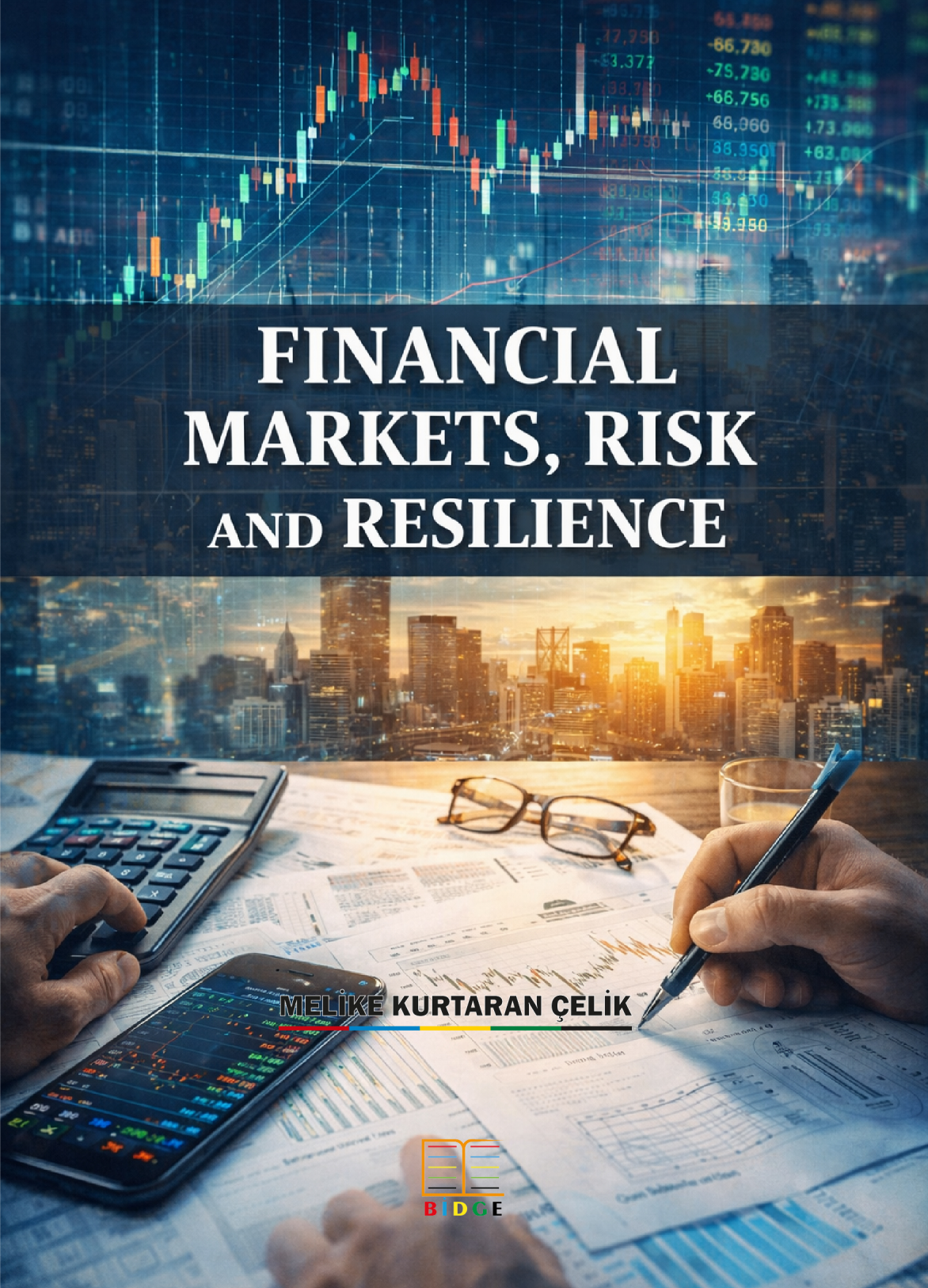

FINANCIAL MARKETS, RISK AND RESILIENCE

MELİKE KURTARAN ÇELİK

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PREFACE

Finance is a multidimensional discipline that examines the resilience of financial systems in the face of economic shocks and natural disasters, the dynamics of price formation and predictability in financial markets, and the transformation of individual and institutional savings over time. Within this framework, finance encompasses a broad analytical domain ranging from the functioning of risk and liquidity channels in the banking sector to price behavior in capital markets and the allocation of long-term savings through pension systems.

Economic shocks, natural disasters, financial fluctuations, and institutional reforms at both global and national levels reveal not only the fragile aspects of financial systems but also their capacity to adapt and recover. In this context, the book aims to analyze the functioning of financial markets around the concepts of risk and resilience by integrating theoretical perspectives with practice-oriented assessments. In this respect, the work seeks to contribute to a deeper and more analytical understanding of financial markets for academics, researchers, policymakers, and professionals working in the financial sector.

I would like to thank all the authors who contributed to the preparation of this book and everyone who contributed to the publication process.

Prof. Dr. MELİKE KURTARAN ÇELİK

TRABZON UNIVERSITY

İÇİNDEKİLER

CHAPTER 1

THE TRANSFORMATION OF RETIREMENT SAVINGS IN TURKEY: AN EXAMINATION OF THE INDIVIDUAL PENSION SYSTEM AND THE AUTO ENROLLMENT SYSTEM

1. ÇETİN ÜNEN[1]

Introduction

The demographic changes, prolonged lifespan and the two-tier system of actively and passively insured citizens have made the long-term financial viability of social security across various jurisdictions a highly controversial issue. Specifically, publicly funded, compulsory pension plans are unable to offer sufficient security of retirement income. In this regard, introduction of supplementary pension plan arrangements has become necessary. In this scenario, personal pension schemes are designed to safeguard the welfare of individuals who are of retirement age and encourage long-term savings. In turn, these mechanisms are one of the fundamental policy instruments aimed at encouraging the financial markets development (OECD, 2025).

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Demographic ageing and long-term sustainability of social security systems are some of the urgent issues that should be under critical examination in Turkey. People need to maintain a sufficiently high standard of living during the retirement period, which has led to the increase of the social security coverage, as well as the introduction of the individual savings tools. As a result, the Individual Retirement Savings and Investment System Law (Law No. 4632) were enacted in 2001 which in turn instituted the individual pension system (IPS) that allows employees to make voluntary contributions to their extra savings. IPS, therefore, will be structured as a contributory retirement scheme; the main idea is to supplement the post-retirement income security of individuals that the statutory social security system offers. It also aims at increasing the aggregate savings stock within society. In this context, the participants save money by making periodic deposits on individual retirement accounts, which are managed by the retirement companies. The accumulated capital goes to a range of financial instruments by virtue of the retirement investment funds and flexiest strategies of the portfolio, and all of which are managed by professional investment managers. Furthermore, the participants are free to make changes to the make-up of their portfolio to meet their risk tolerance. Moreover, the participants have a right to change the service providers based on stipulated requirements (Capital Markets Board of Türkiye, 2025).

The current IPS has shown low coverage and thus a huge portion of the working population has not been covered by the pension system. This empirical fact has highlighted to policymakers the importance of additional policies that can be used to increase the levels of savings. In response to this request, the amendment of the legislation that established the Auto Enrollment System (AES) through Law No. 6740 was adopted in 2017. The AES is set to absorb workers into the private pension plan through their employers. It also

grants people the privilege to abandon the system within a certain period. The key goal of the AES, however, is to improve retention in the system, based on the strategies of behavioral economics. (Seyfullahoğulları, Özpek, & Demirhan, 2017: 105-110).

Within the AES, the employee contributions are made to the gross earnings by their transfer to the pension carriers at defined rates. Government incentives, in conjunction with additional incentive schemes, are critical factors that promote the appeal of the AES. These state level inputs do not only initiate the stimulation of the amount of money saved by the people, but also ensure that a continuous stream of capital to the financial markets in the long run, hence supporting the stability of the macroeconomic situation (Grand National Assembly of Türkiye, 2022). The empirical statistics published by the Pension Monitoring Centre (PMC) also suggest that the AES has expanded its scope of participants. Recent statistical data supports the existence of an apparent increase in the aggregate size of pension funds (Pension Monitoring Center, 2025).

The occupation AES and the IPS are analyzed in a common framework in Turkey. This combined view is chosen in that in addition to the enhancement of the individual pension payment, the dual arrangement brings about a harmonized balance between savings and investments. Moreover, the two plans have an immense indirect impact on capital market development and sustainability of government finance. This means that the role of private pension systems in the larger Turkish social security system is complementary (Macunluoğlu, 2021: 215-220).

In this chapter, the author reviews the historical process of development of the IPS. It then maps out operational areas and stakeholder involvement in IPS, assesses the state contributions and maps out its statutory framework. It also examines the operation and incentive systems of the AES. Lastly, an analytical comparison of

the two systems that are based on quantitative measurements is provided whose conclusion is a complete systematic evaluation.

Individual Pension System (IPS)

Individual Pension System (IPS) system was developed as a legal framework through Law No. 4632, named the Individual Retirement Savings and Investment System, which was asseassented28 March 2001. The law outlines the overall provisions of the system, expounding that it is based on voluntary basis and a defined-contribution model. This framework is going to improve the amount of retirement funds that people have. The framework was finally completed in 2003, and at that time, IPS was officially in operation (Grand National Assembly of Türkiye, 2025).

At the outset, the IPS was to enable increased savings which are mobilizable to retire, supplement the income of retirees after employment and promote expansion of financial sector by investing such savings in the capital markets. Retirement funds under retirement organizations are under the regulation of the Capital Markets Board; they amalgamate their funds in retirement investment funds, which means that the resources collected are put into a productive use through the institutional investment instrument (Pension Monitoring Center, 2025).

Developments in the Individual Pension System to Date

The participants and the size of the aggregate fund grew slowly after the introduction of IPS. However, it is voluntary hence limiting the participation rates and the system has been unable to meet the expected increase in savings. As a result, the authorities of the community have established incentive schemes to enhance the effectiveness of IPS.

In 2013, a significant regulatory shift occurred where the incentive was based on a tax deduction, but it was substituted by a

state contribution scheme. The new regime would give an extra contribution by the government based on a given rate on top of contributions made by individuals on their retirement account. This change has increased the attractiveness of the system and the long-term saving behavior of participants (İnneci, 2013: 105-120).

Later changes in regulations expanded the amount of funding on the IPS, giving participants more discretion on how much funds to allocate and the power to switch providers. The provision of transparency and regulations of pension investment funds has been enhanced and regulations to protect the rights of the participants have been implemented. Simultaneously with the development of capital market, the structure of the portfolio of the privately owned pension funds have been diversified, making the system a great institutional savings tool with a long-term investor pattern (Capital Markets Board of Türkiye, 2025).

In Turkey, institutional and legal frameworks of the IPS have been changing with the help of the reformation processes that are meant to increase the sustainability of the social system of security. Specifically, the social security reforms that began to be implemented in the late 1990s led to the development of a multi-tiered model of pensions as a supplement to the public pension system. International partnerships with various policy suggestions, uniting forces and co-operation with national institutions have played a vital role in building the legal and institutional framework of the IPS.

The IPS was legally founded when the Individual Pension Savings and Investment System Law were passed in 2001. The later years were followed by the constant revision, such as formation of the regulatory and supervisory agencies, introduction of the incentive mechanism, and the expansion of the scope of the system. Some of the most significant ones are the introduction of automatic enrolment, raising the rate of state contribution, and flexible schemes

such as partial payments, all of which are expected to contribute to inclusiveness and functionality.

Table 1 summarizes the major legal, institutional, and regulatory milestones in the historical development of IPS in Turkey in chronological order.

Table 1 Important Developments in the Individual Pension System

Date	Important Changes
1997-1990	In a wider scope of social security reforms guided by the Undersecretariat of the Treasury, there has been systematic review of the process of re-organizing the social insurance system based on the contributions of international organizations and stakeholders. In the process, a multi-level approach to pension was introduced; social insurance reform was introduced by passing Law No. 4447 and preparations were undertaken to create a voluntary third level of private pension system.
1 August 1999	The Individual Pension Commission was established within the Grand National Assembly of Turkey to create the legal framework for the individual pension system.
16 May 2000	The Individual Pension Savings and Investment System Bill, prepared by the Individual Pension Commission and reviewed by the Council of Ministers, has been submitted to the Presidency of the Grand National Assembly of Turkey.
28 March 2001	The Individual Pension Savings and Investment System Law have been adopted by the General Assembly of the Grand National Assembly of Turkey.
7 April 2001	The Individual Pension Savings and Investment System Law were published in the Official Gazette No. 24366.
7 October 2001	The Individual Pension Savings and Investment System Law have entered into force.
10 July 2003	The Pension Supervision Centre has been established with its headquarters in Istanbul, authorized by the Undersecretariat of the Treasury within the framework of the relevant law and secondary legislation.
27 October 2003	Following the approval of the first pension plans, the individual pension system has been put into practice.
29 June 2012	With the amendment to the Insurance Law No. 5684, pension companies are now required to become members of the Turkish Insurance Association; the name of the Association has been changed to 'Turkish Insurance, Reinsurance and Pension Companies Association'.
10 August 2016	With the publication of Law No. 6740 in the Official Gazette, regulations requiring employers to enroll their employees in a pension scheme based on automatic enrolment came into force on 1 January 2017.

18 October 2019	The Presidential Decree that was published in the Official Gazette No. 30922 set up the legal framework for the creation of the Insurance and Private Pension Regulation and Supervision Authority.
5 June 2020	Presidential Decree No. 47 set up the Insurance and Private Pension Regulation and Supervision Authority by defining its structure, duties, powers, and responsibilities.
25 May 2021	The Official Gazette No. 31491 published a rule that removed the requirement of legal capacity for participation in the individual pension system. This means that anyone can now join the system.
22 January 2022	The state contribution rate has gone up from 25% to 30%. People who make more than the annual gross minimum wage can now pay their state contributions in the following years. There are also new rules about partial payment rights, transferring receivables from individual pension contracts, and how to use these rights. The rules for how to move money owed to banks from individual pension contracts have been set.
28 March 2023	The transfer of individual pension receivables to banks through a transfer agreement has begun to work.
3 June 2024	The Official Gazette No. 32321 published the rule that went into effect on July 1, 2024. It set up the process for making partial payments from individual pension savings in cases of marriage, buying a home, or a natural disaster.

Source: (Pension Monitoring Center, 2025)

As seen in the table, IPS was not created by one regulation, but it was created in a multi-stage reform. The conceptual basis was given by the early adoption of a multi-tiered pension strategy inherent in the late 1990s social security reforms and the legal and institutional framework that was developed between 2001 and 2003 made it a reality. Later regulations changed the IPS into a more liberal accumulation-saving framework, which was more of a financial mechanism with a stronger institutional control, more rights of the participants and more flexibility. Government contributions have been strengthened, the concept of automatic enrolment has been introduced, new tools like partial payments have been incorporated which have raised the ability of the IPS to be able to adapt in changing economic conditions and the needs of participants. Therefore, Table 1 shows that the Turkish privatized pension system is an active, constantly renewed socio-financial policy tool.

The Functioning of the Individual Pension System and Its Parties

The IPS is a multi-stakeholder model that is based on voluntary involvement and a defined-contribution model. The members contribute periodically, and they allocate the sum of money to pension investment funds and the savings earned are later paid out to members as either income annuity or lump-sum payments on retirement. This is under a complete legal and institutional system, managed by the regulatory and oversight bodies (Grand National Assembly of Türkiye, 2025).

How the System Works

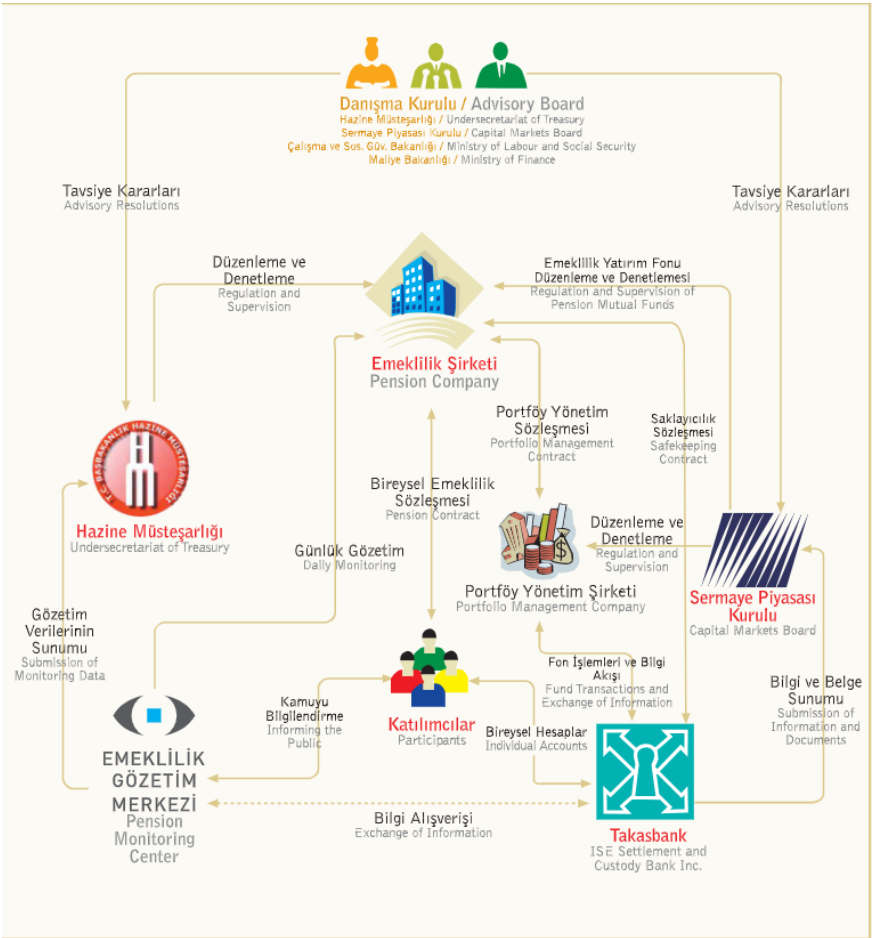
The IPS starts functioning once a contractual agreement is made between one person and a pension firm. The participant chooses the amount of contribution based on their level and savings preferences and invests the amount in their respective pension

accounts at the specified timelines. The money is invested in the pension funds chosen by the participant, and its gains grow as years progress, and they are also dependent on the performance of the capital markets (Capital Markets Board of Türkiye, 2025).

This edifice is specifically created as a process to promote the creation of long-term investment awareness among the population. The system provides the participant with a high level of flexibility, with the right to change the pension providers and to decide how their assets are distributed, being the right to do so. The participants are allowed to change their preferences on funds provided they are within the legal provisions, they can demand a transfer of their assets to a pension company that they consider advantageous. These will be to increase competition and to improve returns available to participants (Pension Monitoring Center, 2025).

Participants will have to meet the duration and age requirements to be entitled to a pension. When such requirements are fulfilled, they can redeem their savings either in a lump-sum, in installments or through an annual income insurance scheme. The system therefore offers a plan of having a fixed income flow at the time of retirement.

Figure 1 The Components and Functioning of the Individual Pension System



Source: (Pension Monitoring Center, 2004)

Parties in the Individual Pension System

The individual pension system gets operationalized by different players having different roles and responsibilities with participants playing the most central role. Contributors are making essential choices about the amount of their contributions, the fund choice, and retirement planning thus practicing a large level of

autonomy in a liberal risk-payoff model. Pension companies make up the main institutions who run the system, sign contracts with the participants, keep personal pension funds and guarantee transfer of the contributions to pension investment funds in time. Pension companies are operating within the limits of the statutory law and under the monitoring of the regulatory bodies. Another critical element is Pension investment funds which involves investing contributions in the capital markets. They are Balanced risk-return portfolio structures, which are run by professional portfolio managers, and the performance is reported to the audience on a regular basis (Capital Markets Board of Türkiye, 2025).

The regulatory and supervisory institutions are an important group that makes the IPS run in a well and transparent manner. The capital markets board regulates investment funds in the pensions sector, whereas the overall regulatory framework is provided by the Ministry of Treasury and Finance. The Pension Supervision Center oversees the accounts of all the participants and publishes the reports on the statistics (Pension Monitoring Center, 2025).

Lastly, the two roles of the state in the IPS are simultaneous, i.e. as regulator and as incentive provider. One of the main characteristics that make the system more appealing is the state contribution scheme, the purpose of which is to encourage the participants to save money on a long-term basis. In this way, state is developed as a key stakeholder, which will help to contribute to the overall stability of individual pension system.

Legal Framework and Regulatory Structure

The normative structure of the state contribution system has been strengthened with references to the amendments to Law No. 6327 of 2012 to complement Law No. 4632 which defines the overall structure of the IPS; the incentive structure of the system has been brought into greater clarity and directness. Application

procedures and content have also been outlined using the secondary regulations, providing specifics of the processes concerning state contributions (calculation, registration, transfer, refund/offset, etc.). The insurance and private pension regulation and supervision authority (SEDDK) legislative documentation and publications in the official gazette form the key reference points of following the current regulations (SEDDK, 2025).

Vesting Structure: A Mechanism that Encourages Retention

One significant feature of the state contribution into the IPS is that it is in a staged vesting form, and this does not allow a person to pull out of the system early. According to attention in the literature, state contribution will depend on the number of years of participant enrollment since 2013, i.e. 15 per cent of not less than three years, 35 per cent of not less than six years, 60 per cent of not less than ten years, and 100 per cent on retirement, death, or disability (Kabataş & Gülay, 2022: 504). The purpose of this structure is to transform the incentive as a short-term reward to a policy tool that promotes long-term savings behaviors.

Auto Enrollment System (AES)

Though the IPS has grown since it is voluntary, it has not been able to cover all workers. According to the literature on behavioral economics, people are irrationally predisposed towards long-term savings; more precisely, their inertia and procrastination have a detrimental impact on retirement savings. Subsequently, people often make short-term and thus irrational decisions that would not be beneficial to them over the long term (i.e. retirement planning) because of worrying about their short-term expenses and may opt out of voluntary programs (Madrian & Shea, 2001:1149; Thaler & Benartzi, 2004:165).

Many nations have adopted the models of automatic enrollment that have the effect of enrolling people into the system

without making them act. This strategy aims at alleviating behavioral constraints. The automatic enrollment makes it easier to participate by having the default option, which makes enrollment levels significantly higher and individual choice is not diminished. The global empirical studies show that automatic enrollment significantly increases the rate of retirement plan participation and has long-term impacts on saving behaviors (Madrian, 2014: 664).

The auto enrollment system (AES) is an international trend, and it was introduced into the legislation about individual pension in Turkey as Law No. 6740. According to the system, which came into effect on 1 January 2017, people of age groups, who in turn are working in the public and the private sector, are automatically covered by the individual pension system by their employers. In this aspect, the Auto Enrollment System does not eliminate the voluntary nature of the Individual Pension System (IPS) entirely; however, by making participation the default, the system is aimed at increasing the retention in the system (Grand National Assembly of Türkiye, 2025).

How the Auto Enrollment System Works

In the AES, employees are registered in personal retirement schemes through their employers without any request. The contribution is deducted at specified rates on gross earnings of the employees and passed on to the retirement institutions. The system allows the participants a right to withdraw after a duration of two months; those employees who withdraw the right during the two months will have their contributions refunded (Grand National Assembly of Türkiye, 2025).

The basic distinguishing characteristic of the AES is that participation is not obligatory, on the contrary, it is automatic and voluntary. Employees can disengage out of the system despite the time frame of withdrawal; they must choose to be retained to enjoy

government contributions as well as other incentives. This plan is one of the policy designs that can help to regulate the saving pattern of people and maintain their free choice.

Incentive Mechanisms in AES

To maximize the performance of the AES, it has been projected that some other incentive factors would be added to the state contribution used in the IPS. In this regard, on top of the contributions made by AESs based on the contribution made by states, the latter can obtain an extra initial incentive in case they continue using the system without asserting their right to withdraw. Also, it is stipulated that an extra state input will be provided in case the accumulated savings will be obtained with the help of an annual income insurance policy reached the retirement age (SEDDK, 2025).

This incentive plan will be to encourage lasting retention within the system other than short-term participation. According to the academic literature, the AES helps to increase the level of savings awareness and helps to develop the sense of retirement among the people who have just been included in the system (Seyfullahoğulları & Demirhan, 2016: 24). Table 2 shows a comparison of AES and IPS applications.

Table 2 IPS-AES Comparison

Comparison criterion	IPS	AES
Method of participation in the system	A voluntary structure in which individuals join the system of their own free will	A structure in which employees are included in the system based on default participation
Gaining entitlement to retirement benefits	Remaining in the system for at least 10 years from the date of entry into the system and meeting the age requirement of 56	Remaining in the system for at least 10 years from the date of entry and meeting the age requirement of 56.
Targeted participant group	All individuals, regardless of age or employment status.	Enrollment is mandatory for employees under 45, and optional for employees over 45.
Participation of foreign nationals	Participation in the system is possible.	Foreign nationals are excluded from the system.
Choosing a pension company	In individual or group contracts, the participant determines the employer; in group contracts, the employer determines the employer.	The pension company is determined by the employer.
Documents approved during the contract process	The participant must submit the offer form and the entry information form; in employer group agreements, the employer or their representative must submit the relevant documents.	Automatic enrollment pension contract by the employer or employer's representative
Right of withdrawal	Available within two months following the signing or approval of the offer form.	It will be available within two months of the employee being notified of their inclusion in the system.
Compensation for depreciation in the initial period.	The company has no such obligation.	Any decrease in value that may occur during the initial period will be covered by the pension company.
Government contribution rate	30% of the contributions paid	30% of the contributions paid
Additional government contribution practices	Depending on remaining in the system, a one-time initial contribution of 1,000 TL and an additional 5% contribution if annual income insurance is chosen.	-
Maximum amount to benefit from government contribution	312,066 TL for the year 2025	312,066 TL for the year 2025
The reflection of the state contribution in the account	The amounts earned will be transferred directly to the participant's account in cash.	Tracking based on commitment until eligibility is met, cash transfer as eligibility arises.
Eligibility rates for government contributions	15% in 3 years, 35% in 6 years, 60% in 10 years; 100% in cases of retirement, death, and disability.	The same eligibility rates apply.
Method of evaluating state contributions	The funds are invested in state contribution funds determined by the ministry.	Interest is accrued according to the CPI change; earned amounts are invested in state contribution funds.
Determining the contribution amount	It can be freely determined above the minimum amount set in the retirement plan.	3% of the prime earnings.
Option to pay an additional contribution.	This is possible at any time and at any amount requested by the participant.	Additional contribution payments are not possible.

Employer contribution	Employers can contribute through group pension plans.	No additional contribution from the employer is foreseen.
Right to suspend contributions	Participants may pause their contributions at any time.	The same right is granted.
Entrance fee deduction	Applicable to the pension company.	Not applicable
Administrative expense deduction	Applicable to the pension company.	Not applicable
Fund total expense deduction	Annual returns range from 1.09% to 2.28%, depending on the fund type.	Maximum annual interest rate of 1.09% for all funds.
The party that decides on a change to the retirement plan.	In individual contracts, the participant is the employer; in group contracts, the employer is the employer.	Employer
Right to change pension companies.	Participant or employer (depending on the type of contract)	Employer
The party that determines the fund preference	Participant	Worker
Right to change fund allocation	Twelve times a year	Twelve times a year; no changes can be made during the initial period.
Withholding tax rate in case of withdrawal from the system	15% before 10 years, 10% after 10 years, 5% in case of retirement/death/disability.	The same rates apply.
Payment options offered in retirement	Lump sum payment, scheduled repayment, annual income insurance	Lump sum payment, scheduled repayment, annual income insurance
Right to withdraw from the system	Participants can withdraw from the system at any time.	The same right is granted.
Partial payment option	Up to 50% of savings in cases of marriage, home purchase, and natural disasters.	Partial payment is not available.
Timing of pension company change	It is possible 2 years after the initial contract, and 1 year after the transfer contract.	The same timeframes apply to the employer.
Types of funds offered	Equity funds, debt instruments funds, participation funds, mixed funds, money market funds, precious metals funds, index funds, and fund of funds.	Initial funds, standard funds, and other funds classified according to risk profile.

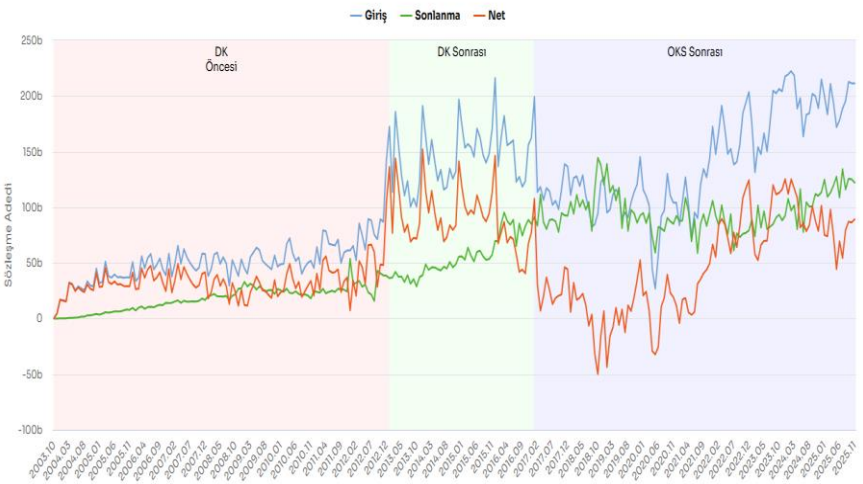
Source: (Pension Monitoring Center, 2025)

Table 2 clearly points to some of the structural differences between the voluntary IPS and the AES, which is organized on a hypothetical participation basis. It can be determined by the comparison that even though the two systems are characterized by the same retirement circumstances, they do have a significant difference in the influence of such circumstances on the process of participant decision-making and savings behavior.

The Development of the IPS and the AES Over the Years

This section attempts to outline the developments of the IPS and AES in Turkey. In that regard, the comparisons in terms of data retrieved through the pension supervisory center will be used to describe the situation. To begin with, the voluntary IPS status will be studied using the contracts signed and present in the system.

Figure 2 Number of IPS Contracts Between 2003-2025



Source: (Pension Monitoring Center, 2025)

As indicated in figure 2, the dynamics of participation in the individual retirement system have changed dramatically over the years because of the policy interventions like the government

contribution (GC) and the AES. Before the government contributed, the entry and exit of the system had comparatively low fluctuations, whereas the net flows were low. With introduction of the government contribution, the accession into the system speeded up significantly and net contributions drifted towards increasing direction. This points out that the government contribution had a robust incentive influence on the saving decision of individuals. Conversely, following the automatic enrollment system, the amount of entry into the system grew, but volatility in exits did, as well as net flows took negative values every other period. These conclusions imply that despite the automatic enrollment being a mechanism which enhances the aspect of inclusion, the structure of the mechanism is weaker on sustainability than voluntary pension systems (voluntary private pensions and the system of government contribution). On balance, the graph shows that government contributions are an effective tool of policy that is decisive in the sustainable development of the IPS, and the AES increases participation but exhibits a more volatility effect based on behavioral and institutional aspects.

The figures utilized in Table 3 clearly indicate that since 2003 IPS in Turkey has been experiencing a consistent growth process both in quantity and finances. Specifically, the growth of the number of participants allows stating that the system has become broader than in its initial years, as it was limited to inclusiveness, and spread among more people over the years. The increase in funds has not only to do with the increase in the number of participants but also with the increase in the amounts contributed and sums invested. It is interesting to note that, after the introduction of the government contribution scheme in 2013, fund accumulation increased tremendously; this increase was further boosted particularly after 2019. The gradual rise in the number of participants who are retiring concurrently depicts that the system has grown out of being a mere savings device to become a framework that is efficient in its

provision of retirement income. On balance, the table shows that the IPS has become more integrated over the years, attained a major niche in the Turkish financial system in terms of finances and exercises decisive influence in institutionalization of long-term savings.

Table 3 IPS Data Between 2003-2025

Year	Number of Participants	Participants' Fund Amount (TL)	State Contribution Fund Amount (TL)	Contribution Amount (TL)	Number of Retired Participants	Amount Directed Towards Investment (TL)
2025	10,077,560	1,694,858,600,000	216,884,100,000	-	-	-
2024	9,526,390	1,002,570,300,000	137,497,300,000	-	-	-
2023	8,676,046	625,517,800,000	77,750,800,000	-	-	-
2022	7,801,306	251,406,500,000	48,667,600,000	-	-	-
2021	7,092,021	205,573,500,000	22,338,000,000	-	-	-
2020	6,900,565	137,093,900,000	21,253,500,000	82,389,100,000	-	80,810,800,000
2019	6,871,132	101,883,900,000	17,262,200,000	67,818,300,000	-	66,687,900,000
2018	6,878,224	76,962,144,906	11,655,982,351	58,413,917,639	89,206	57,514,944,085
2017	6,924,945	67,677,308,661	10,141,315,793	52,575,516,474	63,892	51,810,763,109
2016	6,627,025	53,409,391,715	7,438,179,620	44,363,955,590	44,350	43,733,162,043
2015	6,038,432	42,979,056,589	5,020,000,071	37,119,095,559	27,745	36,549,379,287
2014	5,092,871	34,793,077,808	3,019,076,239	28,346,503,495	15,350	27,842,765,911
2013	4,153,055	25,145,718,418	1,151,765,932	21,921,860,114	7,577	21,455,900,238
2012	3,128,130	20,346,290,278	-	16,177,757,755	5,404	15,741,037,013
2011	2,641,843	14,329,771,986	-	12,393,688,644	3,838	12,028,485,722
2010	2,281,478	12,011,986,651	-	9,515,230,234	2,848	9,221,131,447
2009	1,987,940	9,097,436,467	-	7,102,007,561	1,898	6,869,992,691
2008	1,745,354	6,372,756,623	-	5,467,695,761	368	5,284,206,740
2007	1,457,704	4,566,383,316	-	3,917,061,211	-	880,490,018
2006	1,073,650	2,814,938,925	-	2,592,508,977	-	525,168,314
2005	672,696	-	-	1,117,233,826	-	190,231,197
2004	314,257	-	-	288,325,706	-	276,287,104
2003	15,245	-	-	5,866,764	-	5,692,556

Note: Data is valid until December 5, 2025. Data was obtained from the Pension Monitoring Center website and edited by the author.

Source: (Pension Monitoring Center, 2025)

Table 4 AES Data Between 2017-2025

Year	Number of Employees	Employee Fund Amount (TL)	Contribution Amount (TL)	Number of Certificates	State Contribution Fund Amount
2017	3,420,618	1,793,093,943	1,724,824,215	3,501,427	-
2018	4,990,786	4,598,511,493	4,146,607,921	5,190,546	-
2019	5,354,242	8,194,400,000	6,357,500,000	6,389,681	-
2020	5,724,081	11,304,100,000	8,872,800,000	7,360,682	483,300,000
2021	6,196,692	15,740,300,000	-	8,419,088	735,500,000
2022	6,719,441	31,787,600,000	-	9,488,458	1,542,600,000
2023	7,303,050	49,972,500,000	-	10,727,358	3,180,400,000
2024	7,575,311	81,724,300,000	-	11,393,070	5,437,500,000
2025	7,806,222	114,632,600,000	-	11,917,414	7,951,000,000

Note: Data is valid until December 5, 2025. Data was obtained from the Pension Monitoring Center website and edited by the author.

Source: (Pension Monitoring Center, 2025)

The information provided in Table 4 reveals that the Automatic Enrollment Scheme (AES) in Turkey has acquired an ever-expanding coverage to the working population, especially after 2017. The increased enrollment of employees indicates that the coverage of the system has grown over the years whereas the significant increment of fund volumes over the years indicates that the amount of savings, which is made due to automatic enrollment, is continuously increasing. However, the fact that only the contribution levels were reported in the first few years of the scheme and their reports are missing conspicuously thereafter suggests that the habitual contribution behaviors in AES is relatively weaker than that of voluntary private pensions. The growth in the number of certificates implies increased number of contracts involved in the system, but the high growth in governmental contribution funds after 2020 is the sign that automatic enrollment is strengthened by incentive systems. Taken together, the table indicates that even though AES has significant prospective in terms of the number of participants and fund size, it has a wavey evolution in terms of

continuity and permanence of its contribution in the long term compared to voluntary individual pension plans.

Comparative Analysis of the IPS and the AES

The two most important elements of an individual pension scheme in Turkey are the Individual Pension System (IPS) and AES. Their history of development has followed in varied ways. A closer look at the trends illustrated in the attached graphs combined, voluntary IPS has shown a stabilized growth pattern in terms of the number of participants, amount of funds and net contributions. On the other hand, AES also has had a fast early-year growth in participation but has shown reduced steadiness on maintaining systems and net savings. The government contributions have significantly boosted IPS enrollments and have shot the net fund inflows to the sky. However, with the introduction of automatic enrollment, there was an increase in outflows and accompanying inflows and net contributions occasionally reduced. This tendency suggests that although automatic enrollment can be viewed as an effective tool of increasing the number of participants, it has not been as effective as voluntary IPS is in changing saving habits of the individuals in the long term.

The IPS and the AES from the Perspective of Türkiye's Savings Policy

The increased influx of funds and government funding to the IPS witnessed over the years prove that incentive schemes have led to better saving habits among the players. Through consolidation of graphical and tabular information, IPS presents a strong framework in the context of fund accumulation over long-term and systemic sustainability, and AES presents an unstable growth with no supportive policy tools. Traditionally, IPS has been a niche in Turkey, which has been used as a key policy tool to counter the problem of a low saving rate and an increasing strain on the social

security system. In this conceptualization, the tasks of voluntary IPS and opt-out AES will be supplementary to the policy of national savings. Empirical implementation shows that there are qualitative variations in the impact of these two structures on saving behaviors. The long-term savings discipline that is created by voluntary IPS creates a more solid framework. The direct and open state-provided incentives have a motivational impact that complements the motivation of the participants to stay in the system, hence promoting the growth sustainability in terms of funds accumulation. In this respect, IPS can be considered as a policy instrument which institutionalizes individual savings and provides capital markets with long-term resources. The increasing trend in the size of funds supports the fact that voluntary participation combined with deliberate saving habits produces results that are more sustainable.

Conversely, AES is an intervention based on behavioral change to make savings policy more inclusive. The default participation system has allowed it to add groups of employees, especially those who were initially not aware of the saving system. Nevertheless, the increase in the rate of withdrawal and the lack of permanence in the rate of contribution highlights the fact that automatic enrollment has failed in the long run to transform long-term saving behavior. This implies that the default options do not univariately determine saving choices but instead they interplay with structural variables like income, financial literacy as well as trust in the system. In the framework of Turkish savings policy, IPS and AES cannot be assumed to be separate and mutually exclusive tools but should be seen as parts of a whole. Whereas voluntary IPS is more profound and enduring, AES is used to expand the base of the system.

However, the effectiveness of automatic enrollment can be boosted by optimizing incentive systems, making participation payments easier, and facilitating delivery of information to the

participants otherwise AES will only be limited to the immediate gains of participation. To conclude, one can state that IPS and AES have quite different but complementary roles in the savings policy of Turkey. The individual pension system continues to remain a crucial policy component as it helps to boost saving rates, financial market penetration and supplement the social security system especially when the long-term fund accumulation that would be enabled by voluntary pension campaigns is considered and the comprehensive nature of occupational pension schemes.

Overall Assessment and Conclusion

The present paper explores the historical development of the individual retirement scheme in Turkey on historical, institutional, and quantitative analysis with special emphasis on the Individual Pension System (IPS) and the Auto Enrollment System (AES). The results show that individual retirement system has significantly changed with time, and it can be seen as a savings and investment scheme that supplements the entire social security arrangement. The incentive policies and the institutional setting introduced since the inception of the system have decisively contributed to how individual savings should be. Analytical analyses show that the voluntary IPS has a relatively successful design which encourages disciplined long-term saving and slow accumulation of funds. The significant increase in the number of participants and the size of funds resulting after the implementation of state contributions is a clear indication of how this incentive mechanism affects the savings decisions of people. The IPS has thus been developed into an important strategic tool that does not only contribute income to individuals during their retirement but also contributes to the transfer of funds to capital markets on a long-term basis.

AES, in its turn, is defined as a behavioral-based policy tool that aims at making the individual retirement system more inclusive.

The AES seems to be not as stable as the voluntary IPS in terms of retention and continuity of employee contribution when it was introduced despite an increase in participation. This implies that default enrolment works in the short term but is not adequate to form long-term savings behaviors. Taking IPS and AES together, it might be said that the IPS system of the individual pensions in Turkey provides a multi-channel savings system. The voluntary IPS supports the richness and cost-effectiveness of the system, whereas the AES expands the range of employees who are incorporated into the savings system. Nevertheless, to make the automatic enrollment more effective, the mechanism of incentives must be simplified, information processing among participants should be improved, and a system of structural frameworks that encourages long-term participation should be introduced.

To conclude, the IPS has strategic importance to the savings policy and the social security system in Turkey. The success of the system under consideration in terms of individual confidence reinforcement, the establishment of long-term fund gathering provided by the IPS and the orientation towards inclusiveness peculiar to the AES is reliant on the system of long-term policy that entails the creation of institutional stability, the establishment of permanent saving culture and behavior, and the reinforcement of the individual confidence. On this note, the IPS is set to remain at the core of the role in Turkey as a long-term policy tool to enhance individual welfare and macroeconomic stability.

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CHAPTER 2

Impact of Major Earthquakes on the Financial Resilience of the Turkish Banking Sector: Evidence from Credit Risk and Liquidity Channels

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Introduction

Natural disasters are multi-dimensional shocks that are not limited to physical destruction and loss of life, but also create profound and lasting effects on economic structures and financial systems (Özdemir and Engin, 2024: 15). Earthquakes, in particular, are among the most destructive types of disasters for economic systems due to their sudden occurrence, impact on large geographical areas, and simultaneous pressure on production, income, and employment channels (Aldemir, 2023; AFAD, 2023). While such disasters disrupt regional economic activities, they also create significant challenges for banks, which are fundamental components of the financial system, in critical areas such as credit risk, liquidity management, and balance sheet stability (Gramlich et al., 2023; Ilabaca, 2024).

The banking sector, which forms the backbone of the financial system, plays a central role in financing the economic recovery process following disasters (AFAD, 2023: 87). Banks must simultaneously meet the restructuring and financing needs of individuals and firms, manage their own risks, and maintain financial stability in an environment of increasing uncertainty

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(Guluzade, 2016; Duman and Türkmen, 2023). This dual role necessitates a careful examination of the impact of large-scale shocks, such as earthquakes, on the financial resilience of the banking sector. Studies in the international literature on the macroeconomic effects of natural disasters reveal that disasters can have both short-term and long-term effects on economic growth, public finances, employment, and financial markets (Skidmore and Toya, 2002; Cavallo and Noy, 2011; Klomp and Valckx, 2014). Studies focusing on the impact of disasters on the financial system highlight channels such as credit crunch, increased non-performing loans, and changes in banks' risk-taking behavior (Kahn, 2005; Hosono et al., 2012; Koetter et al., 2020). However, it is observed that the findings in this literature vary depending on country characteristics, the scale of the disaster, and the institutional structure of the financial system.

In countries with a high risk of earthquakes, such as Turkey, this issue becomes even more critical. Due to its location on active fault lines, Turkey has historically experienced frequent and devastating earthquakes (Erdik, 2013; AFAD, 2020). These earthquakes have resulted not only in loss of life but also in significant economic and financial losses. While awareness of the economic dimensions of disaster risks has increased in Türkiye since the 1999 Marmara Earthquake, it is noteworthy that empirical studies on the financial resilience of the banking sector against earthquakes are relatively limited. A significant portion of existing studies focus on macroeconomic growth or public finance effects, while analyses focusing on banking indicators at the provincial level are quite limited.

This study aims to empirically examine the effects of earthquakes on the financial resilience of the banking sector at the provincial level, focusing on the 2011 Van, 2020 Elazığ, and 2023 Kahramanmaraş earthquakes in Türkiye. This study analyzes the

impact of earthquakes on credit risk and liquidity channels using banking indicators such as non-performing loans and loan-to-deposit ratios.

In this context, the study aims to be one of the rare studies in the literature that examines the relationship between earthquakes and the banking sector at the provincial level, taking into account the time dimension and focusing on the concept of financial resilience. The findings are expected not only to contribute to the academic literature but also to contribute to the development of policy recommendations regarding the preservation of financial stability after disasters.

Financial Resilience in Banking: Theory and Literature

In the literature, studies on natural disasters and the banking sector generally offer indirect assessments through indicators such as credit volume, deposit behavior, or financial vulnerability (Beybur, 2024; Başkaya et al., 2024). While there are studies linking earthquakes to the financial sector, these studies have not established a relationship between the financial vulnerability of banks and earthquakes. Kırkağaç and Karpuz (2023) examined the impact of the 2023 Kahramanmaraş earthquakes on the share returns of banks traded on the Istanbul Stock Exchange's banking index (XBANK) and insurance companies traded on the insurance index (XSGRT). The earthquakes caused a sudden shock and significant declines in the cumulative abnormal returns of banks and insurance companies included in the indices. Beybur (2024) analyzed the changes in individual customers' savings and spending preferences in 11 provinces affected by the February 6, 2023, Turkey earthquakes. The research revealed that savings increased in the provinces most affected by the earthquake, while spending increased in the provinces less affected. As can be seen, these studies focus on the effects of earthquakes on the Istanbul Stock Exchange, savings

deposits, and spending. Studies addressing how earthquakes affect the banking sector through credit risk and liquidity channels, how these effects evolve over time, and how banks develop adaptation strategies at the provincial level against these shocks remain limited. At this point, the concept of financial resilience gains importance. In the literature, financial resilience is defined as the capacity of a financial system or institution to maintain its basic functions, tolerate losses, recover, and re-establish equilibrium in the face of external shocks (O'Neill and Xiao, 2011; Deevy et al., 2021). For the banking sector, this concept is not limited only to the ability to survive during crisis periods; it also encompasses the management of credit risk, the protection of liquidity positions, and the ensuring of the continuity of financial relations with the real sector. In this context, the impact of sudden and regionally significant shocks, such as earthquakes, on the financial resilience of the banking sector needs to be examined from a multidimensional analytical perspective, focusing primarily on credit risk and liquidity channels.

Methodology

This section presents the research design, data set, and econometric methodology used to measure the impact of earthquakes on the financial resilience of the banking sector.

Data Set and Variables

This study examines the impact of large-scale earthquakes in Türkiye on the financial resilience of the banking sector. The analyses are based on an event study approach and are carried out using a panel data structure at the provincial level. This method allows for a comparative evaluation of changes in financial indicators before and after the earthquake.

The study uses a balanced panel dataset consisting of annual data from 81 provinces in Türkiye for the period 2009-2023. The use of provincial-level data aims to more clearly observe the relative

differences between provinces directly affected by the earthquake and other provinces. In this context, provinces declared as disaster zones are considered as the focus group in the analysis, while other provinces constitute the comparison group.

The financial resilience of the banking sector is measured using two key indicators. Credit risk resilience is represented by the non-performing loans indicator (NPL), and liquidity resilience is represented by the loan-to-deposit ratio (LDR). These indicators allow for a holistic evaluation of banks' responses to disasters in terms of credit risk and liquidity management. This analysis aims to examine three earthquake events of different magnitudes and impact zones: the 2011 Van earthquake, the 2020 Elazığ earthquake, and the 2023 Kahramanmaraş-centered earthquake. For each event, the provinces included in the analysis were determined according to the officially declared disaster zones (Resmi Gazete, 2023). This approach aims to ensure that the analyses are conducted within an objective and comparable framework. The event definitions and the provinces in the disaster zones are presented in Table 1 below:

Table 1. Event Definition and Provinces in the Disaster Area

Earthquake	Year (t_0)	Disaster Area
Van	2011	Van
Elazığ	2020	Elazığ
Kahramanmaraş	2023	11 provinces (Kahramanmaraş, Hatay, Adıyaman, Malatya, Gaziantep, Adana, Osmaniye, Diyarbakır, Elazığ, Şanlıurfa ve Kilis)

The provincial-level data used in the study were obtained from official and institutional data sources. Financial indicators related to the banking sector were compiled from the BDDK and Fintürk databases, while provincial-level socioeconomic control variables (GDP) were gathered from the annual bulletins published by the Turkish Statistical Institute (TUIK).

Econometric Method and Model

This study uses a panel data-based event study method to measure the impact of earthquakes on the financial resilience of the banking sector. The event study method is an empirical method that allows for the examination of changes in economic and financial indicators around a specific event and their isolation from other effects (Mackinlay, 1997; Sun and Abraham, 2020; Clarke and Tapia Schythe, 2021: 2). This approach allows for the evaluation of pre- and post-disaster changes by making comparisons with provinces unaffected by the earthquake. Thus, relative effects can be estimated independently of common macroeconomic developments other than the earthquake itself. The basic panel case study model used in this study is included in the following equation:

$$Y_{i,t} = \alpha + \sum_k \beta_k \left(Disaster_i \times D_{t+k}\right) + \gamma_i + \delta t + \varepsilon_{i,t}$$

In the equation, $Y_{i,t,}$ represent indicators representing the financial resilience of the banking sector in province i during period t (non-performing loans or loan-to-deposit ratio), $Disaster_i$ represents the provinces declared as disaster areas, D_{t+k} represents the earthquake year and subsequent periods, γ_i represents the fixed effects of the province, and t represents the linear time trend.

Analyses were conducted using panel regression models that include province-specific effects. These effects control for structural characteristics of provinces (economic structure, financial depth, demographic characteristics, etc.) that remain unchanged over time. Additionally, linear time trends were used in the models to account for the overall time trend. For the 2011 Van and 2020 Elazığ earthquakes, a dynamic event study approach was adopted to observe how the effects of the earthquake evolved over time. In this context, separate interaction variables were created for the earthquake year and subsequent years to isolate short- and medium-term effects. For the 2023 Kahramanmaraş earthquakes, the analysis

focused on concurrent effects within the earthquake year due to the dataset ending in 2023. Models were implemented using an estimation approach where standard errors are clustered at the province level. This ensured more reliable statistical results by addressing potential heteroskedasticity and serial correlation issues. The consistency of the analyses was supported by robustness tests performed under different model configurations. All analyses in this study were performed using the Eviews 13 software package.

Event-Study Design

The earthquakes examined in this study were structured within the framework of an event study approach, based on the year of the event (t_0). In the analysis, the provinces directly affected by the earthquake and officially declared disaster areas were defined as the "focus group" at the time of the event. Other provinces formed the comparison group. Thus, the effects of the earthquake were evaluated by comparing them with the course of events in provinces that did not experience earthquakes during the same period. For the 2011 Van and 2020 Elazığ earthquakes, a dynamic time structure was adopted to observe whether the effects of the event were limited only to the year of the earthquake. In this context, in addition to the year of the earthquake, subsequent years ($t+1$, $t+2$, $t+3$) were included in the model to separate the short and medium-term effects of the earthquake. This approach allows us to reveal how the banking sector's responses to disasters have evolved over time. For the 2023 Kahramanmaraş-centered earthquakes, since the dataset ended in 2023, the analysis focused on concurrent effects (t_0). This choice is a decision stemming from the data structure. In this context, the findings reflect the short-term effects of these earthquakes on the banking sector.

Findings and Interpretation

This section presents the findings related to the three major earthquakes analyzed in the study.

Findings from the 2011 Van Earthquake

The 2011 Van earthquake is one of the most significant events analyzed in Turkey, both in terms of its scope and the economic and social devastation it caused. Therefore, the Van earthquake was chosen as an important reference point for evaluating the financial resilience of the banking sector in the face of disasters. The findings of the analysis are presented in Table 2 below:

Table 2. Banking Resilience to the 2011 Van Earthquake – Event Study Results

Variable	NPL (Credit Risk)		LDR (Liquidity Risk)	
	Coefficient	p-value	Coefficient	p-value
Van × t_0 (2011)	−1.843	0.001	−47.61	0.029
Van × t+1 (2012)	−1.535	0.002	−33.38	0.086
Van × t+2 (2013)	−1.197	0.006	−4.92	0.773
Van × t+3 (2014)	−1.788	0.000	54.09	0.003
Cross-section fixed effects were used. Linear time trend was included in the model. The reference period is one year before the earthquake (t−1 = 2010). Standard errors were corrected according to clustering at the provincial level.				

The findings in Table 2 show that the 2011 Van earthquake elicited different responses from credit risk and liquidity indicators regarding the financial resilience of the banking sector.

Non-performing loans, an indicator of credit risk, were observed to produce statistically significant negative coefficients in the year of the earthquake and in subsequent periods. This indicates that there was no significant deterioration in credit risk after the earthquake and that banks managed their loan portfolios prudently.

The loan-to-deposit ratio, used as a liquidity indicator, decreased significantly in the year of the earthquake. This shows that banks prioritized maintaining liquidity in an uncertain environment. The weakening of this effect in subsequent years and its reversal in the third year demonstrates that the banking sector has the capacity to recover over time. Overall, the findings show that the Van earthquake did not lead to an increase in credit risk in the banking sector, but created a temporary and manageable contraction in liquidity.

Findings from the 2020 Elazığ Earthquake

Although the 2020 Elazığ earthquake had a more limited impact area compared to the Van earthquake, it offers an important comparison for observing the banking sector's response to a medium-sized disaster. The findings of the analysis are presented in Table 3 below:

Table 3. 2020 Elazığ Earthquake: Banking Resilience – Event Study Results

Variable	NPL (Credit Risk)		LDR (Liquidity Risk)	
	Coefficient	p-value	Coefficient	p-value
Elazığ × t_0 (2020)	−0.354	0.501	9.19	0.307
Elazığ × t+1 (2021)	−0.879	0.142	4.28	0.668
Elazığ × t+2 (2022)	−1.662	0.018	−6.34	0.576
Elazığ × t+3 (2023)	−1.826	0.018	−25.84	0.057
Provincial fixed effects were used. Linear time trend was included in the model. The reference period is one year before the earthquake (t−1 = 2019). Standard errors were corrected according to clustering at the provincial level.				

The findings in Table 3 show that the 2020 Elazığ earthquake did not create significant short-term financial pressure on the banking sector. Non-performing loans, an indicator of credit risk, showed no statistically significant change in the year of the earthquake and the first year following. In contrast, the significant decrease observed in the credit risk indicator two and three years

after the earthquake reveals that the banking sector, albeit belatedly, has brought its credit risk under control permanently. The results regarding the loan-to-deposit ratio, used as a liquidity indicator, show that the Elazığ earthquake did not create significant and immediate liquidity pressure on the banking sector. The statistically weak changes observed in liquidity indicators show that a moderate earthquake does not severely strain the liquidity structure of the banking sector. Overall, the findings regarding the Elazığ earthquake show that the banking sector responded to this disaster with a limited short-term response and a cautious and balanced response in the medium term. These results indicate that the smaller the scale of the earthquake, the less the financial resilience of the banking sector is strained.

Findings from the 2023 Kahramanmaraş Earthquake

The earthquakes that occurred in Kahramanmaraş in 2023 represent the disaster with the widest impact and the highest economic cost among the events considered in this analysis. Therefore, these earthquakes demonstrate how the financial resilience of the banking sector was affected by a large-scale and widespread shock. The findings of the analysis are presented in Table 4 below:

Table 4. The 2023 Kahramanmaraş Earthquakes: Banking Resilience – Concurrent Effects

Variable	NPL (Credit Risk)		LDR (Liquidity Risk)	
Disaster Area × 2023	−1.437	0.034	−51.314	0.000
The disaster area comprises ten officially declared provinces. Provincial fixed effects have been used. Linear time trend has been included in the model. The reference period is 2022. Standard errors have been corrected for clustering at the provincial level.				

The findings presented in Table 4 show that the 2023 Kahramanmaraş earthquakes simultaneously affected the banking sector, but this effect manifested differently in credit risk and

liquidity channels. Non-performing loans, used as an indicator of credit risk, did not show a statistically significant increase in the provinces declared disaster zones in the year of the earthquake compared to other provinces. This indicates that credit risk in the banking sector did not suddenly worsen in the face of a large-scale disaster, and risk management continued.

The results regarding the loan-to-deposit ratio, a liquidity indicator, are quite significant. The sharp and significant decrease in the loan-to-deposit ratio observed in the disaster zone provinces shows that banks prioritized liquidity conservation by limiting credit expansion in the year of the earthquake. This demonstrates that the banking sector adopted a defensive and cautious liquidity strategy in the face of large-scale uncertainties. Overall, the findings regarding the 2023 Kahramanmaraş earthquakes show that the banking sector adapted to the large-scale shock through a deliberate and strong contraction in the liquidity channel, while maintaining resilience in the credit risk channel. These results demonstrate that the banking system can maintain its financial stability in the short term, even in the face of widespread disasters.

Robustness Tests

Robustness analyses were performed to demonstrate whether the mainframes are sensitive to model temperatures and timing definitions. These analyses focus on the 2011 Van earthquake, the main event where dynamic effects were clearly observable. The aim is to determine whether the obtained results are specific to any particular specification. The results are presented in Table 5 below:

Table 5. Trendless Model – Van 2011 (NPL)

Variable	Coefficient	Std. Err.	p-value
Van × t_0	−1.102	0.335	0.005
Van × t+1	−0.912	0.335	0.017
Van × t+2	−0.698	0.335	0.058
Van × t+3	−1.402	0.335	0.001

The local fixed effects were used; the linear time trend was not included in the model. The reference period is t−1.

As shown in Table 5, even when the time trend is removed from the model, the signs and significance of the coefficients are largely preserved. This indicates that the credit risk findings are not sensitive to the trend assumption.

Table 6. Lead Test – Van 2011 (NPL)

Variable	Coefficient	Std. Err.	p-value
Van × t−2 (Lead)	1.362	0.343	0.001
Van × t_0	−0.978	0.343	0.013
Van × t+1	−0.788	0.343	0.037
Van × t+2	−0.568	0.343	0.120
Van × t+3	−1.278	0.343	0.002
Provincial fixed effects were used. The reference period is t−1.			

Leading coefficients are used to test whether units in pre-event periods have different rates and to evaluate the results for parallel trends (Gujarati et al., 2012). In this analysis, they were used to test whether Van province was systematically different from other provinces in terms of credit risk assessments before the earthquake. This crisis shows that Van × t−2, representing the pre-earthquake periods, is consistently significant, revealing that Van province's credit risk was at a different level than other provinces even before the earthquake. However, the preservation of the significance of the post-earthquake coefficients due to the extension of the analyses to a specific reference period (t−1) reveals that the observed changes are not solely due to previous rates, but that the earthquake has an additional and relative effect on credit risk. This finding supports the idea that credit risk outcomes are not trend-sensitive and that the underlying investment is sound.

Conclusion

This study examines the impact of the 2011 Van, 2020 Elazığ, and 2023 Kahramanmaraş earthquakes on the financial resilience of the banking sector in Türkiye at the provincial level,

using a panel data and event study approach. The findings show that the banking sector's response to the earthquakes was not a unilateral financial disruption, but rather an adaptation process following different time profiles in credit risk and liquidity channels. The results regarding the 2011 Van earthquake show that there was no significant increase in non-performing loans in the post-earthquake period; on the contrary, banks adopted a cautious and restrictive approach to credit risk. The observed decrease in the loan-to-deposit ratio during the same period indicates that banks prioritized maintaining liquidity in uncertain conditions. The disappearance and reversal of this effect in subsequent years demonstrates that the banking sector has the capacity to recover and stabilize after the earthquake. The findings regarding the 2020 Elazığ earthquake show a more limited impact profile compared to the Van earthquake. While no significant deterioration in credit risk and liquidity indicators was observed during and immediately after the earthquake year, the decrease in non-performing loans in the following years shows that banks were able to manage credit risk effectively, albeit with a delay. This suggests that a moderate earthquake has a milder and more gradual impact on the banking sector.

However, the 2023 Kahramanmaraş earthquakes differ from the previous two events in terms of both the area of impact and the uncertainty they created. The findings reveal a very strong and simultaneous decrease in the loan-to-deposit ratio in the provinces declared as disaster zones. This result shows that the banking sector prioritized liquidity security by limiting credit expansion from the year of the earthquake onwards. Conversely, the absence of a sudden and sharp deterioration in the non-performing loan indicator shows that banks activated defense and regulatory mechanisms to control credit risk in the face of a large-scale shock. Therefore, the findings regarding the Kahramanmaraş earthquakes are interpreted not as "ineffectiveness," but as the impact being concentrated through the

liquidity channel. When the three earthquakes are considered together, it is seen that the financial resilience of the banking sector is tested in different ways depending on the magnitude and scope of the earthquake. As the earthquake magnitude increases, the pressure on liquidity becomes more pronounced, while banks try to limit the deterioration through risk management and balance sheet adjustments in the credit risk channel. These findings show that the banking system in Türkiye is not a structure that passively experiences deterioration in the face of earthquakes, but rather one that adapts to shocks and rebalances risks. In conclusion, this study reveals that the effects of earthquakes on the banking sector should be evaluated not only through changes in credit risk but also through adjustments in liquidity behavior and balance sheet composition. The findings show that liquidity management plays a central role in maintaining financial resilience after disasters and that the Turkish banking sector has a certain capacity and resilience in adapting to such extraordinary conditions.

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CHAPTER 3

AN ANALYSIS OF THE PRICE PREDICTABILITY OF INSURANCE SECTOR STOCKS TRADED ON THE BIST FROM THE PERSPECTIVE OF ELLIOT WAVE THEORY

1. MURAT ACET[1]

The insurance sector in Turkey, as an important component of the financial sector, is represented by a total of six shares traded on BIST (Borsa Istanbul A.Ş.). These shares, which are included in the XSGRT index, are: Anadolu Sigorta A.Ş. (ANSGR), Agesa Hayat ve Emeklilik A.Ş. (AGESA), Anadolu Hayat Emeklilik A.Ş. (ANHYT), Aksigorta A.Ş. (AKGRT), Ray Sigorta A.Ş. (RAYSG), and Türkiye Sigorta A.Ş. (TURSG). According to BIST A.Ş. data, the insurance sector's Total Market Value is 294,001,606,016 TL, and the approximate number of investors is 225,000.

The Elliott Wave Theory (EWT) used in the analysis of these stocks is a theory developed by Ralph Nelson Elliott. It claims that natural processes in the universe repeat themselves in an orderly and

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continuous manner according to a law (Neely, 1990).This cyclicality consists of the rhythmic sum of changes. These changes are subject to immutable laws of nature that govern everything, including the different emotional periods of human behavior (Prechter, 1990). Although the magnitude and duration may differ, the rhythm of a new cycle will be identical to that of the previous ones (Poser, 2003). Therefore, according to the fundamental claim of Elliot Wave Theory, if we view markets as part of this universe, the preconception that markets behave chaotically becomes invalid (Prechter and Frost , 1998).

According to EWT, price changes in stock markets reflect the dynamics of human behavior rather than how company values change (Şengöz: 2014). This situation also confirms the rule that there are repeating patterns in the stock market (Çetin and Manga, 2016). It is misleading to think that a stable trend in the stock market is based on any particular news. Therefore, it would be wrong to expect the continuity of a trend linked to a particular news item. The stock market will continue on its own course regardless (D'Angelo and Grimaldi, 2017).

This study attempts to analyze the predictability of price movements in six stocks traded on the BIST within the Turkish Insurance Sector from the perspective of the Elliott Wave Theory. Elliot Wave Theory states that Fibonacci sequences can be used as a reference for price movements. Accordingly, the assumption that the price movements of the six stocks in the insurance sector could move in proportion to Fibonacci numbers and their multiples was tested. The Tradingview Data and Analysis Platform, MS-Excel Package program, and Forex FX Plus Data and Analysis Platform were used in the study. Analyses applied to the daily price movements of six shares traded on the BIST in the insurance sector in Turkey yielded results indicating that they largely moved independently of Elliot Wave Theory.

1-Elliot Wave Theory

Ralph Nelson Elliott, in Elliott Wave Theory, asserts that all natural processes in the universe continue with a certain order and continuity (Gehm,1983). Therefore, price movements in the stock markets show continuity with a certain order and continuity, and predictability should be expected in this direction (Prechter, 2007). One of the underlying factors in this situation is the emotionality in human behavior. The theory states that each movement comes as a wave and that external stimuli cannot permanently prevent the completion of this movement (Ramlall, 2016). Thus, based on this observation, it becomes possible to make predictions.

In 1939, R.N. Elliot wrote a book titled "The Wave Principle," and after his death, many works in this field were published. In 1978, Charles J. Collins presented important points regarding Elliot Wave theory in his book "Elliot Wave Principle."

While studying the US Stock Exchange in the 1920s, R.N. Elliot noticed that price movements were influenced by factors such as human and crowd psychology, and he determined that these movements repeated within certain patterns. Human reflexes, which move in waves and within specific numerical relationships, are rhythmic and decisive in stock markets where large crowds influence prices (Teseo, 2001).

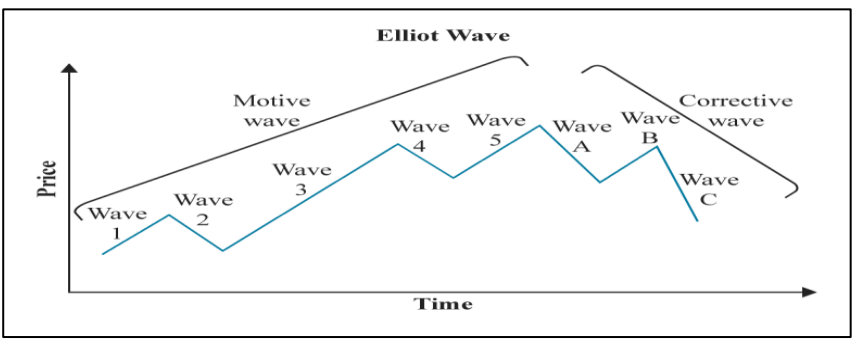
Elliot also conducted research on Fibonacci sequences and used these sequences within his theory. First introduced by the famous Italian mathematician Leonardo Fibonacci, this sequence of numbers is formed by adding each number to the one preceding it. Dividing any two consecutive numbers yields a value close to the golden ratio. In other words, when the larger of two consecutive numbers in the Fibonacci sequence is divided by the smaller, the result approaches the golden ratio (1.618) (Teseo,2001).

Elliot Wave Theory is based on the relationships between repeating patterns according to certain rules and principles. Fibonacci ratios are primarily used when scaling these relationships (Duhan at All, 2018).

The fractal argument used in mathematics for the patterns or shapes formed by repeating cycles in Elliot Wave Theory has been used as a reference (Feder, 2013). Fractal-like patterns were used in mathematics in the 19th century by mathematicians Bernard Bolzano, Bernhard Riemann, and Karl Weierstrass. The concept of fractals was first introduced in 1975 by Benoit B. Mandelbrot. A fractal is the name given to patterns constructed from proportionally enlarged or reduced models of a shape. If the same rule is repeated continuously, the pattern continues indefinitely. In other words, there is self-similarity. Whether the shape is enlarged or reduced, the same pattern is seen . (Prechter and Rougelot, 1994).

A trend is the movement of prices in a certain direction over a certain period of time (Frost and Prechter, 2005.) In Elliot Wave Theory, it is not predicted as a constant; it is variable. In the theory, each trend is symbolized as a wave. There are usually 5 main (impulse) waves (named W1, W2, W3, W4, and W5), followed by 3 corrective waves (A, B, and C waves) in sequence.

Figure 1. Elliot Wave Theory



Source: https://bookmap.com/blog/what-is-elliott-wave-theory

Motive Waves

Wave 1 (W1): Previous developments have caused a decline (cheapening) in the price of the financial asset, ultimately revealing upside potential. The first wave is positive due to an increase in buyers. However, the news is still not entirely positive during this process, and the market is generally affected negatively. This process can take months or be completed in minutes. However, some investors in the market are optimistic about the future, driving purchases in the market and acting as a locomotive (Şengöz, 2014).

Wave 2 (W2): Following the first wave, a correction occurs, provided it is weaker than the first wave. Investors who bought during the first wave believe the financial asset is overvalued. They will want to sell and realize their profits. The correction is necessary for a more stable market afterward. According to EWT, the second wave cannot fall below the price level of the first wave. According to the Fibonacci sequence, the second wave can retreat up to a maximum of 61.8% of the first wave. This is because similar macroeconomic conditions still prevail. Therefore, the market is more inclined to sell (Frost and Prechter,2005).

Wave 3 (W3): If an uptrend begins after a correction, it means that macroeconomic data supports it. The third wave is the longest and most stable wave. In this wave, positive macro and micro changes begin to emerge. Financial assets attract investors' attention. Therefore, with more investors buying, this wave strongly surpasses the first wave. By the middle of the third wave, the market is already saturated with these positive signals. At the same time, the market volume also begins to support this situation. Optimism spreads. According to EWT, the third wave is the longest of the five waves. In fact, according to the Fibonacci sequence, it has the potential to reach up to 161.8% (1.5 times) of the first wave (Şengöz , 2014).

Wave 4 (W4): The fourth wave is a corrective wave, just like the second wave. Since it follows the most stable and longest third wave, the market still tends to interpret positive impressions, making the fourth wave a healthier and cleaner corrective movement. Unlike the second wave, it is a calmer decline. And generally, a pullback of 38.2% of the third wave is expected. Once again, it should be noted that all these ratios are figures obtained by referring to the Fibonacci sequence (Fischer and Fischer, 2004) However, the fourth wave definitely does not fall to the point where the first wave ended.

Wave 5 (W5): Although sentiment remains positive in the fifth wave, volume is weak. This is the stage where the financial asset reaches its most expensive level. The most important indicators in this wave are those that show the strength of the price movement, such as RSI and MACD. These indicators measure divergence in the price. Divergence is when an asset's price moves in the opposite direction to what a technical indicator shows. If a financial instrument is diverging in terms of these indicators, a potential reversal may be starting despite weak price trends. This is an inconsistency. For example, even though the price rises, higher points are not seen in the RSI indicator. Or MACD values start to go down. W1, W3, and W5 waves move in the direction of the general trend. Investors who think the rise is coming to an end move on to correction after this stage (Neely, 1990).

Corrective Waves

The waves observed after the fifth wave, named A, B, and C, are corrective waves and should not be confused with waves 2 and 4 within the Impulse waves (Şengöz,2002).

Wave A: It is generally not very strong. During this wave phase, the intention to sell is uncertain and volume is low.

Wave B: Corrects Wave A. There is a countertrend. Like W2 and W4 waves, it moves in the opposite direction of the preceding wave.

Wave C: The final stage of Elliott Wave Theory, which generally (except in exceptional cases) completes the cycle.

Waves A, B, and C symbolize a downtrend. Wave C can be more than 1.5 times the length of the first wave. It can even reach 2 or 3 times the length.

Elliot Wave Theory can also include micro internal patterns that repeat in the same pattern in each wave stage due to the fractal structure. Thus, within any wave phase, micro waves W1, W2, W3, W4, W5, A, B, and C may be embedded in sequential order. Correction waves can appear in different formations (Şengöz, 2002)

Zigzag Correction Pattern:

Waves A, B, and C form a zigzag pattern. For example, wave C breaks the bottom of wave A. This indicates that the decline will continue (Copsey, 2011)

Flat Band Correction:

The bottom formed by wave A will continue after being broken by C.

Triangle Correction:

This correction pattern occurs when waves B and C break below the bottom points of the preceding waves and continue in a structure resembling a narrowing triangle.

Running Flat Correction:

This is a correction pattern where the B and C correction waves break above the peak points of the previous wave, resembling an expanding triangle.

The mathematical foundations of Elliott Wave Theory are based on Fibonacci ratios. Correction waves (2 and 4) are expected to trigger a retracement of 38.2%, 50%, or 61.8% of the previous wave. In impulse waves, for example, Wave W3 must be 161.8% or 26.8% of the length of the preceding wave (Casti, 2002). If W1 and W3 waves are close in length, it is common for W5 to extend. The Fibonacci sequence can be used to predict the ending price of any wave (Teseo, 2001)

The Elliott Wave Theory emerged from R.N. Elliott's observations of stock market price cycles and was first outlined in his 1938 work, “The Wave Principle.” It was further developed in his 1946 book, “Nature's Law: The Secret of the Universe.” Robert Prechter and A.J. Frost popularized the theory with “Elliott Wave Principle: Key to Market Behavior” (1978), emphasizing its fractal nature and the use of Fibonacci integration for wave validation.

Empirical studies on EWT include: A study by Tabasi, Hadavandi, and Chu (2017) combined EDT with neural networks to forecast Tehran Stock Exchange indices, finding parallels with traditional models but noting difficulties in wave identification. Similarly, Wang and Che (2007) used case-based reasoning with EWT for stock price predictions. In money markets, Al Bullushi (2017) tested EWT and concluded that it effectively identified trends but required confirmation with other indicators due to subjective reasons.

Critics argue that Malkiel (2003) in “A Random Walk Down Wall Street” violates the efficient market hypothesis by implying predictable patterns in random walks. Fama and French (1992) rejected wave theories as non-empirical and lacking statistical rigor. However, Neely, Weller, and Ulrich (2009) found that EDT-based rules generated positive returns in the foreign exchange market and proposed practical approaches despite theoretical debates.

In commodity markets, a study by Vacha and Barunik (2018) applied EDT to energy prices and revealed wave patterns consistent with supply-demand cycles. In emerging markets, Kumar and Mitra (2020) analyzed Indian stocks and observed the effectiveness of EWT during variable periods but noted frequent rule deviations (Ramlall, 2016).

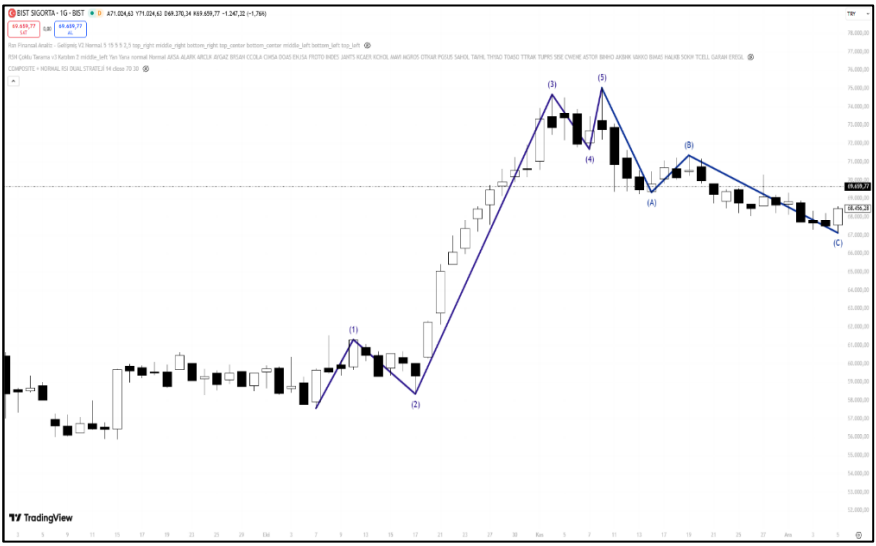
2- Analysis of XSGRT Shares from the Perspective of Elliott Wave Theory

The analysis examined the closing prices of six stocks in the BIST_XSGRT Index for 2025 on a daily BIST basis. Impulse wave cycles and corrective wave cycles were determined separately for each stock. Particular attention was paid to ensuring that the W3 impulse wave was not the shortest wave and that the W4 wave did not overlap with the price range of the W1 wave.

In Fibonacci analysis, the relationship between price movements and Fibonacci retracement and extension levels was determined, and potential future support and target prices were identified.

In momentum analysis, the 14-day Relative Strength Index (RSI 14) was used, and the proximity of stocks to overbought or oversold zones was evaluated.

Graphic 1. EWT wave movements on the BIST_XSGRT Index



Source: Https://tr.tradingview October-December 2025 XSGRT Daily Price movements

The XSGRT index, which contains aggregated data for the insurance sector trading on BIST, complies with EWT rules. However, the same does not apply to individual stocks.

Five stocks violated the W5/W3 rule, i.e., the basic rule that the fifth wave must be shorter than the third wave. Only the ANHYT stock complied with this rule. The ANSGR stock violated this rule with the highest value, at a rate of 400%.

RAYSG recorded a decline of -10% in the W3 wave, and the TURSG stock also recorded a decline of -4.8% in the W3 wave and -12.3% in the W5 wave, providing strong evidence that this wave was corrective rather than impulsive and violated EWT.

Table 1. XSGT Share Certificates' EWT Rule Compliance/Violations

Shares	W3 / W1 Rate(Ideal: 161.8%$)	W5 / W3 Rate (İdeal: < 100%)	W3 or W5 Percentage change	Violation of fundamental rules (Overlap)
AGESA	115,70% (Normal)	225,00% (İhlal)	W5: 40,13%	(✓ YES)
AKSGR	115,70% (Normal)	225,00% (Violation)	W5: 40,13%	(✓ YES)
ANHYT	89,98% (Weak)	59,90% (✓ **Compliance**)	W1: 36,77%	(✓ YES)
ANSGR	29,88% (Weak)	400,00% (Violation)	W1: 4,04%	**NO** (W2 < W1 Start? ✗ NO; W4 < W1 End? ✗ NO)
RAYSG	134,58% (Normal)	123,66% (Violation)	W3: -10,10% (Negatif)	(✓ YES)
TURSG	29,49% (Weak)	150,54% (Violation)	W3: -4,77% (Negatif)	(✓ YES)

Source: Table created by the author.

In terms of the Overlap rule, the ANSGR stock has violated the rule that W2 shall not fall below the price level of W1.

Surprisingly, the technical analysis results for AGESA and AKSGR are very similar. This aspect is noteworthy.

Fibonacci Levels and Market Positioning

It has been determined that the Fibonacci target prices for AGESA, AKGRT, ANSGR, and TURSG shares have not been reached. There is no rule violation.

The figures indicated in parentheses for ANHYT (129.72), RAYSG (282.85), and ANSGR (22.59) represent potential upside areas.

For RAYSG and ANSGR shares, even the nearest Fibonacci support levels are well above the current closing price. This indicates that a strong decline has occurred or that these levels may now function as significant resistance points. For AGESA, AKSGR, and TURSG shares, the fact that the nearest support levels are below the latest closing price indicates that the current price level is in a weak position relative to these supports.

Table 2. Fibonacci sequence alignments of XSGRT shares

Shares	Close Price	T1 (%100)	S1 (%38.2) Posititon
AGESA	218,70	↓ Reached (161,50)	185,29 (⚠ Below)
AKSGR	218,70	↓ Reached (161,50)	185,29 (⚠ Below)
ANHYT	97,45	↑ Upside (129,72)	105,72 (✓ Above)
ANSGR	22,44	↓ Reached (22,04)	25,13 (✓ Above)
RAYSG	238,00	↑ Upside (282,85)	333,07 (✓ Above)
TURSG	12,18	↓ Reached (11,33)	11,56 (⚠ Below)

Source:The table was created by the author using data from the ForexFx platform.

Momentum Analysis (RSI 14)

The Relative Strength Index (RSI) is used to measure the rate of change in share prices and the volume of change. It is a momentum-based indicator. The RSI chart allows for the examination of periods when the financial instrument was strong and weak, both currently and in the past.

The RSI (Relative Strength Index) measures the internal strength or momentum of stocks. Generally, values below 30 are considered oversold, while values above 70 are considered overbought (Perşembe, 2018).

The latest RSI value for AGESA and AKGRT stocks is 57.7. This value indicates a slightly upward momentum in a neutral zone.

Graphic 2. EWT waves on AGESA price movements

Source: The price chart was created by the author using data from the Tradingview

Graphic 3. EWT waves on AKGRT price movements

Source: The price chart was created by the author using data from the Tradingview

The latest RSI value for ANHYT stock is 50.8, indicating that it is in a completely neutral zone. ANHYT's daily closing price movements partially align with the Elliott Wave Theory pattern.

Graphic 4. EWT waves on ANHYT price movements

Source: The price chart was created by the author using data from the Tradingview

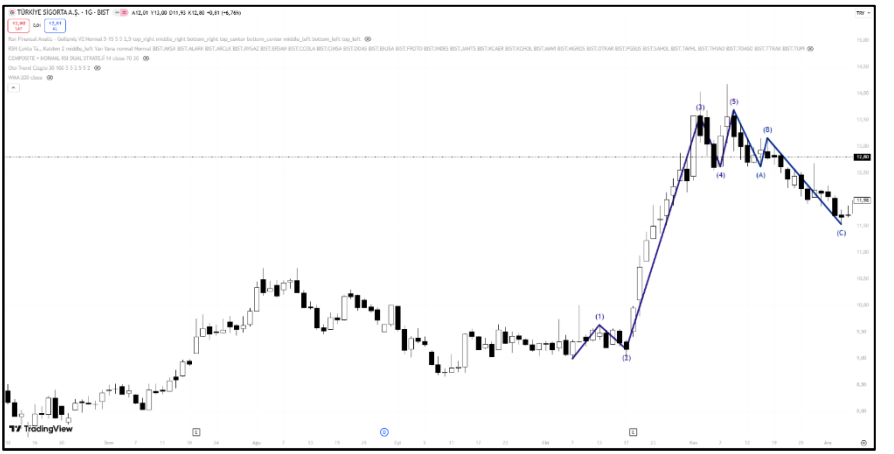
The latest RSI value for RAYSG stock is 47.1. It shows slight weakness in the neutral zone.

Graphic 5. EWT waves on RAYSG price movements

Source: The price chart was created by the author using data from the Tradingview

The TURSG's latest RSI value is 38.5. It is close to the lower boundary of the neutral zone. The possibility that it is approaching the oversold zone should be considered.

Graphic 6. EWT waves on TURSG price movements



Source: The price chart was created by the author using data from the Tradingview

Graphic 7. EWT waves on ANSGR price movements

Source: The price chart was created by the author using data from the Tradingview

Conclusion

The six insurance sector shares traded on the BIST in Turkey exhibit a highly volatile structure due to reasons stemming from both the economic climate and their low share of the total volume. There are numerous factors affecting the prices of these shares, which also makes price predictability difficult. In this sense, the price predictability of insurance sector shares from the perspective of the Elliot Wave theory is impossible, as it violates many of the theory's rules.

It was observed that the impulse waves of the six analyzed stocks deviated significantly from the fundamental principles of EWT. Nearly all of the stocks exhibit a high degree of structural inconsistency and rule violations. A very basic EWT rule violation, such as W5 exceeding the wave length of W3, was observed in five of the six stocks (except ANHYT).

In contrast, the ANHYT stock demonstrated rare compliance with EWT within the index by meeting one of the most critical ratio conditions for impulse waves (W5/W3 < 100%).

According to Fibonacci analysis, potential upside targets were observed for the ANHYT, RAYSG, and ANSGR stocks. The stocks in the XSGRT index rarely conform to the strict rules of Elliot Wave Theory across the sector. This suggests that price movements deviate psychologically from the fractal discipline expected by Elliot Wave Theory or that the cycles examined are part of more complex correction formations. RSI data generally remains in neutral territory, failing to provide a clear short-term directional signal.

Consequently, from the perspective of Elliott Wave Theory, attempting to forecast the price or price range of the five XSGRT index stocks, excluding ANHYT, carries the risk of producing results that fail to meet expectations.

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