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VOLUNTARY PRIVATE PENSION FUNDS AND CAPITAL MARKET DEVELOPMENT

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ABSTRACT

We examine voluntary private pension funds and their relationship to capital market development. Using data from Turkey, we analyse depth, efficiency and liquidity indicators of capital markets after the introduction of voluntary private pension funds in 2003. Overall, our findings indicate that the introduction of voluntary private pension plans are positively associated with indicators of capital market development, focusing on market depth (such as market capitalisation and trading volume) in both debt and equity markets. We also observe that indicators for other more recently established markets are also positively associated with the introduction of voluntary pension plans. In contrast, equity market turnover shows a negative association. These findings, along with the positive association with the corporate governance index, suggest that pension funds are important for capital market development and for corporate governance of firms as they are long-term investors. However, the introduction of state contributions in 2013 is not robust to alternative specifications.

Keywords: Pension funds, retirement, capital market development, developing countries, Turkey

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INTRODUCTION

Pensions are an important part of the retirement system because they create an important channel for individuals to save for retirement and encourage long-term investment (Thomas et al., 2014; Stewart et al., 2014).[1] Starting in the 1980s, existing pension systems were deemed to be insufficient for meeting the changing demographics of ageing populations and their pension needs, which created a burden for governments. Hence, pension fund reforms were identified as critically necessary around the world (World Bank, 1994).

This wave of policy suggestions to change pension systems led to countries starting to reform their pension structure, beginning with Chile in 1981 (Mesa-Lago, 2009; OECD, 2018). Countries started moving away from defined benefit, pay-as-you-go systems to multi-pillar systems with mandatory and voluntary defined contribution options. Many Latin American and European countries subsequently followed (Barr & Diamond, 2016). For instance, Italy implemented a multi-pillar system during the 1990s, and the United Kingdom initiated a defined contribution system during the 1980s (Disney et al., 2003).

A key motivation for countries to reform their pension systems is the desire to achieve a capital market-oriented system. Data show that, on average, countries with large and established pension-fund sectors tend to have well-developed capital markets (Davis, 1998). Based on theory, the basic underlying idea is that privately managed pension funds that invest in debt and equity markets as well as other markets (such as private equity investments) will create a more developed capital market by increasing the depth and efficiency of those markets (Demirgüç-Kunt & Levine, 1996; World Bank, 2015). Investments in capital markets in turn result in an increase in private sector savings, reducing the cost of capital and making it easier for corporations to access funds. For individuals, pension systems encourage long-term investment (Vittas, 1995; Raddatz & Schmukler, 2008; Enache et al., 2015).

However, whether private pensions advance the development of capital markets remains a point of debate in the literature. Some authors argue that pension funds help capital market development by increasing the demand for long-term investment instruments and also by increasing the depth of equity and debt markets, as well as other instruments related to their liquidity and volume. Furthermore, since pension funds are institutional investors with a long-term investment horizon, they are more likely to demand better corporate governance (Stewart et al., 2014; Niggemann & Rocholl, 2010; Catalán, 2004; Catalán et al., 2000, Wahab et al., 2008). They also add to the liquidity of these markets through their trading activity (Davis, 2003; Vittas, 1995; 1999) and increase the

resistance of capital markets to macroeconomic shocks (Davis, 2003). Other authors disagree, arguing that pension funds do not optimally invest the savings of individuals mainly because of heavy regulation (Berstein & Chumacero, 2006). In addition, some researchers suggest there is no link or association between the introduction of pension funds and capital market development (Singh, 1996; Raddatz & Schmuckler, 2008; Stewart et al., 2014; Sanusi & Kapingura, 2021). [2]

To understand whether pensions advance the development of capital markets, we mainly focus on an emerging market with a rich data set on pensions as well as capital market indicators. Turkey provides a good setting to test our empirical question of whether participation in voluntary pension funds has any impact on capital market development. This question has not yet thoroughly been analysed methodologically by looking at various capital market indicators. We aim to fill this gap by considering indicators focusing on market depth, efficiency, and liquidity, as well as attempting to link voluntary pension funds with a corporate governance measure. Compared with previous studies, having various indicators allows us to analyse other measures of capital markets in addition to debt and equity markets. Moreover, introducing various pension-related regulations at different points in time helps us identify exogenous events.

Turkey has initiated many reforms to develop its capital markets within the past four decades. With the establishment of the Capital Markets Board, which is the main regulatory and supervisory authority for the securities markets, and the Istanbul Stock Exchange (BIST) during the early 1980s, Turkey opened the doors to the development of its capital markets. As of 2017, more than 410 companies were listed in BIST and their total market capitalisation was USD 250 million (Yılmaz et al., 2020). With respect to pension reforms, starting in 2001 and going into effect in 2003, Turkey introduced a voluntary private pension system. In addition, the government announced a programme for state contribution to participants, which took effect in 2013.

Our research question focuses on whether these pension reforms and, more specifically, the introductions of the voluntary pension system and state contributions aided capital market development of Turkey. Our paper's contribution to the literature is threefold. First, within the limits of available data, we consider a categorised, systematic analysis of market development, using the indicators suggested by the International Monetary Fund's (IMF) financial development metrics, as described by Sahay et al. (2015), including market depth, efficiency and liquidity (including Amihud illiquidity). Second, to the best of our knowledge, understanding the effect of voluntary pension funds on capital market development by taking into account other variables that may affect overall market

indicators such as credit default swap (CDS) spreads is also novel in this context. Third, we consider whether the introduction of voluntary pension funds also improves the corporate governance of firms or other newly introduced markets in addition to equity and bond markets.

Our results suggest a positive association between the introduction of voluntary private pension funds and capital market development indicators. Examining equity, debt, and additional markets for which we have data (e.g., precious metals), we observe that the total assets invested in pension funds are positively associated with the main channels that the literature identifies as improving capital markets, such as market capitalization, trading volume, and traded amounts in both equity and debt markets (Catalán, 2004). Results hold after controlling for autocorrelation, adjusting for inflation, and controlling for other important determinants of capital market indicators, such as GDP growth, interest rates, and CDS rates. With respect to the corporate governance channel, we also observe a positive association between the introduction of private pension funds and the corporate governance index. For the introduction of state contributions, we see a weak positive effect in certain indicators of the debt and equity markets, but the results are not robust to alternative specifications.

Our findings align with those from studies that identify a linkage between pension fund reforms and capital market development. With respect to Turkey, our findings are similar to those of Bayar (2017), although our analysis uses more comprehensive measures. They are similar to reports by Ertuğrul et al. (2018) and Ertuğrul and Gebesoglu (2020), who focus on the overall savings rate, in terms of finding a positive association between economic indicators and pension funds.

TURKEY'S CAPITAL MARKETS AND PENSION SYSTEMS

From a policy perspective, how to foster income protection for an aging population is a key social policy challenge in a world with a rapidly growing older population. Coverage gaps are observed in formal insurance programs, and informal protection mechanisms face obstacles as a result of changing family patterns (Hujo, 2014).

Income protection is especially important in economies where fiscal and capital market stability is less established compared with developed markets. As one of the largest economies, Turkey has experienced macroeconomic and political volatility, with four major financial crisis/economic contraction periods occurring since the mid-1990s (1994, 1999, 2001 and 2008–2009).[3] However, significant reforms have been undertaken to increase transparency and improve the depth and liquidity of capital markets. After the major financial crisis of

2001, the IMF programme and negotiations with the European Union resulted in a massive influx of capital to Turkey. During this time period, many financial sector reforms also occurred.[4] More recent economic turbulence includes the 2018 currency depreciation, 2020 and onward pandemic-related economic contraction and the subsequent inflationary environment and currency depreciation.

Under volatile economic conditions, it is especially important to establish policies that encourage individuals to save for retirement. Voluntary pension plans are an important mechanism that provides the opportunity to save. Another positive effect of these pension plans is the enabling of capital market efficiency and an increase in the depth of markets (capital market development) (Davis, 1998). Hence, from a policy-making perspective, it is critical to determine whether these reforms actually work.

Following Acemoglu and Zilibotti (1997, p. 711), "the opening of an additional sector creates a positive pecuniary externality on other potential projects since consumers now bear less risk when they buy these securities" due to a widened set of asset diversification opportunities and Kim (2008), we argue that the introduction of voluntary pension plans should help the development of capital markets through increasing the investor base, domestic savings, and the duration of investments; increasing liquidity especially in debt markets, including the issuance of corporate debt; increasing transparency; and strengthening corporate governance.[5] Anecdotal evidence from the pension industry suggests that the introduction of voluntary pension plans is positively associated with development of certain indicators in capital markets, but in-depth empirical evidence remains lacking. Therefore, we aim to measure whether the additional demand created by opening up the voluntary private pension fund system affects any part of the capital markets. In this paper, we focus on understanding the implications of an increased investor base, improved transparency and corporate governance standards, and increased liquidity. We do not analyse domestic savings, but for completeness, we do discuss our observations on the Turkish household saving rate.

In general, most national pension systems combine defined benefit (DB) and defined contribution (DC) plans; and they incorporate 'pay-as-you-go' (PAYG), funded, public and private elements. For instance, public pensions have typically been DB in nature and financed on a PAYG basis. However, increased longevity and the declining ratio of actively employed contributors to retired beneficiaries are threatening the financial sustainability of PAYG DB public systems (OECD, 2018).

Before the pension reform, Turkey had a mature, expensive pension system and unfunded liabilities, similar to Chile (Corbo & Schmidt-Hebbel, 2003). Turkish social security transfers from the state reached above 6% of GDP in 2018 and will likely increase in the future. These transfers to the social security institution represent around 40% of the total annual expenditures. It is also important to note that Turkey's population is relatively young, yet pension expenditures are nevertheless quite high (the OECD average for 2017 is 7.5%).

Currently, the Turkish pension system consists of three pillars.[6] The first is the PAYG social security program, which covers employees' old-age pension benefits and other social protection needs such as health care, survivorship, disability, work-related accidents and occupational diseases, unemployment, and life insurance (Peksevim & Akgiray, 2019). As of year-end 2017, the social security system covered around 70% of the working population. The second pillar of the Turkish pension system includes complementary pension schemes, including occupational pensions schemes sponsored by employers or personal pension arrangements, and mainly consists of two mandatory occupational saving schemes: OYAK and TTK plans. OYAK provides pension and other social benefits for military personnel, and the TTK pension plan covers employees of the state-owned coal-mining companies; about 250 voluntary occupational pension scheme exist in the second pillar of the Turkish pension system (Peksevim & Akgiray, 2019). The second pillar also includes mandatory workplace pensions (automatic enrolment plans), which started in 2017.[7] The third pillar, a voluntary private pension system (BES), was first introduced in Turkey in 2001 and went into effect in 2003.[8] As part of this change in 2003, the government introduced two additional reforms: (i) government matching contributions in 2013, and (ii) automatic enrolment reform (AES) in 2017.

The number of participants and the assets under management in the voluntary private pension system are increasing every year. Starting with only 15,000 participants in 2003, more than 6.5 million were enrolled at the end of 2018.[9] However, the overall size of the market as a percentage of GDP is still small relative to other countries. OECD Pension Market in Focus figures indicate that the ratio of total pension fund assets to GDP in Turkey is 2.1%, with a total amount of USD14.520 million in 2018. Considering preliminary figures of pension fund assets for the year 2018 (OECD, Pension Market in Focus), Turkey is behind Brazil and Russia with respect to the ratio of total pension fund assets to GDP (Turkey, 2.1%; Brazil, 12.6%; and Russia, 5.5%).

In Turkey, voluntary private pension plans can only be operated by retirement firms (life and pension funds). As of March 2021, there were a total of 15 companies (considering "Allianz Hayat ve Emeklilik: and "Allianz Yaşam ve Emeklilik" as a single firm). The market is fairly concentrated among the top players. These retirement firms operate within an enviroment in which more than 85% of asset management companies are related to a bank group (Tuzcu & Ertugay, 2020). Capital Markets Board of Turkey (CMB) regulates the establishment and operations of pension companies. CMB also regulates the structure of fund portfolios. In addition to CMB, the main regulatory bodies are the Ministry of Treasury and Finance, which issues regulatory documents especially about state contribution, and the Pension Monitoring Authority.

According to the statistics of the Capital Markets Board, voluntary pension funds mainly invest in debt securities (T-Bills and Government Bonds), which represent more than 50% of total assets. However, after 2012, the share of debt instruments in total assets under management declined steadily, while the share of other assets increased significantly, which could be attributed to the introduction of new investment instruments. Equities consistently represent about 10% of total assets. Foreign securities started to have a share in total assets under management, though still small, after 2015.

LITERATURE

The primary role of financial institutions and capital markets is to allocate capital efficiently; that is, they must allocate funds to the investment projects with the highest marginal product of capital (Bekaert & Harvey, 1998). Many authors argue that capital market development is beneficial for economic growth (King & Levine, 1993; Demirgüç-Kunt & Levine, 1996; World Bank, 2008).

Capital market development can occur through various channels, such as increased liquidity and increased financial depth and distribution of risk sharing (Demirgüç-Kunt & Levine, 1996; World Bank, 2015). The introduction of pension fund systems that utilise investment in capital markets should thus facilitate capital market development. However, the literature does not definitively show that pension systems help with capital market development. Some authors argue that pension funds are associated with capital market development by increasing demand for investment instruments, as well as the depth and efficiency of equity and debt markets. In addition, since pension funds are long-term investors and are considered institutional investors, they demand better corporate governance (Catalán, 2004; Catalán et al., 2000). Pension funds may also add to the liquidity

of these markets through their trading activity (Davis, 2003; Vittas, 1995, 1999; Corbo & Schmidt-Hebbel, 2003). These possibilities are all empirical questions.

Bodie (1990) suggests that pension funds played a critical role in the evolution of the markets for debt and equity securities and their derivatives in the United States during the 1970s and 1980s. Kim (2008) analyses the impact of pension funds on capital market development by examining stock market capitalisation and the association of bond market capitalisation with pension funds during the period 1991–2003. Findings suggest a need for a critical mass of pension reforms to result in the development of capital markets. Further, a secured market mechanism with respect to the management of pension plans is necessary for pension funds to contribute to the capital market development (externality hypothesis). Liang and Bing (2010) focus on the U.K. pension system and conclude that pension fund growth and financial market development are positively related. Gillan and Starks (2000) focus on two major U.S. pension funds and find that pension fund involvement in companies improves corporate governance practices. Daradkah and Al-Hamdoun (2021) do not find any short-term effects of pension funds on capital market development in Jordan, but they conclude that in the long run, pension funds and capital market development are co-integrated.

Studying pension funds' effects on equity markets from the volatility side, Thomas et al. (2014) focus on 34 OECD countries during the period 2000–2010 and conclude that a negative relation exists between the stock holdings of pension funds and the volatility of the (stock) market. Impavido et al. (2001) base their study on 34 countries and find that the growth of pension funds increases competitive pressure for banks, resulting in banks operating more efficiently. Babalos and Stavroyiannis (2020) conclude that pension fund investments in equities help in the development of stock markets.

Other cross-country studies that find positive linkages between pension funds and capital market developments include Hu (2012), covering 10 Asian and Pacific countries; Raisa (2012), covering 15 EU countries; Sun and Hu (2014), covering 55 countries; Meng and Pfau (2010), focusing on 34 developed and emerging market countries and looking at stock and bond market effects separately; Niggemann and Rocholl (2010), covering 57 countries; and Hryckiewicz (2009) and Enache et al. (2015), focusing on Central and Eastern European countries.

With the introduction of pension reforms during the 1990s in Chile, and then observations of the spillover of these reforms to other countries (Weyland, 2005), various empirical studies have sought evidence of linkages between pension fund reforms and capital markets. Walker and Lefort (2002) support

findings of institutional capital; an increase in adaptive legal framework; increased specialisation, transparency and integrity; increased financial innovation; and better corporate governance. Raddatz and Schmuckler (2008) investigate the relation between pension funds and capital market development in Chile for the period 1995–2005. They argue that the initial expectations from pension funds would be that these funds would play an important role in the development of capital markets. However, the patterns do not support these expectations even though the pension funds may have contributed to the development of certain primary markets.

Others do not find a link between capital market development and pension fund reforms (Raddatz & Schmuckler, 2008). For instance, using time series data, Samwick (2000) does not find any evidence for higher savings rates after implementation of the reforms in countries that switch to defined contribution plans. This strand of the literature argues that the evidence on a positive link is scant (Davis, 2003; Institutional Investors in Emerging Markets, 2004). Sanusi and Kapingura (2021) show that in South Africa, accumulated pension funds have no significant impact on the overall investment level and economic growth.

Studies regarding Turkey are limited. The studies that do exist are in line with those finding a positive effect for developed countries and in emerging economies. In these studies, capital market development is proxied by stock market as well as bond market development. Bayar (2017) examines the effects of individual pension funds on capital market development in Turkey and finds a positive association. Bayar's (2017) study is the first to analyse the association between the introduction of individual pension funds and capital markets, but the analysis relies on only two measures of the market: the market capitalisation of BIST and debt securities traded value. The study considers the total amount of individual pension funds as the explanatory variable and uses a shorter sample (2006–2015). Our study differs from that of Bayar (2017) as we mainly analyse voluntary private pension funds. Further, we also take advantage of an exogenous regulatory change in 2013 (the effect of state contributions); consider many different indicators for equity, debt, and other markets; include an analysis on corporate governance; control for control for variables that may affect capital market development; and use data spanning a longer time period. We also consider the effects of the introduction of voluntary pension funds on the corporate governance of institutions. Recently, Ertuğrul et al. (2018) and Ertuğrul and Gebesoglu (2020) examine the effect of voluntary private pension funds on overall savings rates in Turkey and conclude that the private pension system contributes to the overall saving rate.

While analysing the influence of the policies introducing voluntary pension funds, we mainly contribute to the literature by considering a categorised, systematic analysis of market development, using the indicators suggested by the IMF's financial development metrics including market depth, efficiency, and liquidity (including Amihud illiquidity). In addition, we contribute to the literature by incorporating variables that may affect overall market indicators such as CDS spreads. We also analyse whether the introduction of voluntary pension funds improves the corporate governance of firms as well as newly established markets beyond the debt and equity markets. Based on this comprehensive evaluation, our findings generally accord with the studies that identify a positive linkage between pension fund reforms and capital market development.

DATA AND METHODOLOGY

For the voluntary pension plans, we collect monthly data on the number of participants and the total amount of assets under management (in TRY/TL)[10] for voluntary pension plans from the *Emeklilik Gozetim Merkezi* (Pension Monitoring Centre) for the time period December 2003 until July 2019.

To measure the association between voluntary pensions and capital market development, we collect data on various capital market development measures. These include data from Borsa Istanbul (Istanbul Stock Exchange) on equity markets and debt markets as well as other newly established markets such as precious metals. Since Borsa Istanbul's equity market revised their market definitions in 2015, we mainly focus on major indicators that provide us with consistent time series. These data provide separate indicators for debt and equity markets as well as the newly established markets. Another advantage of using this data set is that we can observe monthly variation both within pension plan variables and within the equity and debt markets.

For the bond market, we retrieve our data from two sources. First, we retrieve the issuance of government debt securities (domestic and Eurobonds) from the Central Bank of Turkey. Second, we focus on the BIST Debt Market data, which include many fixed income instruments that are traded in the secondary market as well as corporate bond offerings that are offered to qualified investors.

To understand whether newly established markets within BIST are associated with the introduction of voluntary private pension funds, we consider markets in which a sufficient number of observations are available. Of these other markets, precious metals market – and especially the BIST gold index and the BIST precious metals index – have sufficient data points. We also consider

swap, venture capital and money market data; however, there is no movement in those markets in most months, which precludes meaningful analyses. Finally, to understand the corporate governance and transparency request channel of pension funds, we focus on firms which treat their corporate governance practices more strictly, and we try to determine whether these firms benefit from additional demand from voluntary pension funds.

Following IMF's capital market development indicators, we categorize our market measures based on measures that fall under *depth*, *efficiency* and *liquidity*. For depth, we consider market value and daily average market trading volume on the equities side. We focus on the number of contracts traded and the market value on the debt site. For efficiency, we calculate the equity and debt market turnover ratios. We also look at monthly returns and closing prices. Since liquidity is another important measure, we consider Amihud illiquidity measure. Finally, we consider the index values of other market indicators which include corporate governance index and precious metal indices.

Our variables and data sources are summarised in Table 1, and the variables are defined in Appendix 1. We have data on voluntary participants' pension fund assets from December 2003 until July 2019. On average, during this time frame, assets in voluntary private pension funds reached 24 billion TL. The average number of participants was around 3 million, starting from a minimum of 15,000 and reaching a maximum of almost 7 million. We summarise the pension fund assets including state contributions in the second row (TL), which shows that the average assets were around 27 billion TL. For the same time frame, we summarise our control variables including the GDP growth rate, interest rate, and CDS spreads (CDS data start in 2008). In Turkey, between 2003 and July 2019, quarterly GDP growth rate was of 1.3% on average, and the interest rate was around 18%. As for equity indicators, we consider the closing prices and returns of BIST 100 index and BIST All as an indicator of the whole market (market cap weighted). The average closing prices for BIST 100 were around 62,000, and the BIST All average closing price was similar. Monthly, CPI-adjusted average returns for the three indices were around 0.6%. With respect to Market Values of the traded equities, we consider BIST Total Market Values, which are provided monthly.

Table 1
Descriptive statistics

The table presents summary statistics for the main variables of interest during the time period when voluntary private pension fund data are available. Variable definitions are provided in Appendix 1. Panel A provides information on BES participants; assets under management for voluntary private pension funds with and without state contributions; main control variables; and Market Value, Closing Prices and Traded Volume of Equity and Debt markets. The number of observations may change either because BIST reorganized market definitions or because no data are available for a certain period. Panel B provides descriptive statistics for debt products including their traded values and number of contracts. Panel B also summarizes variables on alternative markets. In tables, we use TRY and TL interchangeably.

Panel A					
	Count	Average	SD	Min	Max
Assets in VPPF (in millions)	188	24,573.33	24,987.16	5.87	88,356.72
Assets in VPPF including government contributions (in millions)	188	27,180.55	28,804.87	5.87	102,322.28
Participants in VPPF	188	3,317,870	2,337,897	15,245	6,984,044
End of day 5 year CDS spread (mid-point close)	134	237.72	84.44	119.66	582.02
GDP growth	187	1.30	2.04	(5.59)	6.09
Discount rate	188	0.18	0.09	0.09	0.43
Consumer price index (1990-100)	188	211.71	81.79	104.12	419.24
USD/TRY	188	2.24	1.21	1.18	6.38
Equities – market value					
BIST total market value (TL millions)	188	449,421.70	226,392.10	89,264.26	937,567.40
Equities – returns and closing prices					
BIST all returns (monthly, CPI adjusted closing prices)	188	0.60%	7.56%	–24.46%	26.14%
BIST all closing prices	188	61,880.56	26,297.44	16,415.60	121,046.40
Equities – traded volume and liquidity					
BIST daily average traded volume (000s)	188	809,210.70	450,458.40	169,202.00	2,201,844.00
Amihud illiquidity BIST all (CPI adjusted)	188	0.014	0.012	0.001	0.068
Equity market turnover	188	39.80	13.28	16.11	91.91
Panel B					
Debt securities – traded value					
Government domestic debt securities market value (TL million)	94	63,816.03	5,030.45	50,110.90	73,811.60
Debt securities outright purchases and sales (TL million)	188	31,561.72	8,045.96	11,627.55	60,363.67
BIST total market value (TL millions)	188	449,344.90	319,449.70	118,567.40	1,767,339.00
Debt market turnover	188	0.30	0.11	0.10	056

(*Continue on next page*)

Table 1 (*Continued*)

	Count	Average	SD	Min	Max
Debt securities – number of contracts					
Outright purchases and sales market	188	30,939.25	13,103.88	9,694.00	69,025.00
Total number of contracts	188	105,247.30	30,411.72	47,748.00	212,364.00
Other market characteristics					
BIST corporate governance index	144	62,932.69	18,827.84	20,027.24	103,721.70
BIST metals-gold index	85	2,990.38	345.85	2,432.74	4,082.32
BIST precious metals market index	72	2,985.44	383.99	2,412.22	4,119.48

Notes: VPPF = Voluntary Private Pension Funds

With respect to the traded volume, the daily average traded volume was around 809 million transactions, with a range of 169 million to 2.2 billion. Traded volume is considered because it is a measure of market liquidity (Pagano, 1989). We also consider Amihud illiquidity which is measured as the square root of the ratio of absolute dollar returns to dollar volume as shown in equation (1) since trading volume and illiquidity measure different behaviours (Avramov et al., 2006). Following Hasbrouck (2009) to control for skewness and Asparouhova et al. (2010), we use the square root transformed measure.

$$Amihud = 1000 * \sqrt{\frac{abs(Return)}{abs(Price) * Trading\ Volume}} \tag{1}$$

As for debt securities, we mainly consider two bond markets. The first is the government bond issuance market, which measures the market value of the total amount of debt issued by the Turkish Treasury during a given month. The second is the BIST market under which we have the Debt Securities Market consisting of the Outright Purchases and Sales. In this market, trading is conducted for debt securities, securitized assets and income-backed debt securities, lease certificates, liquidity bills issued by the Central Bank of the Republic of Turkey, and other securities approved by Borsa Istanbul Board. These are denominated in TRY, and foreign currency can be traded on the Debt Securities Market. The government bond issuance market data start in June 2012.

With respect to other markets, we consider BIST precious metals market and gold market separately. The gold index value was on average 2,990 with a high of 4,000 during our time period. Precious metals index values were quite similar during this time frame. Finally, we consider the corporate governance index, which was initiated in 2007; it shows the weighted average closing prices of companies with a corporate governance rating greater than 7.[11] The average

closing price of this index was around 63,000 compared with BIST 100 of 71,000 during the same time frame (although with respect to returns, the two indices closely follow each other).

We realise that the relationship between pension fund participation and indicators of capital markets are endogenous. This endogeneity may result from reverse causation (better markets may lead to more contributions into pension plans) or spurious regressions. In addition, we rely on time series data, and autocorrelation may be present among the series. To tackle these issues, we run the traditional autoregressive finite distributed lag model (ARDL) following (Moleko & Ikhide, 2015; Pesaran et al., 2001).

ARDL models have long been used to model time series relationships in a single-equation time-series setup. The current value of the dependent variable is allowed to depend on its own past realisations – the autoregressive part – as well as current and past values of additional explanatory variables – the distributed lag part (Kripfganz & Schneider, 2018). The variables can be stationary, nonstationary, or a mixture of the two. An ARDL model is preferred here as it controls for endogeneity by including lagged variables of the dependent variable (Nkoro & Uko, 2016). Another advantage of the ARDL model over other approaches is that it can be used in time series data irrespective of their order of integration, whether I(0), I(1), and/or fractionally integrated (Pesaran & Shin, 1999) which we also rely on, especially to check co-integration using the bounds-testing procedure.

To find the number of lags to include for the dependent variables, similar to Pardal et al. (2020), we look at the Akaike information criterion (AIC) and the Bayesian information criterion (BIC) for each specification. We also run autocorrelation tests for the various dependent variables separately to check if there is autocorrelation between time t and previous period values. Our results in Appendix 2 suggest that using an order of two lags is optimal for most of the variables.

We also conduct Dickey Fuller tests to see whether our data exhibit any stationary trends. Our findings in Appendix 3 Panel A suggest that, for most variables, we can reject the null hypothesis of the existence of unit root (with trend assumption, we reject the null for all variables).[12] Therefore, we run the regressions on level values. However, for some variables, we cannot reject the null under the no-trend Dickey Fuller tests. To ensure that our results are robust, we also run regressions by taking the first difference of variables on each side of the specification to address a possible stochastic trend. As shown in Appendix 3 Panel B, the null hypothesis for unit root is rejected for all variables when we conduct the test with first differences. As a further test of stationarity, we also allow for

structural breaks in the series.[13] We use the Perron and Vogelsang (1992) unit root tests for structural breaks. As can be seen in Appendix 3 Panels C and D, we cannot reject the null of the existence of unit root for some level variables, but once we take the first differences, then all series are considered stationary.

Our main ARDL model is as follows:

$$y_t = \beta_0 + \sum_{i=0}^{2} \gamma_i a_{t-i} + \sum_{j=1}^{2} \beta_j y_{t-j} + \alpha_k X_{t,k} + \varepsilon_t \quad (2)$$

Where y_t captures our dependent variables of interest, which include closing prices and returns for BIST 100 index, BIST All index, as well as market value and traded volume for BIST. As mentioned previously, debt markets include government issuance of debt securities market and the secondary market BIST trading of fixed income securities. We consider the outright purchases and sales in (traded value in TL) and the number of contracts. Within BIST traded debt securities, we also look for the offerings and the number of contracts for qualified investors, which show us the corporate bond market. For additional products, we consider the markets for which we can observe data such as the BIST Gold Index and BIST precious metals market index to understand whether these special products have gained more attention as a result of the voluntary pension funds coming into play. We finally consider the corporate governance of firms by analysing the BIST corporate governance index as our dependent variable. Since corporate governance is an important indicator and pension funds, as long horizon institutional investors, would have a say in the corporate governance of firms, it is important to understand whether voluntary pension funds have an effect. In our first set of analyses, we utilise the traditional ARDL model (rather than including the error correction), but we later also run the ARDL model with bounds test to check for a long-term relationship. In the specification, is our variable of interest, that is, the coefficient on the amount of assets under management in voluntary pension plans. We also run an alternative specification with the number of participants in voluntary pension plans. All our variables are kept in TRY amounts but we adjust these amounts for inflation (CPI 1990 = 100) as well as the removal of six zeros from TRY on 1 January 2005.

For control variables, we follow the literature and use GDP growth rate (one period lagged), Turkey 5-year CDS spread end of month values, and the interest rate. GDP growth rate and interest rate are widely used in the literature as controls (e.g., see Hryckiewicz (2009); Thomas et al., 2014; Samwick, 2000; Raisa, 2012). GDP growth rate controls for overall macroeconomic factors which might affect the stock market and bond market investments and participation in these capital markets. We expect GDP growth to positively affect capital market participation. However, if investors have a preference between debt and equities (e.g., if debt is seen as a safe asset), then the

relationship might be slightly more ambiguous. To create a monthly time series from quarterly variables (GDP growth), we use a spline extrapolation method following the literature (Eurostat, 2018). We include the interest rate to account for the variation that may result from the market factor effects such as investors preferring equities versus debt or choosing to consume versus save now (i.e., consumption smoothing). Interest rates are a major determining factor in these decisions. If interest rates increase, the debt market trading indicators should be positively affected.

Since we are mainly interested in the additional demand effects of a newly introduced sector on other main capital market indicators, we also control for volatility of the general market by using 5-year Turkey CDS spreads (Thomas et al., 2014).

Next, as mentioned above, because of a possible stochastic trend among the dependent variables, we run the same model of (1) again with differences of variables on each side of the equation. In this version, we do not include the lags of the same variables.

$$\Delta y_t = \beta_0 + \gamma_0 \Delta \alpha_t + \alpha_k \Delta X_{t,k} + \varepsilon_t \quad (3)$$

For robustness purposes, we also conduct Granger causality tests for each of the variables separately. We do not claim that there is a causal relationship, but rather that there is a positive association between capital market development and the introduction of voluntary private pension plans. The results of Granger causality tests confirm our hypotheses. Finally, to understand whether the associations we see exist in long term, we also run co-integration tests using the bounds test.

RESULTS

The tables for equity indicators, debt indicators, and other market indicators including the corporate governance index are provided in the following order. In all tables, Panel A specifications use level variables. Panel B provides the results of the first differences. In the specifications, all TRY variables are inflation adjusted, and we control for GDP growth rate, interest rate and CDS spreads (market wide volatility), and past two lags of the dependent variable. Since CDS data for Turkey start in 2008, we conduct the regressions with and without CDS. Results without the use of CDS are provided in Panels 2 and 4 of Tables 2 and 3. We also run tests with both robust and Newey West standard errors and receive very similar results. (These results are not shown owing to space restrictions and the number of regressions reported; the results are available upon request). Here, we show

the specifications with CDS in detail and without CDS in summary form and use robust standard errors.

Table 2 provides the results for stock market indicators whereby we group the different stock market variables under closing prices, returns, market value, traded volume, liquidity, and equity turnover. In Panel A of Table 2, we run the specifications on each of these market values with incorporating the control variables and including CDS spreads. We also include the one- and two-period-lagged values of both the dependent and the independent variable to control for any time lags. The results suggest a positive and significant association using inflation-adjusted asset values in voluntary private pension plans and various equity market indicators (coefficients closing prices, returns, and market value are positive and significant). These indicators provide some guidance on how developed the equity markets are with respect to market depth (Cihak et al., 2012; Sahay et al., 2015). The results use robust standard errors. The Amihud Illiquidity measure is not statistically significant, which suggests market liquidity is not affected by the introduction of these funds. Equity turnover is negatively significant (in Panels A1, A2, and A4) which may suggest that since pension funds are long-term investors, their increased investments are for the long term so the turnover decreases. This finding suggests that perhaps pension funds, as institutional investors, invest for the long-horizon. Findings are positively significant from a corporate governance perspective which also supports our hypothesis on the long-horizon role of private pension funds. The number of participants in relation to the equity market indicators do not seem to be significantly associated. Control variables also generally have the expected signs. For instance, as GDP increases (we use the one-period-lagged measure), market value increases and equity turnover decreases. As volatility in the market increases, the equity market values and returns decrease.

Table 2
Voluntary pension funds and equity markets

Panel A provides the results of ARDL regressions for the equity market (Borsa Istanbul). The dependent variables are the closing prices (1), monthly returns (2), market value (3), Daily Average Trading Volume (4), Amihud illiquidity (5), and Equity Turnover (6). In Panels A1 and A2, the variable of interest for all specifications is the inflation-adjusted TRY value of assets in voluntary private pension funds (we use TRY and TL interchangeably). In Panels A3 and A4, the variable of interest is the number of participants in voluntary private pension funds. Panels A2 and A4 show the results for same specifications without the CDS Spread variable (to include the whole time period). Control variables include one-period-lagged GDP growth, interest rate, and CDS 5-year spreads. Panel B runs the specifications as first differences on both sides of the equation. All specifications control for first and second lags of the dependent variable. The results for those coefficients are not shown in tables to save space, but they are available on request.

Panel A1						
Variables	(1) Values (close)	(2) Returns	(3) Market value	(4) Daily avg. trading vol.	(5) Amihud illiquidity	(6) Equity turnover
Assets in VPPF	0.001** (2.129)	0.000*** (2.518)	0.009** (2.408)	0.015 (0.573)	–0.000 (–1.535)	–0.003*** (–2.304)
Assets in VPPF (t–1)	–0.001* (–1.747)	–0.000* (–1.890)	–0.007 (–1.626)	0.001 (0.040)	–0.000 (–0.092)	0.001 (0.801)
Assets in VPPF (t–1)	–0.000 (–0.206)	–0.000 (–0.318)	–0.001 (–0.299)	0.003 (0.088)	0.000** (2.408)	0.002 (1.305)
GDP growth	0.125* (1.690)	–0.007 (–1.323)	0.277 (0.428)	–11.203 (–1.257)	0.000 (1.374)	–1.075** (–2.297)
Discount rate	2.577 (0.403)	0.312 (1.207)	35.888 (0.778)	1,683.004*** (3.655)	–0.032*** (-2.987)	31.021* (1.667)
CDS spread	–0.026*** (-4.318)	–0.000*** (-0.318)	–0.001 (–0.299)	0.003 (0.088)	0.000** (2.408)	0.002 (1.305)
Constant	17.412*** (4.809)	0.027 (0.715)	90.077*** (5.226)	–59.757 (–0.797)	0.007*** (2.954)	8.653** (2.185)
Observations	134	134	134	134	134	134
R-squared	0.909	0.179	0.909	0.883	0.794	0.737
Panel A2 (without CDS)						
Assets in vol. private pension fund	0.002** (2.189)	0.000** (2.328)	0.012** (2.191)	0.012 (0.465)	–0.000 (–1.253)	–0.003*** (–2.764)
Observations	184	184	184	184	184	184
R-squared	0.883	0.097	0.930	0.915	0.750	0.620
Panel A3						
Participant in vol. private pension fund	–0.001 (–0.450)	–0.000 (–0.756)	–0.011 (–0.834)	–0.220 (–1.279)	0.000 (0.240)	–0.010 (–1.327)
Observations	134	134	134	134	134	134
R-squared	0.904	0.098	0.901	0.884	0.786	0.731
Panel A4 (without CDS)						
Participant in vol. private pension fund	–0.001 (–0.331)	–0.000 (–0.399)	–0.011 (–0.798)	–0.346** (–2.081)	0.000 (1.579)	–0.013* (–1.876)
Observations	186	186	186	186	186	186
R-squared	0.876	0.031	0.925	0.918	0.749	0.616

(*Continue on next page*)

Table 2 (*Continued*)

Panel B.1						
Variables	(1) Values (close)	(2) Returns	(3) Market value	(4) Daily avg. trading vol.	(5) Amihud illiquidity	(6) Equity turnover
Assets in Vol. Private Pension Funds	1.211** (2.143)	0.044** (2.286)	9.280** (2.155)	2.745 (0.143)	–0.001 (–1.084)	–3.680*** (–2.873)
GDP growth	0.013 (0.112)	-0.004 (-0.447)	0.098 (0.129)	4.741 (0.381)	0.000 (1.528)	0.085 (0.142)
Discount Rate	–8.125 (–0.571)	-0.186 (-0.275)	-34.461 (-0.359)	-1,419.905** (-2.000)	-0.039 (-0.936)	–113.268*** (–3.315)
CDS Spread	–0.019*** (–3.785)	–0.001*** (–3.024)	–0.138*** (–3.820)	–0.328 (–1.286)	0.000*** (3.791)	–0.004 (–0.333)
Constant	–0.148 (–0.894)	–0.002 (–0.268)	–0.828 (–0.706)	7.142 (0.527)	0.000 (0.626)	0.265 (0.397)
Observations	131	131	131	131	131	131
R-squared	0.302	0.116	0.324	0.024	0.145	0.056
Panel B.2 (Without CDS)						
Assets in Vol. Private Pension Funds	1.442** (2.130)	0.056** (2.304)	10.893** (2.134)	12.158 (0.621)	–0.001 (–1.145)	–3.055** (–2.402)
Observations	186	186	186	186	186	186
R-squared	0.091	0.049	0.105	0.010	0.048	0.020
Panel B.3						
Participants in Vol. Private Pension Funds	0.000 (0.259)	0.000 (0.257)	0.001 (0.112)	-0.050 (-0.322)	0.000 (0.996)	–0.007 (–1.128)
Observations	131	131	131	131	131	131
R-squared	0.233	0.080	0.243	0.024	0.138	0.017
Panel B.4 (Without CDS)						
Participants in Vol. Private Pension Funds	–0.000 (–0.087)	0.000 (0.457)	–0.003 (–0.158)	–0.031 (–0.202)	0.000 (0.440)	–0.003 (–0.553)
Observations	186	186	186	186	186	186
R-squared	0.027	0.012	0.024	0.009	0.042	0.006

Notes: Robust *t*-statistics in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. All variables are defined in Appendix 1. Robust *t*-statistics are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

In Panel B of Table 2, we consider the same question by taking the first differences (here, we do not include the lagged values of the dependent variable and the variable of interest to interpret the coefficients). Even though the results are not as strong as those in Panel A, they still support the positive association with respect to the changes in assets being positively related to changes in the equity market indicators and the negative equity turnover.

Having established a positive association between the introduction of the private voluntary pension system and equity market value, we next investigate if the introduction of the system had an effect on the government bond market issuance and corporate bond issues as well as the secondary fixed income trading market. The government bond issuance market measures the market value of the total amount of debt issued by the Turkish Treasury during a given month. The BIST Debt measures, which include the Debt Securities Market, consist of the Outright Purchases and Sales Market, where the secondary market transactions of debt securities are conducted. In this market, trading is conducted for debt securities, scuritised asset and income-backed debt securities, lease certificates, liquidity bills issued by the Central Bank of the Republic of Turkey, and other securities which are approved by Borsa Istanbul Board, which are denominated in TRY; foreign currency can be traded on the Debt Securities Market.[14]

Table 3 Panels A and B show the results of our regressions with respect to bond markets. We use the same controls as before. Our results for the government bond market suggest that the introduction of voluntary pension plans is positively and significantly associated with the market value of government borrowing. This is visible with the introduction of voluntary private pension funds as a significant portion of the assets under management are invested in government bonds. With respect to the secondary market, we do not see a significant association between the number of participants in the voluntary pension plans and the market value and number of contracts for the overall bond transactions. Although some indicators (e.g., number of participants) are positively associated with total market value, the results are not robust. The results for the outright purchases and sales are negatively significant. The decline in demand for corporate bonds in the portfolios of pension funds could be attributable to a change in the behavior of portfolio managers of these funds. This change is because some firms failed to pay the term interest or principal of the corporate bonds they issued during 2018–2019 financial turbulence in Turkey, which in turn caused portfolio managers to become more conservative in adding (or preferring) corporate bonds to the pension fund portfolios. Panel B of Table 3 considers the first differences. Again, the change in voluntary private pension fund assets is positively associated with the change in government borrowing market value. However, there is no observed significant relationship when considering the BIST debt indicators.

Table 3
Voluntary pension funds and debt markets

Panel A provides the results of ARDL regressions for the bond market indicators from the Central Bank of Turkey and Borsa Istanbul. The dependent variables are market value of government debt securities, outright purchases and sales, total BIST fixed income market trading value, and the number of contracts and debt market turnover, respectively. For specifications in Panels A1 and A2 and Panels B1 and B2, the variable of interest is the assets in TRY (we use TRY and TL interchangeably) terms (inflation adjusted), and for specifications in Panels A3 and A4 and Panels B3 and B4, the variable of interest is the number of participants in voluntary private pension funds. Control variables include one-period-lagged GDP growth, interest rate, and CDS 5-year spreads. Panels A2 and A4 show the results for same specifications without the CDS Spread variable (to include the whole time period). Panel B runs the specifications as first differences on both sides of the equation. All specifications in Panel A also control for first and second lags of the dependent variable. The results for those coefficients are not shown in tables to save space, but they are available on request.

Panel A.1

	Market value			Number of contracts		
Variables	(1) Government debt securities	(2) Outright purchase and sales	(3) Total	(4) Outright purchase and sales	(5) Daily average	(6) Debt market turnover
Assets in Vol. Private Pension Funds	0.006***	–0.001	0.001	–0.000	0.000	–0.000
	(6.190)	(–1.222)	(0.457)	(–0.126)	(1.181)	(–1.430)
Assets in Vol. Private Pension Funds (t-1)	–0.007***	0.001	0.002	–0.001	0.000	0.000
	(–4.457)	(0.676)	(0.766)	(–0.417)	(0.360)	(0.509)
Assets in Vol. Private Pension Funds (t-1)	0.000	0.001	–0.003	0.001	–0.000	0.000
	(0.079)	(0.413)	(–1.262)	(0.589)	(–1.331)	(1.225)
GDP growth	0.141	0.701*	0.642	0.586*	0.140**	0.001
	(0.720)	(1.894)	(1.413)	(1.659)	(2.164)	(0.613)
Discount Rate	0.467***	0.476**	–0.525*	0.295	–0.082**	0.001
	(4.848)	(2.239)	(–1.822)	(1.568)	(–2.001)	(1.405)

(*Continued on next page*)

Table 3 (*Continued*)

	Market value			Number of contracts		
Variables	(1) Government debt securities	(2) Outright purchase and sales	(3) Total	(4) Outright purchase and sales	(5) Daily average	(6) Debt market turnover
CDS Spread	–0.027**	–0.017	0.043***	–0.002	0.007***	–0.000*
	(2.344)	(–1.571)	(3.304)	(–0.201)	(3.670)	(–1.851)
Constant	35.552**	11.254**	6.424	9.062**	1.507*	0.039**
	(2.429)	(2.448)	(1.193)	(2.325)	(1.883)	(2.291)
Observations	84	134	134	134	134	134
R-squared	0.973	0.329	0.687	0.650	0.624	0.912
Panel A.2 (Without CDS)						
Assets in Vol. Private Pension Funds	0.007***	–0.001	0.001	–0.000	0.000	–0.000
	(6.657)	(–1.291)	(0.338)	(–0.056)	(0.965)	(–0.928)
Observations	84	186	186	186	186	186
R-squared	0.964	0.318	0.670	0.769	0.601	0.949
Panel A.3						
Participants in Vol. Private Pension Funds	0.005	–0.013	0.028**	0.001	0.005***	–0.000**
	(0.325)	(–1.495)	(2.191)	(0.062)	(3.452)	(–2.290)
Observations	84	134	134	134	134	134
R-squared	0.952	0.330	0.699	0.650	0.639	0.914
Panel A.4 (Without CDS)						
Participants in Vol. Private Pension Funds	–0.009	–0.016**	0.025*	0.001	0.004***	–0.000
	(–0.511)	(–2.006)	(1.799)	(0.083)	(3.236)	(–1.475)
Observations	84	186	186	186	186	186
R-squared	0.940	0.326	0.684	0.769	0.619	0.949

Notes: Robust *t*-statistics in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. All variables are defined in Appendix 1. Robust *t*-statistics are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 3 (*Continued*)

Panel B.1

	Market value			Number of Contracts		
Variables	(1) Government debt securities	(2) Outright purchase and sales	(3) Total	(4) Outright Purch. And Sales	(5) Daily Average	(6) Debt Market Turnover
Assets in Vol. Private Pension Funds	0.006***	–0.001	0.001	0.000	0.000	–0.000
	(4.343)	(–1.162)	(0.141)	(0.512)	(0.552)	(–0.995)
GDP growth	–0.488**	0.490	1.245	–0.195	0.133	–0.003
	(–2.164)	(0.621)	(1.570)	(–0.285)	(1.147)	(–0.830)
Discount Rate	0.415	0.301	0.391	0.481	0.089	–0.003
	(1.165)	(0.824)	(0.941)	(0.734)	(1.374)	(–0.917)
CDS Spread	–0.030***	–0.013	0.002	0.005	–0.000	–0.000
	(–4.263)	(–0.940)	(0.056)	(0.484)	(–0.003)	(–0.678)
Constant	–1.358***	0.257	0.033	–0.248	–0.024	–0.001
	(–3.381)	(0.342)	(0.032)	(–0.425)	(–0.149)	(–0.277)
Observations	84	131	131	131	131	131
R-squared	0.587	0.013	0.023	0.010	0.025	0.050
Panel B.2 (Without CDS)						
Assets in Vol. Private Pension Funds	0.007***	–0.001	0.000	0.000	0.000	–0.000
	(4.558)	(–1.065)	(0.105)	(0.451)	(0.561)	(–0.802)
Observations	84	186	186	186	186	186
R-squared	0.433	0.007	0.013	0.004	0.018	0.014

(*Continued on next page*)

Table 3 (*Continued*)

	Market value			Number of Contracts		
Variables	(1) Government debt securities	(2) Outright purchase and sales	(3) Total	(4) Outright Purch. And Sales	(5) Daily Average	(6) Debt Market Turnover
Panel B.3						
Participants in Vol. Private Pension Funds	–0.013 (–1.295)	–0.002 (–0.346)	0.013 (0.716)	0.004 (0.574)	0.003 (1.321)	–0.000 (–0.956)
Observations	84	131	131	131	131	131
R-squared	0.336	0.009	0.033	0.011	0.035	0.046
Panel B.4 (Without CDS)						
Participants in Vol. Private Pension Funds	–0.015 (–1.393)	–0.003 (–0.489)	0.013 (0.722)	0.004 (0.559)	0.003 (1.265)	–0.000 (–0.973)
Observations	84	186	186	186	186	186
R-squared	0.063	0.005	0.022	0.005	0.028	0.017

Notes: Robust t-statistics in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Next, we also want to understand whether the introduction of the voluntary private pension funds had an effect on newly established sections of the capital markets. Here, we start by considering venture capital markets, derivatives markets, and precious metals markets. Unfortunately, the data for venture capital and derivatives markets are not yet large enough to conduct an evaluation. In Table 4, we provide our results for the precious metals and the gold indexes and their relationships to our dependent variable. The results show strong support for the introduction of voluntary private pension funds and the gold market index in both specifications (Columns 1 and 4) even though we do not observe any significance with respect to the precious metals index.

Table 4
Voluntary pension funds and other market characteristics

The table provides the results of ARDL regressions for the Gold Index, Precious Metals index, and the Corporate Governance Index (Borsa Istanbul). The dependent variables are represented as the CPI-adjusted TRY index values (1–3) and first differences (4–6). The variable of interest for specifications is the CPI-adjusted TRY value of assets in voluntary private pension funds (we use TRY and TL interchangeably). Control variables include one-period-lagged GDP growth, interest rate, and CDS 5-year spreads. All specifications also control for first and second lags of the dependent variable. The results for those coefficients are not shown in tables to save space, but they are available if requested.

Variables	(1) Metals-Gold Index	(2) Precious Metals Index	(3) BIST Corp. Gov. Index	(4) Metals-Gold Index	(5) Precious Metals Index	(6) BIST Corp. Gov. Index
Assets in Voluntary Private Pension Funds	28.323**	39.379	0.931**	34.886**	20.526	1.029**
	(2.254)	(1.437)	(2.305)	(2.265)	(0.555)	(2.041)
Assets in Vol. Private Pension Funds (t-1)	–24.687	–23.522	-0.599			
	(–1.362)	(–0.519)	(-1.177)			
Assets in Vol. Private Pension Funds (t-2)	–6.352	–18.180	–0.257			
	(–0.518)	(–0.527)	(–0.542)			
GDP Growth	0.021	-0.129	0.172**	–7.913*	–9.370*	0.014
	(0.007)	(-0.032)	(2.563)	(–1.772)	(–1.969)	(0.088)
Discount Rate	0.855	6.211	0.078	6.955	6.678	–0.029
	(0.438)	(0.773)	(1.531)	(0.712)	(0.693)	(–0.273)
CDS Spread	–0.060	0.081	–0.022***	–0.080	–0.360	–0.016***
	(–0.666)	(0.484)	(–4.237)	(–0.875)	(-0.832)	(–3.071)
Constant	144.113	64.193	11.905***	–19.158***	–18.582*	–0.148
	(1.390)	(0.419)	(4.748)	(–2.665)	(–1.703)	(–0.928)
Observations	83	70	134	83	71	131
R-squared	0.971	0.961	0.915	0.087	0.085	0.243

Notes: Robust t-statistics in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. All variables are defined in Appendix 1. Robust *t*-statistics are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Since pension funds are long-term investors, pension fund managers are assumed to improve the corporate governance of the firms they invest in. Although pension fund managers in Turkey are unlikely to have a large say in the firms they hold shares in, it is likely that pension funds choose better governed firms. To understand whether this is the case, we also examine firms that are in the BIST corporate governance index and assess whether that index is associated with voluntary private pension funds. Indeed, we again observe a strongly positive association between assets in voluntary private pension funds and the BIST Corporate Governance index. The negative significance we see in the equity turnover and the positive significance in corporate governance index suggest that voluntary pension plans might make their investments for the long run and are helping firms with respect to better corporate governance practices.

We next consider the effect of state contributions. After 2013, the government introduced a regulation that offered government participation. We analyze whether this additional flow of funds had a significant impact on the markets. From portfolio distributions of these funds, we observe that they mainly invest in government bills and bonds. As a result, any effect should be in the bond market. Indeed, looking at Table 5, we do not see a special effect in the equities markets. However, on the bond side, we see an improvement after 2013 for secondary market debt security contracts traded. Interestingly, the debt market turnover also increases post 2013 which supports our observation that the flows from the government participation mainly affect secondary bond markets.

Table 5 present results of ARDL regressions for the equity and bond markets pre and post the introduction of government participation. The table below (Panel A) provides the results of ARDL regressions for the equity market (Borsa Istanbul). The dependent variables are the closing prices (1), monthly returns (2), market value (3), Daily Average Trading Volume (4), Amihud illiquidity (5), and Equity Turnover (6). In Panel A1, the variable of interest for all specifications is the inflation-adjusted TRY value of assets in voluntary private pension funds (we use TRY and TL interchangeably) and its interaction with post 2013 indicator. In Panel A2, the variable of interest is the number of participants in voluntary private pension funds. Panel B conducts the same analysis for Debt Market variables. Specifications also control for first and second lags of the dependent variable. The results for those coefficients are not shown in tables to save space, and they are available if requested.

Table 5
Introduction of state contributions

Panel A.1

Variables	(1) Values (close)	(2) Returns	(3) Market value	(4) Daily avg. trading vol.	(5) Amihud illiquidity	(6) Equity turnover
Assets in Voluntary Private Pension Funds	1.547**	0.059**	12.042**	15.563	–0.001	–3.395***
	(1.988)	(2.126)	(2.029)	(0.549)	(–1.080)	(–2.741)
Assets in Voluntary Private Pension Funds*Post 2013	0.089	0.004	–0.184	1.253	–0.000	0.316
	(0.670)	(0.925)	(–0.193)	(0.154)	(–0.438)	(0.651)
Post 2013 Dummy	–1.355	–0.055	–4.031	–87.219	0.003	–4.533
	(–1.065)	(–1.276)	(–0.456)	(–0.903)	(0.743)	(–0.835)
GDP Growth	0.032	–0.002	0.252	–5.899	0.000	–0.755**
	(0.344)	(–0.459)	(0.415)	(–1.186)	(1.155)	(–2.036)
Discount Rate	–0.077*	–0.001	–0.474*	1.032	0.000	0.014
	(–1.859)	(–0.402)	(–1.874)	(0.408)	(0.083)	(0.067)
Constant	5.481***	0.034	33.240***	43.063	0.001	12.338*
	(2.739)	(0.664)	(2.866)	(0.490)	(0.427)	(1.807)
Observations	186	186	186	186	186	186
R-squared	0.884	0.104	0.931	0.917	0.751	0.621

Panel A.2

Participants in Voluntary Private Pension Funds	–0.001	–0.000	–0.013	–0.340*	0.000	–0.013**
	(–0.634)	(–0.803)	(–0.813)	(–1.962)	(1.098)	(–2.190)
Participants in Voluntary Private Pension Funds*Post 2013	0.000	0.000	–0.002	–0.013	–0.000	0.001
	(0.580)	(1.101)	(-0.721)	(–0.433)	(–0.041)	(0.414)
Observations	186	186	186	186	186	186
R-squared	0.876	0.039	0.926	0.918	0.749	0.616

Notes: Robust t-statistics in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. All variables are defined in Appendix 1. All TRY values are inflation adjusted. Robust t-statistics are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel B.1

	Market value			Number of contracts		
Variables	(1) Government debt securities	(2) Outright purchase and sales	(3) Total	(4) Outright purchase and sales	(5) Daily average	(6) Debt narket turnover
Assets in Voluntary Private Pension Funds	0.005***	–0.001	0.001	–0.001	0.000	–0.000*
	(3.914)	(–1.058)	(0.519)	(–1.367)	(1.149)	(–1.824)
Assets in Voluntary Private Pension Funds *Post 2013	1.487	0.001	–0.001**	1.905***	–0.113**	0.000***
	(1.116)	(0.002)	(–2.360)	(3.440)	(–2.281)	(3.745)
Post 2013 Dummy	–15.987	–2.075	11.356**	–16.760***	1.464***	–0.077***
	(–1.273)	(–0.431)	(2.474)	(–2.998)	(2.649)	(–3.690)
GDP Growth	0.101	0.551**	0.125	0.328	0.026	0.001
	(0.581)	(2.269)	(0.557)	(1.202)	(0.763)	(0.964)
Discount Rate	0.167	0.052	0.172	–0.110	0.019	–0.001*
	(1.375)	(0.421)	(1.380)	(–0.916)	(1.060)	(–1.962)
Constant	29.301**	13.349**	–1.356	32.896***	0.564	0.120***
	(2.016)	(2.459)	(–0.323)	(4.120)	(0.815)	(4.103)
Observations	84	186	186	186	186	186

(*Continue on next page*)

Table 5 (*Continued*)

Panel B.1						
	Market value			Number of contracts		
Variables	(1) Government debt securities	(2) Outright purchase and sales	(3) Total	(4) Outright purchase and sales	(5) Daily average	(6) Debt market turnover
R-squared	0.965	0.321	0.682	0.787	0.614	0.952
Panel B.2						
Participants in Voluntary Private Pension Funds	0.001 (0.047)	–0.017** (–2.027)	0.028** (2.065)	–0.002 (–0.274)	0.005*** (3.399)	–0.000** (–2.391)
Participants in Voluntary Private Pension Funds *Post 2013	–0.007 (–1.432)	–0.000 (–0.143)	–0.002* (–1.771)	0.006*** (3.138)	–0.000* (–1.675)	0.000*** (3.478)
Observations	84	186	186	186	186	186
R-squared	0.940	0.326	0.690	0.784	0.625	0.953

Notes: Robust *t*-statistics in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Next, we also want to understand the direction of causality in the series. Hence, we run a VAR model for each dependent variable with four lags and the same control variables (one-period-lagged GDP Growth, discount rate, interest rate) and then conduct Granger causality tests for each variable separately. The results of our robustness checks are provided in Appendix 4. Within each category of equity returns, closing prices, market value, debt traded value, and other market characteristics, there is at least one capital market indicator where the hypothesis is rejected that lagged values of Plan Assets or Number of participants do not Granger cause the dependent variable. Of course, the Granger causation sometimes runs both ways. However, this supports our positive association argument.

Finally, Appendix 5 shows the results of co-integration tests to understand if there are any long-run relationships among the variables. The tests are conducted using the ARDL method as before on the same specifications but also including the error correction option and then using the Bounds Test procedure of Pesaran et al. (2001). The results for almost all dependent variables reject the null that there is no levels relationship (only Debt market turnover and BIST Metals indices F-stats do not reject the null hypothesis). The results for all other variables suggest a long-run equilibrium relationship between voluntary pension fund assets and the respective market indicators. To get these statistics, we run the specifications using ARDL as before with the error correction specification (again with two lags). These long-run and short-run coefficients are then used to calculate the Bounds test results.

Overall, our results support the view that the new channel of investment via the introduction of voluntary private pension funds is positively associated with capital markets as measured by various equity and debt indicators as well as other market characteristics.

Does the increase in pension fund participation transfer to savings for individuals and make it easier/cheaper to access funds for the private sector? Although we do not conduct an econometric analysis here, we plan to do so in our further research. As an initial observation, for individual savings, we collect data on an annual survey conducted on households in Turkey (Household Budget Survey). An initial look at the microdata suggests that the household saving rate has decreased over our time period from 19% in 2002–2003 to around 4% in 2012–2013, before increasing to around 12% in 2018.[15] Clearly, many factors affect a household savings rate, but overall, the introduction of voluntary pension funds does not seem to obviously increase the household savings rate. With respect to easier access to markets, we again consider a simple statistic, the number of initial public offering (IPO) announcements. We simply observe the activity of firms choosing to raise funds via equity markets and know that there are many determinants of IPOs.[16] However, looking at data from Bloomberg, we observe that a positive trend occurs in the number of IPO announcements during this time frame starting with six announcements in 2003 up to 44 announcements in 2018 (with highest being 88 in 2010). Further empirical research is necessary to understand the linkages of the savings behaviour of households and their retirement investments as well as the capital market developments and firm choice of equity and debt markets to raise funds.

CONCLUSION

Many individuals and organisations, including policymakers, are interested in seeing whether pension reforms undertaken in many countries within the past two decades are associated with capital market development. Turkey implemented a voluntary private pension plan scheme that went into effect in 2003, and we analyse whether this introduction is associated with capital market development indicators in a volatile but important emerging market.

Looking at market capitalisation, market volume, and the number of transactions, we observe that the additional demand created by the introduction of the voluntary private pension funds is positively associated with equity markets in general. As for the debt markets, although the evidence is not as strong as in the equity markets, it is still statistically significant, especially with respect to the market value of government bond securities. However, in the corporate

bond market and the secondary market where any type of fixed income securities is traded, significance is observed only with respect to the number of contracts traded. The results hold after controlling for macroeconomic indicators such as the GDP growth rate, interest rates, and a measure of market volatility, the CDS spreads.

For newly established markets for which there are data (i.e., precious metals markets), the gold index is positively associated with the introduction of voluntary pension plans. More importantly, assets in voluntary pension funds are also positively associated with an index of Corporate Governance measuring firms that pass a certain threshold with respect to their corporate governance practices. This is an important indicator suggesting that the long horizon of pension fund investments might increase the monitoring role of institutional investors in these firms.

The introduction of state contributions in 2013 makes a positive contribution to the government domestic bond issuance market as well as the equity market with respect to increased liquidity. However, the results are not robust to alternative specifications.

Although our results provide some evidence that voluntary pension funds are associated with capital market development, it should be noted that endogeneity issues may be inherent within this context (such as reverse causality or omitted variables). Although we utilise one exogenous event (the introduction of state contributions) which is available to us during our time period, and control for lagged versions of the variables, the results should still be considered as associations.

Overall, our results suggest that the introduction of voluntary pension plans are associated positively with capital market indicators, the introduction of new markets, and better corporate governance in firms. Future research is needed to understand whether this association channels through to individual savings, provides cheaper credit opportunities for firms, and allows better governance by increasing the depth and efficiency of capital markets.

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NOTES

1. The first pension was created in 1881 by Otto von Bismarck, the president of Prussia, who presented a radical idea to the Reichstag: government-run financial support for older members of society (i.e., retirement). At the time, people did not retire. In the United States in the mid-1800s, certain municipal employees, firefighters, police officers, and teachers started receiving public pensions, and in 1875, the American Express Co. started offering private pensions. In 1920s, many industries promised their workers some sort of support for retirement (railroads, banks, and oil, among others) (Source: The Atlantic Magazine, "How Retirement was Invented", 24 October 2014).
2. Capital markets are essential in accelerating economic growth, creating jobs, and hence reducing poverty (Bekaert & Harvey, 1998; King & Levine, 1993; Beck et al., 2005). The literature suggests capital markets provide an important financing channel for the economy by providing risk allocation through a diversification of funding sources and instruments; supporting economic growth and financial stability; helping with efficient allocation of domestic and international savings; providing long-term financing needed for infrastructure investments; financing long-term housing mortgages; facilitating equity and debt for small and medium sized enterprises (SMEs); and enabling individuals to save for their old age and purchase retirement products (Committee on the Global Financial System, 2019; World Bank, Financial & Private Sector Development note, no date). Hence, the development of these markets is important for economic growth.
3. The World Bank statistics and Comert and Yeldan (2018).
4. A detailed overview of the pension fund system and capital market development is provided in Kayhan and Togan Eğrican (2021).
5. The World Bank Group presentation "Capital Markets Development in Poland and Turkey" by Martin Raiser. Retrieved on 18 November 2019 from https://www.tepav.org.tr/upload/files/haber/1427479594-3.Martin_Raiser_in_Sunumu.pdf and Capital Markets Board presentation, Retrieved 25 March 2015 from https://www.tepav.org.tr/upload/files/haber/1427479594-7.Bora_Oruc_un_Sunumu.pdf
6. The Turkish national pension system was mainly initiated after World War II. The deficits created by the national pension system over time required increasingly large transfers from the general budget, showing a need for pension reform. http://www.sgk.gov.tr/wps/portal/sgk/tr/kurumsal/kurumumuz/tarihce (Brook & Whitehouse, 2006).
7. https://www.anadoluhayat.com.tr/files/yatirimci-iliskileri/yatirimci-sunumlari/2017/2017-03-31-Investor-Presentation.pdf (Retreived on 30 December 2019).
8. Capital Markets Board (https://www.spk.gov.tr/Sayfa/AltSayfa/286 [Retrieved on 3 December 2019]).

9. These values do not include the AES participants.
10. We use TRY and TL interchangeably in this paper.
11. The corporate governance rating is calculated by a private rating agency approved by the BIST https://www.borsaistanbul.com/files/bist-stock-indices-ground-rules.pdf.
12. Dickey Fuller tests with trends are available upon request. We do not report them here for brevity.
13. We thank an anonymous referee for this suggestion.
14. Under debt securities, there are additional sub-sections of the market. These include the Repo-Reverse Repo Market, the Repo Market for Specified Securities, the Equity Repo Market, and International Bonds Market, where foreign debt instruments issued by the Turkish Treasury and listed by Borsa-Istanbul are conducted. There are also two additional markets: The Watchlist Market and the Committed Transactions Market where same say or forward value buy-sell transactions are realised between the seller with a commitment to repurchase a predetermined security and the buyer with a commitment to resell that security. Mainly lease certificates issued by asset leasing companies are traded in this market. However, we do not include these in our analyses as the level of transactions in the market is relatively small.
15. In this survey, the questions ask households on the level of income as well as the amount of spending every month. We calculate annual household savings as $S = (Y - C)/Y$ separately for each year. We annualize monthly expenses. Our saving results seem to be consistent with Altug and Firat (2018).
16. An interesting recent study by Tutuncu (2020) considers a regulation change to analyse the lockup provisions on IPO values, for example.

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APPENDICES

Appendix 1
Variable definitions

Variable	Definition and Source
Amihud Illiquidity	Amihud (2002) illiquidity measure calculated for BIST 100 index or BIST All index using daily CPI-adjusted prices using Amihud = 1000*sqrt((abs(Return))/(abs(Price)*Trading Volume)). Daily BIST 100 and BIST All prices and trading volume data are retrieved from Thomson Reuters.
Assets in Voluntary Private Pension Funds (in millions)	Total amount of assets that are traded in portfolios of voluntary private pension funds (in TL). Monthly data. Source: Pension Monitoring Center.
Assets in Voluntary Private Pension Funds including Government Contributions (in millions)	Total amount of assets that are traded in portfolios of voluntary private pension funds as well as government contributions (in TL). Monthly data. Source: Pension Monitoring Center.
BIST All Closing Prices	The index consists of the stocks of all companies traded on Stars, Main, and Emerging Companies markets. Source: Borsa Istanbul.
BIST Corporate Governance Index	The index consists of the stocks of companies traded on Stars, Main, and Emerging Companies markets and has the minimum required corporate governance rating grade. Source: Borsa Istanbul.

(*Continued on next page*)

Appendix 1 (*Continued*)

BIST Daily Average Traded Volume (in thousands)	Average traded volume of all stocks traded on Borsa Istanbul. Source: Borsa Istanbul.
BIST Metals - Gold Index	Precious Metals Market (Gold Only). Index Values. Source: Borsa Istanbul.
BIST Precious Metals Market Index	Precious Metals Market, includes the spot trade of standard and non-standard gold, silver, platinum, and palladium metals. Index Values. Source: Borsa Istanbul.
Variable	Definition and Source
BIST Total Market Value (TL millions)	Borsa Istanbul Equity Market total market value. Monthly Data. Source: Borsa Istanbul.
BIST All Return	Calculated as the percent change from the previous month using CPI-adjusted variables.
Consumer Price Index (1990=100)	Consumer Price Index, December year over year percentage growth. 1994 = 100. Monthly data. Source: Turkish Statistical Institute.
Debt Market Turnover	Debt market turnover is calculated as total debt market number of contracts/ total market value for each month. Source: Borsa Istanbul.
Debt Securities Daily Average Number of Contracts	Daily average number of contracts for all debt securities scaled by 1,000. Source: Borsa Istanbul.
Debt Securities Offerings Market for Qualified Investors Market Value (TL millions)	The Offering Market for Qualified Investors is the market in which the debt securities of the issuers defined in the related CMB Communiqué are issued to 'qualified investors' as defined in the capital markets legislation, in accordance with the regulations of the Capital Markets Board of Turkey. Source: Borsa Istanbul.
Debt securities outright purchases and sales market value (TL thousands)	Fixed income securities are traded on the Outright Purchases and Sales Market, which is an organized and transparent secondary market. Debt securities, securitized asset and income-backed debt securities, lease certificates, liquidity bills issued by the Central Bank of the Republic of Turkey, and other securities which are approved by Borsa Istanbul Board, all of which can be issued in Turkish Lira (TRY) or foreign currency can trade on this market. Source: Borsa Istanbul.
Debt Securities Outright Purchases and Sales Market Number of Contracts	The number of contracts (monthly) for fixed income securities that are traded in the secondary market. Source: Borsa Istanbul.
Debt Securities Total Market Value (TL millions)	Traded value of all debt securities. Source: Borsa Istanbul.

(*Continue on next page*)

Appendix 1 (*Continued*)

Discount Rate	Interest Rates, Discount Rate for Turkey, Percent per Annum, Monthly, Not Seasonally Adjusted. Source: St. Louis FED, FRED Database.
End-of-Day 5-Year CDS Spread (Mid-Point) Close	5-Year Credit Default Swap spreads for Turkey. Mid-point, End-of-Day Values. Source: Thomson Reuters Eikon.
Equity Turnover	Equity market turnover is calculated as total equity market trading volume/total market capitalisation for each month. Source: Borsa Istanbul.
Variable	Definition and Source
GDP Growth	Quarterly growth rates of real GDP which represents the changes in value as compared to previous quarter. In between quarters are interpolated to use with monthly data. Source: OECD.
Government Domestic Debt Securities	The Market Value of Government Domestic Debt Securities issues (TL thousands) (DIBS). Source: Central Bank of Turkey EVDS Database.
Participants in Vol. Private Pension Funds	Total number of participants in the voluntary private pension system. Monthly data. Source: Pension Monitoring Center.

Appendix 2: Optimal Lag Selection Criterion Tests

Lag	AIC	HQIC	SBIC	Lag	AIC	HQIC	SBIC	Lag	AIC	HQIC	SBIC
BIST All Closing Value (CPI Adjusted)				**BIST All Returns (CPI Adjusted)**				**BIST Total Market Value (TL Millions)**			
1	18.8834	18.9259	18.9882*	1	12.2415	12.284	12.3463*	1	22.6784	22.7209	22.7832*
2	18.8344*	18.9052*	19.0091	2	12.1869*	12.2577*	12.3616	2	22.6191*	22.6899*	22.7938
3	18.8502	18.9494	19.0948	3	12.1988	12.2979	12.4434	3	22.6416	22.7408	22.8862
4	18.8585	18.986	19.173	4	12.24	12.3674	12.5545	4	22.6335	22.761	22.948
BIST Daily Traded Volume (000s)				**Amihud Illiquidity - BIST All (CPI Adjusted)**				**Equity Turnover**			
1	27.3475	27.39	27.4524	1	7.3959	7.43839	7.50074*	1	21.6862	21.7287	21.791
2	27.2759*	27.3467*	27.4506*	2	7.34493*	7.41575*	7.51965	2	21.579*	21.6498*	21.7537*
3	27.2836	27.3827	27.5282	3	7.3636	7.46275	7.60821	3	21.6097	21.7088	21.8543
4	27.317	27.4445	27.6316	4	7.38998	7.51745	7.70448	4	21.6398	21.7673	21.9543
Govt. Dom. Debt Sec. Mrkt. Value (TL Mill.)				**Debt sec. outright purch. and sls (TL Mill.)**				**Debt Total Market Value (TL Millions)**			
1	33.1345	33.2052*	33.3106*	1	35.2446	35.2871	35.3494	1	21.2435	21.2859	21.3483
2	33.1166	33.2345	33.4101	2	35.1627*	35.2336*	35.3375*	2	21.0835	21.1543*	21.2582*
3	33.0805*	33.2455	33.4914	3	35.1985	35.2976	35.4431	3	21.0687*	21.1678	21.3133
4	33.1387	33.3508	33.667	4	35.1659	35.2934	35.4804	4	21.0743	21.2017	21.3888
Daily Average Number of Contracts				**Debt sec. outright purch. and sls (Contracts)**				**Debt Market Turnover**			
1	31.1836	31.226	31.2884	1	35.2446	35.2871	35.3494	1	10.2181	10.2606	10.3229
2	31.0044	31.0752*	31.1791*	2	35.1627*	35.2336*	35.3375*	2	10.1216	10.1924*	10.2964*
3	30.9889*	31.0881	31.2335	3	35.1985	35.2976	35.4431	3	10.0968	10.196	10.3414
4	30.9928	31.1203	31.3073	4	35.1659	35.2934	35.4804	4	10.0865*	10.214	10.401

(*Continue on next page*)

Appendix 2 (*Continued*)

Lag	AIC	HQIC	SBIC	Lag	AIC	HQIC	SBIC	Lag	AIC	HQIC	SBIC
BIST Metals - Gold Index				**BIST Precious Metals Market Index**				**BIST Corporate Governance Index**			
1	25.0963*	25.1675*	25.2737*	1	24.7034*	24.781*	24.8993*	1	32.8781	32.9293	33.0042*
2	25.1232	25.2418	25.4188	2	24.7112	24.8405	25.0376	2	32.8322*	32.9176*	33.0423
3	25.1814	25.3475	25.5953	3	24.7585	24.9396	25.2155	3	32.8545	32.9741	33.1487
4	25.2042	25.4177	25.7363	4	24.7969	25.0297	25.3844	4	32.8672	33.0209	33.2454

Notes: The table provides the results for the Akaike information criterion (AIC), Schwarz's Bayesian information criterion (SBIC), and the Hannan and Quinn information criterion (HQIC) lag order selection statistics. An asterisk appears next to the likelihood ratio statistic indicating the optimal lag. Variable definitions are provided in Appendix 1. All TRY values are inflation adjusted.

Appendix 3: Unit Root Tests for Dependent Variables

The table below presents the results of the unit root tests (Augmented Dickey-Fuller results) and critical values for the main variables of interest during the time period. Variable definitions are provided in Appendix 1. All TRY values are inflation adjusted (we use TL and TRY interchangeably). Panel A provides information on the test results for the values. Results for same variables with trend assumption are not presented here to save space. This information is available upon request. Panel B provides information on test results for first differences. Panels C and D conduct the stationarity tests allowing for structural breaks using the Perron and Vogelsang (1992) unit root tests.

Panel A	
Critical values: 1% (-3.478); 5% (-2.884); 10% (-2.574)	
Variable	ADF Test
	Stat
BIST All Closing Value (CPI Adjusted)	-3.202
BIST All Returns	-7.797
BIST Total Market Value (TL Millions)	-2.721
BIST Daily Avg. Traded Volume (000s)	-0.811
Amihud Illiquidity BIST All	-3.619
Equity Turnover	-3.132
Government Domestic Debt Securities Market Value (TL Million)	-2.42
Debt securities outright purchases and sales (TL Millions)	-4.949
Total Debt Market Value (TL Millions)	-3.12
Outright Purchases and Sales Market - Number of Contracts	-2.39
Daily Average - Number of Contracts	-3.885
Debt Turnover	-1.604
BIST Metals - Gold Index	-3.747
BIST Precious Metals Market Index	-3.393
BIST Corporate Governance Index	-3.194
Panel B	
BIST All Closing Value (CPI Adjusted)	-7.908
BIST All Returns	-13.521
BIST Total Market Value (TL Millions)	-8.196
BIST Daily Avg. Traded Volume (000s)	-10.126
Amihud Illiquidity BIST All	-7.776

(*Continue on next page*)

Appendix 3 (*Continued*)

Panel B	
Equity Turnover	-9.762
Government Domestic Debt Securities Market Value (TL Million)	-5.457
Debt securities outright purchases and sales (TL Millions)	-11.887
Total Debt Market Value (TL Millions)	-9.708
Outright Purchases and Sales Market - Number of Contracts	-12.191
Daily Average - Number of Contracts	-10.206
Debt Turnover	-9.314
BIST Metals - Gold Index	-5.924
BIST Precious Metals Market Index	-5.715
BIST Corporate Governance Index	-6.515
Panel C	
Critical values = 5%; 3.56	
BIST All Closing Value (CPI Adjusted)	-3.574
BIST All Returns	-15.008
BIST Total Market Value (TL Millions)	-3.392
BIST Daily Avg. Traded Volume (000s)	-3.153
Amihud Illiquidity BIST All	-2.786
Equity Turnover	-5.266
Government Domestic Debt Securities Market Value (TL Million)	-2.962
Debt securities outright purchases and sales (TL Millions)	-5.807
Total Debt Market Value (TL Millions)	-3.706
Outright Purchases and Sales Market - Number of Contracts	-5.807
Daily Average - Number of Contracts	-3.706
Debt Turnover	-3.07
BIST Metals - Gold Index	-3.747
BIST Precious Metals Market Index	-3.393
BIST Corporate Governance Index	-3.194
Panel D	
BIST All Closing Value (CPI Adjusted)	-7.908
BIST All Returns	-13.521
BIST Total Market Value (TL Millions)	-8.196
BIST Daily Avg. Traded Volume (000s)	-10.126
Amihud Illiquidity BIST All	-7.776
Equity Turnover	-9.762

(*Continue on next page*)

Appendix 3 (*Continued*)

Panel D	
Government Domestic Debt Securities Market Value (TL Million)	-5.457
Debt securities outright purchases and sales (TL Millions)	-11.887
Total Debt Market Value (TL Millions)	-9.708
Outright Purchases and Sales Market - Number of Contracts	-12.191
Daily Average - Number of Contracts	-10.206
Debt Turnover	-9.314
BIST Metals - Gold Index	-5.924
BIST Precious Metals Market Index	-5.715
BIST Corporate Governance Index	-6.515

Appendix 4

Granger Causality Tests

Null Hypothesis	Chi-square	Prob.
Closing Prices		
BIST All does not Granger cause of Assets in Voluntary Private Pension Funds	11.093	0.026
Assets in Voluntary Private Pension Funds does not Granger cause of BIST All	18.462	0.001
Returns		
BIST All does not Granger cause of Assets in Voluntary Private Pension Funds	1.5947	0.81
Assets in Voluntary Private Pension Funds does not Granger cause of BIST All	9.4666	0.05
Market Value		
BIST Total Market Value does not Granger cause of Assets in Voluntary Private Pension Funds	21.358	0
Assets in Voluntary Private Pension Funds does not Granger cause of BIST Total Market Value	20.671	0
Traded Volume and Liquidity		
BIST Total Traded Volume does not Granger cause of Assets in Voluntary Private Pension Funds	15.617	0.004
Assets in Voluntary Private Pension Funds does not Granger cause of BIST Total Traded Volume	1.9202	0.75
Amihud Illiquidity BIST All does not Granger cause of Assets in Voluntary Private Pension Funds	7.7763	0.1

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Appendix 4 (*Continued*)

Traded Volume and Liquidity		
Assets in Voluntary Private Pension Funds does not Granger cause of Amihud Illiquidity BIST All	4.3463	0.361
Equity Turnover does not Granger cause of Assets in Voluntary Private Pension Funds	2.3778	0.667
Assets in Voluntary Private Pension Funds does not Granger cause of Equity Turnover	3.3329	0.504
Debt Market Turnover does not Granger cause of Assets in Voluntary Private Pension Funds	0.94566	0.918
Assets in Voluntary Private Pension Funds does not Granger cause of Debt Market Turnover	22.759	0
Traded Value		
Govt. Domestic Debt Securities Market Value does not Granger cause of Assets in Voluntary Private Pension Funds	9.7859	0.044
Assets in Voluntary Private Pension Funds does not Granger cause of Govt. Domestic Debt Securities Market Value	45.518	0
Debt Securities Outright Purchases and Sales does not Granger cause of Assets in Voluntary Private Pension Funds	6.6983	0.153
Assets in Voluntary Private Pension Funds does not Granger cause of Debt Securities Outright Purchases and Sales	12.863	0.012
BIST Total does not Granger cause of Assets in Voluntary Private Pension Funds	6.3833	0.172
Assets in Voluntary Private Pension Funds does not Granger cause of BIST Total	17.695	0.001
Number of Contracts		
No. of Contracts Outright Purchases and Sales does not Granger cause of Assets in Voluntary Private Pension Funds	3.4366	0.488
Assets in Voluntary Private Pension Funds does not Granger cause of No. of Contracts Outright Purchases and Sales	3.0393	0.551
Total number of contracts (Debt) does not Granger cause of Assets in Voluntary Private Pension Funds	5.7537	0.218
Assets in Voluntary Private Pension Funds does not Granger cause of Total number of contracts (Debt)	17.176	0.002
Other Market Characteristics		
BIST Corp. Gov. Index does not Granger cause of Assets in Voluntary Private Pension Funds	7.8108	0.099
Assets in Voluntary Private Pension Funds does not Granger cause of BIST Corp. Gov. Index	14.063	0.007
BIST Metals- Gold Index does not Granger cause of Assets in Voluntary Private Pension Funds	3.1857	0.527

(*Continue on next page*)

Appendix 4 (*Continued*)

Other Market Characteristics		
Assets in Voluntary Private Pension Funds does not Granger cause of BIST Metals- Gold Index	9.1463	0.058
BIST Precious Metals Index does not Granger cause of Assets in Voluntary Private Pension Funds	3.2801	0.512
Assets in Voluntary Private Pension Funds does not Granger cause of BIST Precious Metals Index	7.2793	0.122

Appendix 5

Cointegration Tests

Variable	Calculated F statistics
BIST All Closing Value (CPI Adjusted)	17.910***
BIST All Returns	22.186***
BIST Total Market Value (TL Millions)	12.451***
BIST Daily Avg. Traded Volume (000s)	4.233**
Equity Turnover	4.491**
Government Domestic Debt Securities Market Value (TL Million)	8.710***
Debt securities outright purchases and sales (TL Millions)	6.818***
Debt securities Total (TL Millions)	5.893***
Outright Purchases and Sales Market - Number of Contracts	5.601***
Daily Avg Number of Contracts	7.990***
Debt Market Turnover	2.351
BIST Metals - Gold Index	1.801
BIST Precious Metals Market Index	1.600
BIST Corporate Governance Index	16.019***

Notes: The table provides the results of the Bounds test (Pesaran et al., 2001) for the dependent variables used in analyses where the null hypothesis tests the existence of no level relationship. The calculated F statistics are provided. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. In tables and text, we use TRY and TL interchangeably. Tests are conducted without the CDS variable for BIST All Returns and Debt Market Turnover. Amihud illiquidity variables are excluded as the results cannot be calculated under the Bounds test.