Received: 4 October 2025 | Accepted: 29 October 2025
DOI: 10.52898/ijif.2025.7

ORIGINAL ARTICLE

THE ROLE OF PRIVATE PENSION SYSTEM IN FINANCIAL DEEPENING: AN EMPIRICAL APPLICATION ON TURKEY*

Gaye UGUN
Gürçem ÖZAYTÜRK

Abstract
The inadequacy of the social security system during retirement has led to a search for a new social security system. Thus, the private pension system emerged. In this respect, the private pension system complements the social security system. This system offers individuals the opportunity to supplement their retirement income by transferring savings earned during their working years into private pension funds. With this income, individuals can increase their standards and focus on investing. Thus, financial deepening, which refers to the diversification and proliferation of financial intermediaries and financial instruments, increases, and funds can be transferred between entrepreneurs seeking to invest and the private pension system.
This study investigates the role of the private pension system in financial deepening in Turkey using quarterly data from 2006Q4 to 2024Q1. The study used M2 money supply as an indicator of financial deepening and the fund amount of private pension participants as an indicator of private pensions as variables. The analysis was conducted using the ARDL bounds test and the Granger causality test. The results indicate that an increase in the amount of Private Pension System funds increases financial deepening. The Granger causality test results also support this conclusion, indicating that the Private Pension System is a Granger causal factor for financial deepening. Therefore, increasing participation in the Private Pension System through government support and incentives will lead to increased funds, increased resources for the financial system, and financial deepening.

Keywords
Financial Deepening, Individual Retirement System, Türkiye.

JEL Classification
G22 - G41.

Authors Notes:
Correspondence
Assoc. Prof. Dr. Marmara University Institute of Banking and Insurance, Department of Insurance,
Istanbul, Turkey,
ORCID: 0000-0002-3056-3539,
gayeugun01@gmail.com

Assistant Professor, Ömer Halisdemir Üniversitesi, Niğde, Turkey,
ORCID: 0000-0001-5321-9784,
grcmoransay@gmail.com

** This study was prepared using material from the master's thesis entitled "The Role of the Individual Pension System in Financial Deepening: An Empirical Application on Türkiye," supervised by Assoc. Prof. Dr. Gürçem ÖZAYTÜRK.*

1. INTRODUCTION

The private pension system is a system that creates a sustainable standard of living and provides supplemental income during retirement by investing savings earned during working periods into regular funds. The private pension system is a sub-branch of the social security system and complements and expands the social security system. The essence of this system is to provide individuals with additional income during retirement and to transfer savings earned during active employment into income-generating funds (Ippolito, 1986: 13).

In other words, a private pension system is an organized retirement system where participants transfer contributions to their accounts at regular intervals and manage their funds until retirement under a predetermined contract. The private pension system is generally a complement to the state social security system. The system is based on the principle that participants contribute a portion of their savings during their working years to maintain their standard of living during retirement and provide another income-generating fund (EGM, 2001). The basis of the individual retirement system is to eliminate the concerns of its participants about the future, to guarantee their future while they are able to work, and to use a portion of their income effectively by saving (Önder, 2017: 8).

While there are significant differences in the retirement systems of countries, it has been observed that social security systems and pension funds are structured around a three-part structure. The first part is the traditional state pension system, which is based on a distributional principle and is a mandatory retirement system. This system, which allows for the redistribution of income provided by the state to various age groups within the social security system, is based on the principle that collections made to retired individuals are covered by funds collected from actively employed individuals. The second part, while based on occupational pension funds, is suitable for a group based on employment relationships or the practice of a profession. The third part is private pension funds. The purpose of private pension systems, which also include individual pensions, is to utilize personal contributions and pay the available funds as retirement income to individuals (Kara & Yıldız, 2016).

Financial deepening is defined as the channeling of funds from the financial sector to the real sector. Financial deepening is an indicator of the diversification of financial instruments and the development of the financial system (Şahin, 2022: 13). In other words, financial deepening refers to the channels through which savings are transferred to investment through financial innovations in the economy. It can also be defined as financial assets per capita, the increase in financial institutions, and financial services (Öztürk et al., 2011: 55). As the financial intermediaries and instruments that transfer funds between entrepreneurs seeking to invest and the private pension system become more widespread, the relationship between financial deepening and the private pension system gains importance.

The aim of this study is to investigate whether the private pension system affects financial deepening and, if so, to what extent, to present empirical findings. For this purpose, this study, conducted for Turkey between 2006Q4-2024Q1, aims to investigate the role of the private pension system in financial deepening. A review of the relevant literature reveals that most studies have a theoretical structure. This study, however, conducts an empirical analysis and presents evidence. Therefore, it is believed to contribute to the literature. In addition to the introduction and conclusion sections, the study includes two theoretical and one empirical section. The second section examines the relationship between the private pension system and financial deepening, and the third section provides a literature review. The fourth section presents the empirical component of the study, presenting the dataset, methodology, and empirical results.

2. THE IMPACT OF THE PRIVATE PENSION SYSTEM ON FINANCIAL DEEPENING

In the second half of the 20th century, social security systems faced numerous problems, impacted by developing technology and demographics. Rising welfare levels, a declining youth population, and a rising life expectancy led to the ineffective management of income. This, in turn, necessitated the government's increased support for the social security system. The burden placed on the state by the social security system and the desire to raise people's living standards led to the development of new criteria over time, leading to the idea that private pension systems could provide a solution to all these problems. The private pension system, which generates resources for the financial sector by channeling individuals' long-term and periodic savings into capital markets, thus deepening the financial sector, has been steadily increasing in funding since its inception (Önder, 2017: 129-132).

One of the key factors determining the effectiveness of a private pension system is the portfolio allocation of funds. Portfolio allocation is both a key factor in determining the returns generated by a private pension system and one of the indicators determining which sectors of the economy the resources accumulated within the system will be allocated to. As private pension fund portfolios expand, investors demand newly developed financial instruments, thereby fostering the development of financial markets. The increase in funds in a private pension system will increase the total stock of financial assets and positively impact financial deepening. (Oktayer & Oktayer, 2007: 77). Directing savings accumulated within the system into various investment instruments through the capital market contributes to the increase in national income, and individuals whose incomes increase and who benefit from the increase in national income have the opportunity to increase their savings. Furthermore, individuals' recording of their savings, made as a precaution against future uncertainty, by including them in the private pension system, eliminates short-term speculative funds and provides longer-term fund growth, thus enabling the deepening of the financial system (Asiltürk, 2018: 51). Furthermore, the private pension system, which eliminates the informal nature of savings and records all savings, can lead to the development of capital markets and the financial system by extending the maturities of collected funds (Çetiner & Gündoğdu, 2018: 33).

By facilitating the sharing of private pension funds, increasing real sector investments, and facilitating savings, the private pension system contributes to financial deepening by contributing to the liquidity and capitalization of financial markets. As financial markets deepen and become more efficient, private sector financing conditions further improve, enabling risk diversification. Thus, by providing financing for investments that yield high returns in the long term, the depth of financial markets increases again (İşseveroğlu & Hatunoğlu, 2012: 162).

The development of private pension funds contributes to the development of bond and stock markets and the increased diversity of funds. Consequently, the depth of financial markets increases. As savings increase and are channeled into effective investments, individuals' living standards also rise. Effectively managed private pension funds increase the depth of the capital market, increase the diversity and applications of financial instruments, and increase long-term savings, which are then invested both efficiently and effectively. Similarly, by transferring the savings that individuals keep under their pillows to the system, individuals can both gain profits and financial markets can be deepened (Günay & Güneş, 2015: 256).

As can be seen, the private pension system contributes not only to the development of the social security system but also to the economy and the financial sector. Savings in Turkey are low, financial markets and assets are still in their infancy, and demand for financial instruments is limited. Furthermore, savings are not channeled into financial instruments but are kept under the mattress, preventing the total funds available for investment from reaching a sufficient level. In this case, small savings can be accumulated, contributing to the growth of funds and increasing the depth of financial markets (Can, 2010: 141).

3. LITERATURE REVIEW

Impavido & Musalem (2000) investigated the relationship between individual pension systems and capital market instruments in a study conducted for 21 OECD countries and 5 developing countries between 1982-1996. The study found a positive relationship between individual pension funds and the development of capital market instruments. Gürbüz & Ekinci (2003) investigated the relationship between individual pension funds and government bonds, private sector bonds, certificates of deposit, and GNP in a study conducted for Chile, Peru, Colombia, Argentina, Mexico, Hungary, and Poland between 1981-1999. The study found that government bonds, private sector bonds, certificates of deposit, and GNP positively affected individual pension funds and that there was a bidirectional relationship between the variables. Aras & Müslümov (2005) investigated the relationship between institutional investors, stock markets, financial assets, stock market capitalization, and GDP in a study conducted for 23 OECD countries between 1982-2000. They concluded that there is a bidirectional Granger causality relationship between institutional investors and the independent variables used in the study.

Oktayer & Oktayer (2007) investigated the relationship between individual pension funds, total financial asset stock, and capital market instruments in a study conducted for Turkey between 2001-2006. They concluded that an increase in individual pension funds positively affects financial deepening. Kim (2008) investigated the relationship between individual pension funds and stocks, inflation rates, real interest rates, and the ratio of banks' private loans to the stock market in a study conducted for 21 OECD countries between 1992-2003. The study found no significant relationship between the variables, but indicated that individual pension funds positively affect GDP. Raddatz & Schmukler (2008) investigated the relationship between individual pension funds, bank deposits, and government bonds in a study conducted for Chile between 1995-2005. They concluded that bank deposits and government bonds have a statistically positive and significant effect on individual pension funds. Alptekin & Şıklar (2009) investigated the relationship between individual retirement system funds and stock retirement investment funds in their study for Turkey between 2007-2008. The study found that individual retirement system funds and stock retirement investment funds affect each other.

Asekunowo (2010) investigated the relationship between individual retirement system funds and GDP, private sector loans, bank deposits, M2 money supply, total domestic savings, and inflation rates in a study conducted for Nigeria between 2001-2007. The study concluded that individual retirement system funds positively and significantly affected the independent variables used. Meng & Pfau (2010) investigated how capital market instruments, stock markets, and bond markets affected individual retirement system funds in a study conducted for 16 developed and 16 underdeveloped countries between 2003-2007. The study found that capital market instruments, stock markets, and bond markets had a positive effect on individual retirement system funds. Niggemann & Rocholl (2010) investigated the relationship between individual retirement system funds, stock markets, and bond markets in a study conducted for 57 countries between 1976-2007. The study found that stock and bond markets positively affect individual retirement system funds. Raisa (2012), in a study conducted for European Union member states between 1994-2011, investigated the relationship between individual retirement system funds, the market capitalization of publicly traded companies, inflation rates, interest rates, and GDP per capita. The study concluded that individual retirement system funds positively affected financial development and negatively affected the inflation rate. Uyar (2012), in a study conducted for Turkey between 2004-2009, investigated the relationship between the number of individual retirement system participants, investment amount and number of policies, deposit interest, inflation, Istanbul Stock Exchange index, growth rate, exchange rate, and foreign trade. The study found a significant relationship only between deposit interest and the number of policies. Hu (2012), in a study conducted for Australia, China, Pakistan, Korea, India, New Zealand, Thailand, Singapore, and Malaysia between 2002-2010, investigated the relationship between individual retirement system funds, bond markets, stock markets, and GDP. As a result of the study, evidence was

obtained that the growth of private pension system funds has a statistically significant and positive effect on the development of the capital market.

Ayaydın (2013) investigated the relationship between individual retirement system funds, the stock market, treasury bonds, and interest rates in a study conducted for Turkey between 2010-2013. The study found that the relationship between the variables was positive. Özel & Yalçın (2013) investigated the relationship between the domestic savings rate, GDP, broad money supply, credit to the markets, urbanization rate, real interest rate, and deflator rate in a study conducted for 16 countries between 1970-2010. They concluded that the independent variables positively and significantly affected the domestic savings rate. Sibindi (2014) investigated the relationship between life insurance funds, M2 money supply, GDP, and long-term insurance density in a study conducted for South Africa between 1990-2012. The study found a causal relationship running from economic growth to the life insurance sector in the short run. Kılıç (2014) conducted a study for Turkey between 2005-2013, investigating the relationship between the number of private pension system participants, consumer price index (CPI), deposit interest rate, industrial production index, savings, expenditures, and income. The study found a statistically positive relationship between the number of private pension system participants and other variables. Enache et al. (2015) conducted a study for Bulgaria, Hungary, the Czech Republic, Estonia, Slovenia, Romania, Lithuania, Poland, Slovakia, and Latvia between 2001-2010, investigating the relationship between pension funds and the market capitalization of publicly traded companies. The study concluded that private pension funds positively influenced the development of capital markets in both the long and short term.

Akgiray et al. (2016) investigated how credit default risk, GDP, and portfolio investments affect private pension system funds in a study conducted for Chile and Turkey between 2004-2014. The study found that credit default risk, GDP, and portfolio investments positively affected private pension funds. İşi et al. (2016) investigated the relationship between private pension system funds and private pension contribution amounts in a study conducted for Turkey between 2004-2015. A break was identified in 2012, and they found evidence that the amount of contributions included in the private pension system has increased statistically significantly since then. Özmen (2016) investigated the relationship between private pension system funds, the number of private pension system participants, the amount of private pension system contributions, deposit interest rates, exchange rates, stock market indexes, and inflation in a study conducted for Turkey between 2010-2015. The study identified a bidirectional causal relationship between macroeconomic indicators and the private pension system. Başar et al. (2016), in their study conducted for 14 OECD countries between 2005-2014, investigated the relationship between private pension system funds, current account deficit, and savings amount. The study concluded that developments in the private pension system led to balance and improvement in the current account deficit. Bayar (2016), in their study conducted for Turkey between 2005-2015, investigated the relationship between private pension system funds, Borsa Istanbul national stock value, and debt instruments market transaction value. The study identified a causal relationship between private pension system funds and the private pension system market. Zubair (2016), in their study conducted for Nigeria between 2009-2016, investigated the relationship between private pension system funds, inflation, interest rates, and GDP per capita. The study identified a significant and positive relationship between the performance of private pension system funds and the investments of pension funds.

Moleko & Ikhide (2017) investigated the relationship between individual pension funds, the bond market, government debt instruments, and GDP in a study conducted for South Africa between 1975-2012. The study found no statistically significant long-term relationship between individual pension funds and other variables. Önder & Karabulut (2017) investigated the relationship between the amount of funds invested in the individual pension system and the BIST price index, industrial production index, and consumer price index in a study conducted for Turkey between 2005-2015. They concluded that funds directed to investment from the individual pension system have a positive effect on financial deepening. Bayar (2017) investigated the relationship between the asset value of individual

pension funds, GDP per capita, growth rate, and financial development index in a study conducted for 16 countries between 2002-2016. The study identified a bidirectional causal relationship between private pension funds and economic growth, and a unidirectional causal relationship running from financial development to private pension funds. Musawa & Mwaanga (2017) investigated the relationship between private pension funds and the stock market in their study for Zambia between 2009-2015. The study identified a long-term relationship between private pension funds and the stock market.

Şahin et al. (2018) investigated the relationship between the fund size of private pension system participants, the total value of the equity market, and the total value of the debt market in Turkey between 2006-2017. The study concluded that private pension system fund size affects the size of the equity market in the long run, but has no effect in the short run. Growth in the debt market affects pension funds in the long run, while pension funds have a positive impact on the equity market in the short run. Çelik & Erer (2018) investigated the relationship between private pension system funds and the current account deficit in their study for Turkey between 2004-2016. The study found a negative and unidirectional relationship between private pension system funds and the current account deficit in the long run. No statistically significant relationship was found between the variables in the short run. Çetiner & Gündoğdu (2018), in their study conducted for Turkey between 2011-2017, investigated the relationship between private pension system fund size and the number of private pension system participants, exchange rate, interest rate, and BIST 100 index. The study found a statistically positive and significant relationship between private pension system fund size and other variables. Yeşilyurt (2019), in their study conducted for Turkey between 2004-2016, investigated the relationship between the number of private pension system contracts, total investment amount, current account deficit, unemployment, deposit interest, exchange rate, growth, and investment. The study found a positive relationship between deposit interest and the number of private pension system contracts, and a unidirectional causality relationship from investment to unemployment, from investment to current account deficit, from growth to unemployment, and from growth to current account deficit. Udeh & Igwebuike (2019), in their study conducted for Nigeria between 1981-2016, investigated the relationship between private pension system funds, GDP, stock market, and savings. As a result of the study, it was proven that the relationship between stock capitalization and GDP is positive but not significant, and private pension system funds affect GDP positively and significantly.

Kahramanoğlu (2020) investigated the relationship between individual pension system funds and capital market instruments in a study conducted for Chile, OECD countries, Asian and Latin American countries between 2014-2019. The study concluded that individual pension system funds will contribute to the deepening and development of the capital market. Karabacak & Küçükçaylı (2020) investigated the relationship between the individual pension system, GDP, current account deficit, and capital market in a study conducted for Turkey between 2009-2018. While a long-term relationship was found between the individual pension system, GDP, and the capital market, no significant relationship was found between the current account deficit and the individual pension system. Furthermore, no causal relationship was found between the individual pension system and other variables. İslamoğlu et al. (2020), in a study conducted for Turkey and the G7 countries between 2004-2017, investigated the relationship between individual pension system funds and the ages and years of participation in the individual pension system. The study found that private pension system fund size and the number of participants positively affect the private pension system. Budak (2021) investigated the relationship between private pension system funds allocated for investment and the BIST full index in Turkey between 2010-2019. The study identified a causal relationship running from private pension system funds allocated for investment to the BIST full index. The causal relationship running from the BIST full index to the private pension system funds allocated for investment is long-term. Bregnard & Salva (2022) investigated the relationship between private pension system funds, market stock prices, and foreign assets in their study for Switzerland between 2010-2012. The study concluded that private pension system funds positively affect market stock prices and foreign asset variables.

4. DATASET, MODEL, AND EMPIRICAL FINDINGS

In this study, the model established to investigate the relationship between financial deepening and private pension system in Turkey using quarterly data between 2006Q4-2024Q1 is given in Equation 1.

$$FIN = \beta 1 + \beta 2\, LNBES_t + \beta 3\, ENF_t + \varepsilon_t \quad (1)$$

The dependent variable 'FIN' used in the model is an indicator of financial deepening, and the M2/GDP ratio is used. The independent variable 'LNBES' is included in the model as the fund amount of private pension system participants (TL). The control variable 'ENF' in the model is the inflation rate, and the Consumer Price Index (CPI) rate is used. Because the data for the dependent variable 'FIN' is obtained in TL and is proportional, and the control variable is proportional, ln is not used. However, the independent variable 'LNBES' in the model is in TL, so ln is used and included in the model. Quarterly data for the dependent variable 'FIN' and the control variable 'ENF' used in the model were obtained from the Central Bank of the Republic of Turkey (CBRT) database. Quarterly data for the independent variable 'LNBES' were obtained from the EGM database. Before proceeding with this analysis, descriptive statistics of the variables used are presented in Table 1.

Table 1
Descriptive Statistics of Variables

Variables Std.	Observation Number	Mean	Deviation	Minimum	Maximum
FIN	*70*	*1,908078*	*0,2740381*	*1,353324*	*2,9036*
LNBES	*70*	*24,36298*	*1,412155*	*21,75821*	*27,33678*
ENF	*70*	*1,356952*	*1,590907*	*-0,1066667*	*7,776667*

The model has 70 observations for each variable, and the average value of the dependent variable "FIN" for the quarterly periods between 2006Q4-2024Q1 is 1.908. The average value for the independent variable "LNBES" is 24.362, while the average value for the control variable "ENF" is 1.356. The maximum value for the "FIN" variable is 2.903, while the maximum values for the "LNBES" and "ENF" variables are 27.336 and 7.776, respectively.

Pearson Correlation Analysis, a pretest performed on variables, is used to measure the relationship between two variables and the strength of this relationship. Pearson Correlation Analysis is also used to calculate the effect of a change in one variable on other variables (Keskin & Özsoy, 2004: 67). Table 2 shows the results of Pearson Correlation Analysis for the variables.

Table 2
Pearson Correlation Matrix

Variable	FIN	LNBES	ENF
FIN	*1.0000*		
LNBES	*0,4554*	*1,0000*	
ENF	*0,0653*	*0,6176*	*1,0000*

According to Table 2, a relationship is understood between the variables, and it can be interpreted that as one variable increases, the other associated variable also increases. A positive correlation is observed between the dependent variable 'FIN' and the independent variable 'LNBES', with a correlation coefficient of 0.4554. Similarly, a positive correlation is observed between the variables 'FIN' and 'ENF', with a correlation coefficient of 0,0653. However, this coefficient is negligible, being almost zero. Furthermore, a positive correlation is observed between the variables 'LNBES' and 'ENF', with a correlation coefficient of 0.6176.

This study, which investigates the impact of the private pension system on financial deepening, uses time series analysis methods. Before starting the time series analysis, to ensure the accuracy and consistency of the model results and to eliminate spurious regression problems, it is necessary to test the stationarity of the variables using unit root tests. The Extended Dickey-Fuller (ADF) unit root test, frequently used in empirical applications, was used to test the stationarity of the series, and the results are presented in Table 3.

Table 3

Extended Dickey-Fuller (ADF) Unit Root Test Results

	Level		One difference	
Variable	**Constant**	**Constant and Trend**	**Constant**	**Constant and Trend**
FIN	*-2,2909*	*-2,7332*	*-3,2892*	*-3,5739*
	0,1779	*0,2276*	*0,0199***	*0,0411***
LNBES	*1,6790*	*1,2495*	*-3,6419*	*-3,9442*
	0,9995	*0,9999*	*0,0073****	*0,0154***
ENF	*-3,6030*	*-5,0360*		
	*0,0081****	*0,0006****		

Not: *The values given in ( ) represent MacKinnon (1996) one-sided p (probability) values. *, **, *** signs indicate 10%, 5%, 1% significance levels, respectively.*

According to the results in Table 3, the null hypothesis "Ho: There is a unit root (the series is not stationary)" could not be rejected for the FIN and LNBES variables in both the constant and constant-trend models. In this case, when the first difference is taken, it is observed that the variables become stationary in both the constant and constant-trend models. For the ENF variable, however, the null hypothesis "H0: There is a unit root (the series is not stationary)" was rejected in both the constant and constant-trend models, and the alternative hypothesis "Ha: There is no unit root (the series is stationary)" was accepted. Therefore, it can be said that the ENF variable is stationary at the level.

Autoregressive Distributed Lag (ARDL) bounds test, developed by Pesaran & Shin (1999), tests the existence of a cointegration relationship between series that are stationary at different degrees. Furthermore, this test provides statistically more reliable results than classical cointegration tests because it uses an unrestricted error correction model. The main feature of this error correction model is that it provides information about the long- and short-term relationships of the variables used. Another feature of this test is that it can be applied even in cases with small sample sizes and provides consistent results (Mülayim, 2022: 83). The dependent variable FIN and the independent variable LNBES used in the study were found to be I(1), while the control variable ENF was found to be I(0). Given that the variables were stationary at different levels, it was decided to apply the ARDL bounds test. Before the ARDL bounds test, the existence of cointegration between the variables was investigated using the F bounds test, and the results are presented in Tables 4 and 5.

Table 4
F Bound Test Results – Pesaran, Shin, and Smith (2001) (1,0,0)

Test Statistic	Significance Level	Limit Critical Values	
		I(0)	I(1)
F Statistics 5,575	*0,1*	*3,17*	*4,14*
	0,05	*3,79*	*4,85*
	0,025	*4,41*	*5,52*
	0,01	*5,15*	*6,36*

Table 5
F Bound Test Results – Kripfganz and Schneider (2018) (1,0,0)

Test Statistic	Significance Level	Limit Critical Values	
		I(0)	I(1)
F Statistics 5,575	*0,1*	*3,25*	*4,22*
	0,05	*3,94*	*5,00*
	0,01	*5,50*	*6,74*

The F-bounds test shows long-term coexistence between variables. If the obtained F-statistic values are compared with the critical values given in Pesaran et al. (2001), and the calculated F-statistic values are less than I(0), the hypothesis "Ho: There is no cointegration relationship between the variables" is accepted and can be interpreted as meaning that there is no cointegration relationship between the variables. However, if the F-statistic value is greater than I(1), Ho is rejected and a cointegration relationship between the two variables is accepted. Accordingly, based on the results of the bound tests given in Tables 4 and 5, the F test was found to be greater than the upper critical values at the 5% significance level, indicating a cointegration relationship between the variables. The long-run coefficient results obtained with the ARDL bound test are presented in Table 6.

Table 6
ARDL Bounds Test Results (Long-Term Coefficients)

Variables	Coefficient	p-value
LNBES	*0,0954*	*0,081**
ENF	*-0,0511*	*0,265*
Diagnostic Test Results		
ADJ (FIN)	*-0,4191 0,000****	
Autocorrelation (Durbin-Watson)	*1,855*	
Heteroscedasticity (white test)	*0,072*	
Normality Test (jaqaue- bera)	*0,065*	

***Note:** *, **, *** signs indicate 10%, 5%, 1% significance levels, respectively.*

Table 6 presents the long-term effects of variables on financial deepening. Accordingly, Turkey's LNBES coefficient is statistically significant at the 10% level, but the ENF coefficient is statistically insignificant. It can be concluded that there is a positive relationship between Turkey's financial deepening rate and the fund amount of private pension system participants. A one-unit increase in the fund amount of private pension system participants increases Turkey's financial deepening rate by 0.095 units. Therefore, an increase in the fund amount of Turkey's private pension system participants increases Turkey's financial deepening.

The regression assumes that there is no relationship between the error terms, that is, no autocorrelation problem, no heteroscedasticity problem, and finally, the series is normally distributed. For this purpose, the Durbin-Watson Autocorrelation Test, the White Test, and the Jarque-Bera Normal Distribution Test were also conducted, and the results are presented in Table 6. According to the results obtained, it was determined that there was no autocorrelation problem or heteroscedasticity problem in the series and the series was normally distributed.

Granger (1969), basing his theory on endogenousness and exogenousness, argued that causality occurs if two variables cause each other in a time series. Therefore, feedback occurs between them. The Granger causality test examines whether a change in one variable creates a change in the other variable in a bidirectional manner. The hypotheses of Granger causality analysis are as follows:

H_0: "X does not Granger cause Y (there is no Granger causality from X to Y)"

H_a: "X is the Granger cause of Y. (There is a Granger causality relationship from X to Y)"

As the final analysis of the study, the causality relationship between the variables was investigated and the results are given in Table 7.

Table 7
Granger Causality Test Results

Null Hypothesis	F-Statistic	Probability Value	Decision
LNBES is not Granger causal to FIN.	*3,09778*	*0,0521**	Reject
FIN is not Granger causal to LNBES.	*2,19182*	*0,1202*	Accept
ENF is not a Granger causal factor of FIN.	*2,70247*	*0,0748**	Reject
FIN is not a Granger causal factor of ENF.	*0,70154*	*0,4997*	Accept
ENF is not a Granger causal factor of LNBES.	*3,01002*	*0,0564**	Reject
LNBES is not a Granger causal factor of ENF.	*14,0369*	*0,0000****	Reject

***Note:** *, **, *** signs indicate 10%, 5%, 1% significance levels, respectively.*

The null hypothesis of the Granger causality test is "X is not Granger causal for Y." As can be seen in Table 7, at the 1% significance level, there is a causal relationship running from the "LNBES" variable to the "ENF" variable. Therefore, the main hypothesis is rejected. Similarly, at the 10% significance level, there is a causal relationship running from the "LNBES" variable to the "FIN" variable, from the "ENF" variable to the "FIN" variable, and back to the "LNBES" variable, and the main hypothesis is again rejected. According to these results, the causality between the "ENF" and "LNBES" variables is bidirectional. Furthermore, the fact that the fund amount of private pension system participants is Granger causal for the financial depth ratio is consistent with the obtained results.

5. CONCLUSION

The private pension system is a system, with pre-determined terms and conditions, that allows individuals to deposit their savings into private pension funds during their active working years and generate a second income during their retirement period. The basis of the relationship between financial deepening and the private pension system is that as funds are transferred between entrepreneurs seeking to invest and the private pension system, it fosters the proliferation and development of financial intermediaries and instruments, thereby increasing financial deepening. Savings accumulated in the private pension system are effectively invested in private pension system investment funds on behalf of the individuals participating in the system. These savings are transferred into various financial instruments such as real estate, gold, bonds, and stocks, contributing to the development and deepening of the financial sector through capital markets. The increase in private pension system funds is expected to increase the resources transferred to the real sector, which in turn will increase financial deepening.

This study examines the relationship between the private pension system and financial deepening using quarterly data from Turkey between 2006Q4-2024Q1 using ARDL bounds tests and Granger causality tests. The ARDL bounds test concludes that an increase in private pension system funds increases financial deepening. Government support and incentives will increase participation in the private pension system, leading to increased funds. This will provide significant resources to the financial system and contribute to its development. Consequently, financial deepening will increase. In summary, the increase in the private pension system positively impacts financial deepening. The Granger causality test results also support these findings, indicating that the private pension system Granger causally influences financial deepening. However, no causality running from financial deepening to the private pension system was found. In other words, a unidirectional causal relationship can be inferred, running from the private pension system to financial deepening.

In light of these results, it is believed that measures and incentives to increase the number of private pension system participants will contribute to financial deepening. To achieve this, it is necessary to promote and explain the participation of private pension system participants to individuals from all walks of life. While the automatic enrollment system offered by the private pension system to government employees has increased the number of private pension participants, ensuring that not only government employees but everyone benefits from this automatic enrollment system and is automatically enrolled in the system could help increase the number of participants. Furthermore, studies should be conducted to ensure that the private pension system offers higher income generation opportunities compared to other financial investment instruments. Considering these recommendations, it is anticipated that participation in the private pension system will increase significantly and the amount of funds will increase. This will provide significant resources to the financial sector and contribute to increased financial deepening.

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How to cite this article: Uygun, G. & Özayürk, G. (2025). The Role of Private Pension System in Financial Deepening: An Empirical Application on Turkey. *International Journal of Insurance and Finance, 5*(2), 15-27. https://doi.org/10.52898/ijif.2025.7