected, whereas the \( PFA/VOL \) ratio is not significant for any of these measures.

Interest rates and inflation have a significant effect only on the Zeros and Amihud illiquidity measures. A higher interest rate leads to drying-up liquidity because money is rotated from the stock market to the bond market, which becomes more attractive due to increased yields. On the contrary, a higher inflation rate makes the stock market relatively more attractive and liquid, because the bond market offers reduced yields when inflation is high. Higher GDP growth rates negatively affect liquidity when it is measured using the Roll measure, because the prices tend to trend over longer periods when economic conditions are good, reducing the likelihood of mean reversion. On the contrary, liquidity is increased when measured by the Amihud measure, because prices are likely to experience a slower, steadier rise on the same volume during economic expansion compared to contraction. There is no statistically significant correlation between the real GDP growth and the Zeros measure.

**ROBUSTNESS CHECKS**

**SAMPLE SPLIT—EU AND NON-EU COUNTRIES**

To check the robustness of the results, the Prais–Winsten regression model for the three illiquidity measures is additionally estimated for EU and non-EU countries. Similar to the baseline results (see table 7), PFs also contribute to stock market liquidity when analyzed separately for EU (see table 8) and non-EU countries (see table 9). Moreover, in the EU
and non-EU context, PFs’ liquidity provision does not differ during crisis and non-crisis times, based on the interaction terms in tables 8 and 9. Most of the coefficient signs of the control variables remain similar for EU and non-EU countries, with the exception of the share of PFs’ assets in the stock market volume (PFA/VO). The model explanatory power is lower for non-EU compared to EU countries due to more proclaimed differences between non-EU countries.
<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Zeros</th>
<th>Roll</th>
<th>Amihud</th>
</tr>
</thead>
<tbody>
<tr>
<td>PF</td>
<td>−1.0385***</td>
<td>−0.0137</td>
<td>−0.6704***</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.359]</td>
<td>[0.001]</td>
</tr>
<tr>
<td>CRISISGFC</td>
<td>−0.0476</td>
<td>0.0053</td>
<td>−0.0101</td>
</tr>
<tr>
<td></td>
<td>[0.337]</td>
<td>[0.164]</td>
<td>[0.591]</td>
</tr>
<tr>
<td>CRISISEDC</td>
<td>−0.5268</td>
<td>−0.0003</td>
<td>−0.0387</td>
</tr>
<tr>
<td></td>
<td>[0.193]</td>
<td>[0.850]</td>
<td>[0.339]</td>
</tr>
<tr>
<td>PF*CRISISGFC</td>
<td>1.0362</td>
<td>0.0858</td>
<td>0.3484</td>
</tr>
<tr>
<td></td>
<td>[0.127]</td>
<td>[0.231]</td>
<td>[0.160]</td>
</tr>
<tr>
<td>PF*CRISISEDC</td>
<td>0.6178</td>
<td>0.0024</td>
<td>0.7470</td>
</tr>
<tr>
<td></td>
<td>[0.261]</td>
<td>[0.930]</td>
<td>[0.168]</td>
</tr>
<tr>
<td>RET</td>
<td>0.0489</td>
<td>−0.0063*</td>
<td>0.0090</td>
</tr>
<tr>
<td></td>
<td>[0.120]</td>
<td>[0.076]</td>
<td>[0.547]</td>
</tr>
<tr>
<td>VOL</td>
<td>0.1651***</td>
<td>−0.0003</td>
<td>−0.0566*</td>
</tr>
<tr>
<td></td>
<td>[0.006]</td>
<td>[0.953]</td>
<td>[0.095]</td>
</tr>
<tr>
<td>SMCAP</td>
<td>0.0129***</td>
<td>−0.0211***</td>
<td>−0.0181***</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.001]</td>
</tr>
<tr>
<td>PF/VOL</td>
<td>−0.0279**</td>
<td>−0.0003</td>
<td>−0.0326***</td>
</tr>
<tr>
<td></td>
<td>[0.011]</td>
<td>[0.349]</td>
<td>[0.001]</td>
</tr>
<tr>
<td>INT</td>
<td>−0.3904</td>
<td>0.0497***</td>
<td>−0.3397</td>
</tr>
<tr>
<td></td>
<td>[0.307]</td>
<td>[0.005]</td>
<td>[0.505]</td>
</tr>
<tr>
<td>GDP</td>
<td>−0.2640</td>
<td>−0.0236</td>
<td>−0.2383</td>
</tr>
<tr>
<td></td>
<td>[0.420]</td>
<td>[0.453]</td>
<td>[0.109]</td>
</tr>
<tr>
<td>INF</td>
<td>0.7486*</td>
<td>0.0557***</td>
<td>−0.2010</td>
</tr>
<tr>
<td></td>
<td>[0.100]</td>
<td>[0.009]</td>
<td>[0.565]</td>
</tr>
<tr>
<td>sConstant</td>
<td>0.4229***</td>
<td>0.0098***</td>
<td>−0.0324</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.362]</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.75</td>
<td>0.47</td>
<td>0.49</td>
</tr>
</tbody>
</table>

Note: Robust p-values are indicated in brackets. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively.
<table>
<thead>
<tr>
<th>ROBUSTNESS CHECK: RESULTS FOR THE NON-EUROPEAN UNION COUNTRIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Variable</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>PF</td>
</tr>
<tr>
<td>CRISISGFC</td>
</tr>
<tr>
<td>CRISISEDC</td>
</tr>
<tr>
<td>PF*CRISISGFC</td>
</tr>
<tr>
<td>PF*CRISISEDC</td>
</tr>
<tr>
<td>RET</td>
</tr>
<tr>
<td>VOL</td>
</tr>
<tr>
<td>SMCAP</td>
</tr>
<tr>
<td>PFA/VOL</td>
</tr>
<tr>
<td>INT</td>
</tr>
<tr>
<td>GDP</td>
</tr>
<tr>
<td>INF</td>
</tr>
<tr>
<td>Constant</td>
</tr>
<tr>
<td>$R^2$</td>
</tr>
</tbody>
</table>

Note: Robust p-values are indicated in brackets. ***, **, and * indicate significance at the 1-percent, 5-percent, and 10-percent levels, respectively.
## Robustness Check: Excluding Crisis Periods

Table 10 includes the estimation of the same three illiquidity measures for non-crisis periods only. In accordance with Table 7, the positive effect of PFs on stock market liquidity also is confirmed (although the result becomes insignificant for the Roll measure). The crisis dummies and their interaction terms are insignificant, indicating that PFs’ liquidity provision does not differ between crisis and non-crisis times. The coefficient signs at the control variables remain highly consistent with the baseline regression results.

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Zeros</th>
<th>Roll</th>
<th>Amihud</th>
</tr>
</thead>
<tbody>
<tr>
<td>PF</td>
<td>-0.4036***</td>
<td>-0.0002</td>
<td>-0.2185***</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.912]</td>
<td>[0.000]</td>
</tr>
<tr>
<td>RET</td>
<td>-0.5902</td>
<td>-0.0045</td>
<td>-0.0009</td>
</tr>
<tr>
<td></td>
<td>[0.211]</td>
<td>[0.154]</td>
<td>[0.884]</td>
</tr>
<tr>
<td>VOL</td>
<td>0.4783***</td>
<td>-0.0113*</td>
<td>0.0065</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.069]</td>
<td>[0.605]</td>
</tr>
<tr>
<td>SMCP</td>
<td>0.0665***</td>
<td>-0.0043***</td>
<td>-0.0261***</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.000]</td>
</tr>
<tr>
<td>PFA/VO</td>
<td>0.0054*</td>
<td>0.0005***</td>
<td>0.0008***</td>
</tr>
<tr>
<td></td>
<td>[0.054]</td>
<td>[0.000]</td>
<td>[0.000]</td>
</tr>
<tr>
<td>INT</td>
<td>3.3452***</td>
<td>0.0224</td>
<td>0.0966*</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.240]</td>
<td>[0.056]</td>
</tr>
<tr>
<td>GDP</td>
<td>0.1712</td>
<td>0.0331</td>
<td>0.0177</td>
</tr>
<tr>
<td></td>
<td>[0.735]</td>
<td>[0.262]</td>
<td>[0.781]</td>
</tr>
<tr>
<td>INF</td>
<td>0.4953</td>
<td>-0.0203</td>
<td>-0.0601</td>
</tr>
<tr>
<td></td>
<td>[0.250]</td>
<td>[0.184]</td>
<td>[0.186]</td>
</tr>
<tr>
<td>Constant</td>
<td>0.2425***</td>
<td>0.0127***</td>
<td>0.0155***</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.000]</td>
</tr>
<tr>
<td>R²</td>
<td>0.75</td>
<td>0.35</td>
<td>0.40</td>
</tr>
</tbody>
</table>

Note: Robust p-values are indicated in brackets. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively.
### Robustness Check: Additional Control Variable—GDP per Capita

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Zeros</th>
<th>Roll</th>
<th>Amihud</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PF</strong></td>
<td>−0.4490***</td>
<td>−0.0029</td>
<td>−0.2165***</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.159]</td>
<td>[0.002]</td>
</tr>
<tr>
<td><strong>CRISISGFC</strong></td>
<td>−0.0133</td>
<td>−0.0009</td>
<td>−0.0035</td>
</tr>
<tr>
<td></td>
<td>[0.403]</td>
<td>[0.418]</td>
<td>[0.804]</td>
</tr>
<tr>
<td><strong>CRISISEDC</strong></td>
<td>0.0056</td>
<td>−0.0004</td>
<td>−0.0011</td>
</tr>
<tr>
<td></td>
<td>[0.607]</td>
<td>[0.689]</td>
<td>[0.951]</td>
</tr>
<tr>
<td><strong>PF*CRISISGFC</strong></td>
<td>0.07185</td>
<td>−0.0006</td>
<td>0.0318</td>
</tr>
<tr>
<td></td>
<td>[0.165]</td>
<td>[0.850]</td>
<td>[0.503]</td>
</tr>
<tr>
<td><strong>PF*CRISISEDC</strong></td>
<td>0.0399</td>
<td>0.0018</td>
<td>0.0150</td>
</tr>
<tr>
<td></td>
<td>[0.341]</td>
<td>[0.607]</td>
<td>[0.812]</td>
</tr>
<tr>
<td><strong>RET</strong></td>
<td>0.0215</td>
<td>−0.0035**</td>
<td>−0.0067</td>
</tr>
<tr>
<td></td>
<td>[0.150]</td>
<td>[0.031]</td>
<td>[0.549]</td>
</tr>
<tr>
<td><strong>VOL</strong></td>
<td>0.1541***</td>
<td>0.0080**</td>
<td>−0.0450</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.012]</td>
<td>[0.108]</td>
</tr>
<tr>
<td><strong>SMCAP</strong></td>
<td>0.0591***</td>
<td>−0.0010***</td>
<td>−0.0285***</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.001]</td>
<td>[0.000]</td>
</tr>
<tr>
<td><strong>PFA/VO</strong></td>
<td>0.0041</td>
<td>0.0002**</td>
<td>−0.0080**</td>
</tr>
<tr>
<td></td>
<td>[0.184]</td>
<td>[0.044]</td>
<td>[0.028]</td>
</tr>
<tr>
<td><strong>INT</strong></td>
<td>0.1871</td>
<td>0.0198</td>
<td>−0.7488</td>
</tr>
<tr>
<td></td>
<td>[0.692]</td>
<td>[0.302]</td>
<td>[0.301]</td>
</tr>
<tr>
<td><strong>GDP</strong></td>
<td>0.3958***</td>
<td>0.0516***</td>
<td>−0.2879**</td>
</tr>
<tr>
<td></td>
<td>[0.002]</td>
<td>[0.000]</td>
<td>[0.014]</td>
</tr>
<tr>
<td><strong>INF</strong></td>
<td>0.9661***</td>
<td>0.0074</td>
<td>−0.5030**</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.571]</td>
<td>[0.018]</td>
</tr>
<tr>
<td><strong>GDPCapita</strong></td>
<td>0.2734***</td>
<td>−0.0021*</td>
<td>0.0467</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.063]</td>
<td>[0.140]</td>
</tr>
<tr>
<td><strong>Constant</strong></td>
<td>2.1912***</td>
<td>−0.0114</td>
<td>−0.3644</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.325]</td>
<td>[0.291]</td>
</tr>
<tr>
<td><strong>R²</strong></td>
<td>0.80</td>
<td>0.33</td>
<td>0.42</td>
</tr>
</tbody>
</table>

Note: Robust p-values are indicated in brackets. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

### ALTERNATIVE CONTROL VARIABLES

Tables 11 and 12 report the results of additional robustness checks involving model modification by including additional control variables: GDP per capita (GDPCapita) in table 11 and money supply (MSUPPLY) in table 12. Similarly to the baseline results, these robustness checks also confirm the role of PFs in enhancing stock market liquidity based on the Zeros and Amihud measures. The crisis dummies are not statistically significant at any level. Their interaction terms are likewise insignificant, indicating a continued provision of liquidity by PFs in crisis times. Overall, the sign of the coefficients at the other control variables and their significance is similar to table 7.
### Table 12: Robustness Check: Additional Control Variable—Money Supply

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Zeros</th>
<th>Roll</th>
<th>Amihud</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PF</strong></td>
<td>-0.5562***</td>
<td>0.0257</td>
<td>-0.2896***</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.124]</td>
<td>[0.000]</td>
</tr>
<tr>
<td><strong>CRISISGFC</strong></td>
<td>-0.0046</td>
<td>-0.0004</td>
<td>-0.0164</td>
</tr>
<tr>
<td></td>
<td>[0.773]</td>
<td>[0.541]</td>
<td>[0.289]</td>
</tr>
<tr>
<td><strong>CRISISEDC</strong></td>
<td>0.0014</td>
<td>0.0001</td>
<td>-0.0120</td>
</tr>
<tr>
<td></td>
<td>[0.898]</td>
<td>[0.851]</td>
<td>[0.564]</td>
</tr>
<tr>
<td><strong>PF*CRISISGFC</strong></td>
<td>0.0472</td>
<td>0.0009</td>
<td>0.0496</td>
</tr>
<tr>
<td></td>
<td>[0.340]</td>
<td>[0.689]</td>
<td>[0.272]</td>
</tr>
<tr>
<td><strong>PF*CRISISEDC</strong></td>
<td>0.0393</td>
<td>0.0002</td>
<td>0.0541</td>
</tr>
<tr>
<td></td>
<td>[0.412]</td>
<td>[0.936]</td>
<td>[0.438]</td>
</tr>
<tr>
<td><strong>RET</strong></td>
<td>0.0309*</td>
<td>-0.0025*</td>
<td>0.0032</td>
</tr>
<tr>
<td></td>
<td>[0.087]</td>
<td>[0.089]</td>
<td>[0.778]</td>
</tr>
<tr>
<td><strong>VOL</strong></td>
<td>-0.1764***</td>
<td>0.0075**</td>
<td>-0.0270</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.11]</td>
<td>[0.300]</td>
</tr>
<tr>
<td><strong>SMCAP</strong></td>
<td>-0.0551***</td>
<td>0.0014**</td>
<td>-0.0289***</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.020]</td>
<td>[0.001]</td>
</tr>
<tr>
<td><strong>PFA/VD</strong></td>
<td>-0.0001</td>
<td>0.0001</td>
<td>-0.0016</td>
</tr>
<tr>
<td></td>
<td>[0.960]</td>
<td>[0.649]</td>
<td>[0.522]</td>
</tr>
<tr>
<td><strong>INT</strong></td>
<td>1.1677***</td>
<td>0.0109</td>
<td>-0.8494</td>
</tr>
<tr>
<td></td>
<td>[0.003]</td>
<td>[0.230]</td>
<td>[0.141]</td>
</tr>
<tr>
<td><strong>GDP</strong></td>
<td>-0.3359***</td>
<td>0.0279***</td>
<td>-0.3100**</td>
</tr>
<tr>
<td></td>
<td>[0.008]</td>
<td>[0.006]</td>
<td>[0.022]</td>
</tr>
<tr>
<td><strong>INF</strong></td>
<td>-0.8423***</td>
<td>0.0049</td>
<td>-0.0381</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.593]</td>
<td>[0.871]</td>
</tr>
<tr>
<td><strong>MSUPPLY</strong></td>
<td>-0.0342***</td>
<td>-0.0022***</td>
<td>-0.0288***</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.001]</td>
</tr>
<tr>
<td><strong>Constant</strong></td>
<td>0.7442***</td>
<td>0.0213***</td>
<td>0.2697***</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.000]</td>
</tr>
<tr>
<td><strong>R²</strong></td>
<td>0.81</td>
<td>0.33</td>
<td></td>
</tr>
</tbody>
</table>

Note: Robust p-values are indicated in brackets. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively.
OUTLIER COUNTRIES

Tables 13 and 14 report the results for the Prais-Winsten regression model estimated after excluding outlier countries. First, the Czech Republic, Latvia, and Korea, which have the smallest share of PFs’ equity investments, are excluded from the sample (table 13). Second, only the countries with the highest share of PFs’ investments, i.e., Peru, Poland, and South Africa, are excluded (table 14). Similar to the baseline regression results (table 7), the effect of the PFs on market liquidity remains positive and statistically significant for the Zeros and Amihud measures. The crisis dummies and their interactions are not significant, confirming the results for the baseline regression. The control variables have similar significances as in table 7.
ENDOGENEITY

The baseline regression results do not allow a causal interpretation because the dependent and independent variables might be determined by some omitted variables, such as investment restrictions imposed by PFs for certain asset classes. Moreover, there may be a reverse causality problem because instead of PF equity investments having a causal effect on stock market liquidity, a high level of market illiquidity may lead to lower PF investments in equities. Hence, in order to identify the causal effect of PFs on market liquidity, I employ a two-stage least squares instrumental variables (2SLS IV) regression model estimated with fixed-effects country clustered standard errors.

Following Thomas et al. (2014) and Xue et al. (2021), I use lagged PFs’ equity investments and life expectancy at birth as instrumental variables. As indicated by the Anderson and Hsiao (1982), Cragg and Donald (1993), and Sargan (1958) tests, the instruments are valid, and according to the endogeneity tests, both instrumental variables are exogenous (see table 15).

Although the significance of the PFs’ effect on market liquidity has decreased, it still remains significant at the 5-percent level for the Zeros and Amihud liquidity measures, confirming the results of the baseline model (see table 7). Also, the significance of control variables decreases when modeling...
I employ three market liquidity measures—Zeros, Roll, and Amihud—that capture different dimensions of market liquidity, namely resiliency, tightness, and depth. The main findings can be summarized as follows. First, PFs supply liquidity to stock markets, as measured by the Zeros and Amihud measures. Second, liquidity provision by PFs to stock markets is not time-varying and is not reduced in times of crisis. Moreover, these findings are robust to several robustness checks, such as (1) a sample split (EU versus non-EU countries), (2) excluding crisis periods, (3) alternative control variables, (4) excluding outlier countries, and (5) endogeneity bias. Crisis dummies and their interaction terms remained non-significant.

**CONCLUSION**

PFs have experienced significant growth in EM countries over the past decade. Given their growing presence and unique characteristics, i.e., long-term liabilities, PFs’ importance to financial stability in EMs has attracted increased attention, particularly following the GFC.

Using data from 2006Q1 to 2019Q4, I investigate the effect of PFs on stock market liquidity in seventeen EM countries.

### Table 15: Robustness Check: Endogeneity Bias

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Zeros</th>
<th>Roll</th>
<th>Amihud</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PF</strong></td>
<td>-0.4729**</td>
<td>0.0072</td>
<td>-0.1471**</td>
</tr>
<tr>
<td></td>
<td>[0.026]</td>
<td>[0.501]</td>
<td>[0.019]</td>
</tr>
<tr>
<td><strong>CRISIGFC</strong></td>
<td>-0.0136</td>
<td>-0.0013</td>
<td>0.0157</td>
</tr>
<tr>
<td></td>
<td>[0.723]</td>
<td>[0.458]</td>
<td>[0.541]</td>
</tr>
<tr>
<td><strong>CRISISED</strong></td>
<td>0.0191</td>
<td>0.0007</td>
<td>-0.0012</td>
</tr>
<tr>
<td></td>
<td>[0.494]</td>
<td>[0.641]</td>
<td>[0.671]</td>
</tr>
<tr>
<td><strong>PF*CRISIGFC</strong></td>
<td>0.2020</td>
<td>-0.0070</td>
<td>-0.0455</td>
</tr>
<tr>
<td></td>
<td>[0.157]</td>
<td>[0.287]</td>
<td>[0.401]</td>
</tr>
<tr>
<td><strong>PF*CRISISED</strong></td>
<td>-0.0325</td>
<td>0.0002</td>
<td>0.0075</td>
</tr>
<tr>
<td></td>
<td>[0.791]</td>
<td>[0.968]</td>
<td>[0.540]</td>
</tr>
<tr>
<td><strong>RET</strong></td>
<td>0.0382</td>
<td>-0.0061</td>
<td>0.0265***</td>
</tr>
<tr>
<td></td>
<td>[0.688]</td>
<td>[0.176]</td>
<td>[0.005]</td>
</tr>
<tr>
<td><strong>VOL</strong></td>
<td>-0.0118</td>
<td>0.0123**</td>
<td>0.0435***</td>
</tr>
<tr>
<td></td>
<td>[0.913]</td>
<td>[0.016]</td>
<td>[&lt;0.001]</td>
</tr>
<tr>
<td><strong>SMCAP</strong></td>
<td>0.0013</td>
<td>-0.0005*</td>
<td>0.0017</td>
</tr>
<tr>
<td></td>
<td>[0.720]</td>
<td>[0.092]</td>
<td>[0.234]</td>
</tr>
<tr>
<td><strong>PFA/VOL</strong></td>
<td>0.5196***</td>
<td>-0.0002</td>
<td>-0.0112</td>
</tr>
<tr>
<td></td>
<td>[0.001]</td>
<td>[0.979]</td>
<td>[0.486]</td>
</tr>
<tr>
<td><strong>INT</strong></td>
<td>-0.3070</td>
<td>0.0044</td>
<td>-0.0554</td>
</tr>
<tr>
<td></td>
<td>[0.491]</td>
<td>[0.832]</td>
<td>[0.212]</td>
</tr>
<tr>
<td><strong>GDP</strong></td>
<td>-0.0793</td>
<td>0.0092</td>
<td>-0.1466***</td>
</tr>
<tr>
<td></td>
<td>[0.877]</td>
<td>[0.700]</td>
<td>[0.004]</td>
</tr>
<tr>
<td><strong>INF</strong></td>
<td>-1.0421***</td>
<td>0.0078</td>
<td>-0.0210</td>
</tr>
<tr>
<td></td>
<td>[0.002]</td>
<td>[0.628]</td>
<td>[0.539]</td>
</tr>
<tr>
<td>Anderson Canon Test (p-value)</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>Cragg-Donald-Wald F Statistic</td>
<td>390.418</td>
<td>314.792</td>
<td>360.415</td>
</tr>
<tr>
<td>Sargan Test (p-value)</td>
<td>0.1049</td>
<td>0.9021</td>
<td>0.1550</td>
</tr>
<tr>
<td>Endogeneity Test (p-value)</td>
<td>0.2758</td>
<td>0.6967</td>
<td>0.4172</td>
</tr>
</tbody>
</table>

Note: Robust p-values are indicated in brackets. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively.
Overall, the results are in line with the earlier literature findings that PFs have a stabilizing role in financial markets by supplying liquidity during periods of crisis (Anand et al. 2013; Becker and Ivashina 2015; Timmer 2018). These empirical findings allow policy-makers to gain further insights into the behavior of domestic investors and PFs. From a policy perspective, the positive impact of PFs on market liquidity is supportive of policies such as automatic enrollment, which has been recently initiated by governments to increase the size of PFs.

Automatic enrollment programs aim to increase participation rates by enrolling employees into pension plans with a default contribution rate and asset allocation unless they actively choose not to participate. During the past decade, automatic enrollment practices were implemented at the national level in some developed (Italy, New Zealand, and the United Kingdom) and EM countries (Chile, Turkey, and Poland). A number of studies documented a dramatic increase in participation rates in retirement savings plans due to automatic enrollment (Madrian and Shea 2001; Choi et al. 2004). The majority of EM countries have PF sizes below the OECD average; therefore, policy-makers have the option of adopting automatic enrollment as a policy tool, which can allow them to mitigate market illiquidity.

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ENDNOTES

1. For Zeros, \( p_{\text{value}}=0.013 \); for Roll, \( p_{\text{value}}=0.024 \); for Amihud, \( p_{\text{value}}=0.003 \).
2. The null hypothesis of “there is no first-order autocorrelation” is rejected for all three illiquidity measures: for Zeros, \( p_{\text{value}}=0.043 \); for Roll, \( p_{\text{value}}=0.021 \); for Amihud, \( p_{\text{value}}=0.061 \).
3. The null hypothesis of “the variance of error terms is constant” is rejected for the Zeros and Roll measures and cannot be rejected for the Amihud measure; for Zeros, \( p_{\text{value}}=0.000 \); for Roll, \( p_{\text{value}}=0.000 \); for Amihud, \( p_{\text{value}}=0.114 \).
4. The null hypothesis of “there is no cross-sectional dependence” is rejected for the Zeros and Amihud measures, each with \( p_{\text{value}}=0.000 \), whereas it cannot be rejected for the Roll measure, which has a \( p_{\text{value}}=0.145 \).

REFERENCES


