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Analysis of The Impact of Risks in The Turkish Banking Sector on Investor Behavior

Türk Bankacılık Sektöründeki Risklerin Yatırımcı Davranışlarına Etkisinin Analizi

Hikmet AKYOL [1]
Gümüşhane Üniversitesi, Şiran Mustafa Beyaz Meslek Yüksekokulu, Mülkiyet Koruma ve Güvenlik Bölümü, Gümüşhane, Türkiye

Gümüşhane University, Şiran Mustafa Beyaz Vocational School, Department of Property Protection and Security, Gümüşhane, Türkiye
hikmetakyol@gumushane.edu.tr

(Sorumlu Yazar-Corresponding Author)

Selim BAŞAR [2]
Anadolu Üniversitesi, İktisat Fakültesi, Çalışma Ekonomisi ve Endüstri İlişkileri Bölümü, Eskişehir, Türkiye

Anadolu University, Faculty of Economics, Department of Labor Economics and Industrial Relations, Eskişehir, Türkiye
selim@anadolu.edu.tr

Abstract

This research examined the effects of Turkish banking risks on investor behavior. This context, the period of nine deposit banks covering the period between 2008Q3-2019Q3 was analyzed using panel regression estimators. Researchers found that systemic and systematic risks negatively affected investor sentiment in the real sector. The rise in systemic and market risks of banks has led to an increase in investor pessimism. The findings showed that the real sector confidence index can be used as an effective early warning system for financial instability. It has shown that banking sector risks have the potential to spread to the entire economy through real sector investment behavior. The results revealed that stock returns positively affect real-sector investment behavior. Accordingly, positive developments in the stock markets encouraged the real-sector to invest. In the research, the effects of selected macro variables on investor sentiment were analyzed. The forecast results documented that inflation rates, the current account balance, and the VIX uncertainty index negatively affected real-sector investor behavior. On the contrary, it was determined that the effect of the MSCI Europe index on investor sentiment was positive.

Keywords: Individual Risk, Systematic Risk, Systemic Risk, Investor Sentiment, Turkish Banking Sector, Financial Economy.

Öz

Bu araştırma Türk bankacılık sektöründeki risklerin yatırımcı davranışları üzerindeki etkilerini ele almıştır. Bu çerçevede dokuz mevduat bankasının 2008Q3-2019Q3 arasını kapsayan dönemi panel regresyon tahmincileri kullanılarak analiz edilmiştir. Araştırma sonuçları, sistemik ve sistematik risklerin reel kesim yatırımcı duyarlılığını negatif yönlü etkilediğini göstermiştir. Bankaların sistemik ve piyasa risklerinin artması yatırımcı kötümserliğini arttırmıştır. Bulgular reel kesim güven endeksinin finansal istikrarsızlıkların tahmin edilmesinde etkin bir erken uyarı sistemi olarak kullanılabileceğini göstermiştir. Aynı zamanda bankacılık sektöründeki risklerin reel kesim yatırım davranışları kanalıyla ekonominin tümüne yayılabilme potansiyeli taşıdığını göstermiştir. Sonuçlar hisse senedi getirilerindeki artışın reel kesim yatırım davranışlarını pozitif yönlü etkilediğini ortaya koymuştur. Buna göre hisse senedi piyasalarındaki olumlu gelişmeler reel kesimi yatırım yapmaları konusunda teşvik etmiştir. Araştırmada seçilmiş makro değişkenlerin yatırımcı duyarlılığı üzerindeki etkileri analiz edilmiştir. Tahmin sonuçları enflasyon oranları, cari denge ve VIX belirsizlik endeksinin reel kesim yatırımcı davranışları üzerindeki etkilerinin negatif yönlü olduğunu göstermiştir. Aksine MSCI-Avrupa endeksinin yatırımcı duyarlılığı üzerindeki etkisinin pozitif yönlü olduğu saptanmıştır.

Anahtar Kelimeler: Bireysel Risk, Sistematik Risk, Sistemik Risk, Yatırımcı Duyarlılığı, Türk Bankacılık Sektörü, Finansal Ekonomi.

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Introduction

Homo-economicus, one of the most basic concepts of Neo-Classical economics, argues that individuals behave rationally when making economic decisions. This concept led to modern finance. Von Neumann and Morgenstern (1944) Expected Utility, Markowitz (1952) Modern Portfolio, Sharpe (1964), Lintner (1965) and Mossin (1966) Pricing Capital Asset and the Effective Markets hypothesis proposed by Fama (1970) It is based on the assumption that investors trading in the market act rationally and prefer choices that are in their own interest. On the contrary, the Expectation hypothesis proposed by Kahneman and Tversky (1979) opposed the idea that investors are rational and critically criticized the expected benefit approach in particular and the rational investor phenomenon in general. Black (1986), Shleifer, and Vishny (1997) have argued that noisemakers can be a serious obstacle to financial markets' effectiveness and that the arbitrage mechanism can be restricted in some cases. The concepts of arbitrage limitations, in which investors are not completely rational, have paved the way for financial behavioral science. This consists of finance and psychology. One of the basic concepts used in this area is investor sentiment. This concept represents investors' attitudes and behaviors towards a particular security or financial asset.

The financial collapse caused by the 2007-2008 Global Financial Crisis affected financial markets in developed and developing countries. In addition, the Financial Crisis has shown that individual, systematic, and systemic risks can pose a serious problem for the banking system and macroeconomics. Post-crisis studies have shown that investor sentiment is closely related to financial risks (Schmeling, 2009; Antoniou et al., 2016; Borovkova et al., 2017; Hussain & Shah, 2017; Kaya, 2018; Paraboni et al., 2018; Jiang et al., 2019). In addition, some studies from this period have indicated that investor sentiment can predict financial crises (Bandopadhyaya & Truong, 2010).

In this study, the effects of Turkish banking sector risks on investor behavior were estimated using panel regression estimators. In this context, it is aimed at presenting the following contributions to the literature:

- It was aimed at testing the extent to which the real sector confidence index is a reliable tool for predicting individual, systemic, and systematic risks
- In this context, it was examined whether the real sector confidence index can be used as an early warning tool.
- The link between investor sentiment and banking risks and financial stability was shown.
- The relationship between investor sentiment and basic macroeconomic variables was determined.

The research comprises four parts. The first part is an introduction. In the second part, the conceptual framework for the variables is given. In the third part, the study data set is introduced and the econometric methods used are explained. In the fourth part, the results from the applied econometric analyses were interpreted.

Literature Review

In this section, the conceptual framework for the relationship between investor sentiment and individual, systemic, and systematic risks is explained. In addition, empirical studies are mentioned. Traditional financial theories can be traced back to Bayes' (1763) theorem. These theories assume that investors can process the relevant information they have and make unbiased probabilistic decisions based on Bayes' rule (Salzman & Trifan, 2005 p. 2). This theorem, based on rationalism, implies that by using the information in their hands correctly, individuals make evaluations based on the future and obtain results. The concept of the rational individual was used for many hypotheses in the following period. The Expected Utility hypothesis, put forward by Bernoulli (1738) and developed by von Neuman and Morgenstein (1944), assumes that when individuals need to make decisions under uncertainty, they must act in a certain way (Ackert & Deaves, 2010, p. 6). According to this model, individuals can correctly calculate what will provide the most appropriate benefit for them in the face of uncertainty they face, and they can make their decisions by choosing the right one (Yiğit, 2019, p. 97). Markowitz (1952) Modern Portfolio hypothesis (MPT) is based on the calculation of the expected return and expected risk of a portfolio consisting of financial assets under certain assumptions (Sefil & Çilingiroğlu, 2011, p. 251). MPT assumes that the expected return of a stock or portfolio is its standard deviation and its correlation with other stocks or mutual funds held in the portfolio (Ricciardi & Simon, 2000, p. 1). The Capital Asset Pricing Model hypothesis (CAPM) proposed by Sharpe (1964), Lintner (1965), and Mossin (1966) is a mathematical model that attempts to explain how securities should be priced based on their relative riskiness along with the return on risk-free assets. CAPM argues that there is only one component that describes the process of creating returns on a financial asset and that this is the systematic risk of that asset or the risk associated with the market

(Bajpai & Sharma, 2015, p. 260). The model assumes that investors determine the relationship between stocks and market returns by considering the beta coefficient and make decisions to invest in stocks according to the direction and size of the beta (Sefil and Çilingiroğlu, 2011, p. 252). The Effective Markets hypothesis (EMH) developed by Fama (1970) argues that assets in financial markets reflect all available information, so markets are highly efficient. Accordingly, any new or shock information on the market is reflected in asset prices very quickly (Dobbins & Witt, 2007, p. 65). The EMH assumes that both the future flow of information and investors' reactions are generated simultaneously, causing an "instantaneous" and random movement in prices (Duarte-Duarte et al., 2014, p. 100). According to this model, since no investor can have more information in the existence of active markets than the other, it is impossible for them to provide more returns than normal. Fama (1970, 1991) stated that EMH has three forms. Weak-form EMH shows the extent to which an asset's past prices are reflected in its future prices (Fama, 1970, p. 383). According to this form, a security's past value provides information about its present value. Therefore, it is impossible to make abnormal profits at past prices. The semi-strong form EMH shows how quickly securities prices reflect publicly available information announcements. This form assumes that asset prices accurately reflect all publicly available information (Fama, 1970, p. 415). The semi-strong form also includes market activity, as the semi-strong form EMH argues that both past price movements and all publicly available information are reflected in asset prices (Duman Atan et al., 2009, p. 35). The strong form of EMH concerns whether investors or groups have monopolistic access to information about price formation (Fama, 1970, p. 383). The main issue here is assessing whether any investor has private information that is not fully reflected in market prices (Fama, 1991, p. 1576). The strong-form EMH assumes asset prices fully reflect all information (Fama, 1970, p. 415). Therefore, since it is not possible for any investor to have more confidential information than other investors, it is not possible for him to make much profit on securities.

The Relationship between Behavioral Finance Theories and Investor Behavior

The Expectation hypothesis proposed by Kahneman and Tversky (1979) criticizes the Expected Utility hypothesis as a descriptive model of decision-making under risk. The authors have shown that choices among risky prospects exhibit a variety of pervasive effects that are inconsistent with the expected utility theory. The EMH assumes that irrational investors carry out transactions that are purely coincidental and therefore disruptions in the markets are eliminated by rational arbitrageurs. Shleifer and Vishny (1997) proposed The Arbitrage Limitation approach, arguing that a full arbitrage situation in markets is impossible. In practice, since arbitrage involves costs and risk assumption, the limits of its effectiveness in eliminating incorrect securities pricing emerge (Omoruyi & Monday, 2017, p. 233). Arbitrage limitations arise from the fact that financial intermediaries may face financing constraints if mispricing becomes dominant in the market (Hombert & Thesmar, 2014, p. 26). It is argued that the disruptions that occur as a result of random securities transactions carried out by individuals, who are called noisy in traditional finance theories, are eliminated by rational investors in the market. However, behavioral finance theories assume that the efficiency of markets will also be restricted, as the mispricing of noisemakers in a market will lead to arbitrage limitations. Black (1986) stated that noise, which is composed of a large number of small events, usually causes much stronger events than a small number of large events can cause. One of the main issues in behavioral finance is investor sentiment. Baker and Wurgler (2007) define this concept as beliefs about future cash flows and investment risks that are not substantiated by the facts at hand. The existence of the phenomenon of noise has made it significant how investors' feelings, thoughts, and beliefs change in the face of asset prices and risks. Taking it as a basis on rumors rather than information and reacting more or less than normal to the current information stems from investor sentiment (Olgaç & Temizel, 2008, p. 225).

The Relationship between Individual Risks and Investor Behavior

Classical financial theory holds that investor sentiment plays no role in predicting stock returns (Yang & Copeland, 2014, p. 28). Contrary to theory, empirical studies have shown that investor sentiment correlates with stock returns. However, when research on this subject is examined, complex findings are reached. Fisher and Statman (2000) examined the relationship between different investors and stock returns in the United States over the period from 1987 to 1998. The researchers showed that there was a negative correlation between each group of investors and S&P 500 returns. Canbaş and Kandır (2007) estimated the relationship between IMKB index returns and investor sentiment over 1997-2006. In the study where regression analyses were applied, investor sentiment systematically affected stock returns. Schmeling (2009) discussed the relationship between investor sentiment and stock returns in 18 developed countries between 1985 and 2005. The results of the panel data analysis indicated that investor sentiment had a negative effect on stock returns. Aydoğan and Vardar (2014) analyzed the impact of investor sentiment on Borsa Istanbul in the period between 2004 and 2014. In the study using VAR and Impact-Response analyses, VAR analysis results showed that macroeconomic variables other than inflation had no effect on investor sentiment, while impact-response analyses showed all sector returns except the transport and communication sectors gave meaningful responses to irrational investor sentiment. Bolaman and Mandacı (2014) evaluated the relationship between investor sentiment and stock returns under the influence of financial crisis periods between 2003 and 2012. In his study, in which the researcher showed that there was a relationship between the variables in the long term, he found that there were structural breaks in the crisis period in the same direction as the expectation. Sun et al. (2016) discussed investor sentiment and predictability of stock returns over the period from 1998 to 2011. The findings of the regression analysis revealed that intraday S&P 500 index returns can be estimated using delayed half-hour investor sentiment. Kaya (2018) estimated the relationship between BIST 100 index returns and investor sentiment over 1997-2018. The researcher has shown that investor sentiment has a positive impact on stock returns. Concetto and Ravazzolo (2019) analyzed the relationship between stock returns and investor sentiment in the US and EU from 1990 to 2014. In the study using regression analysis, it was shown that investor sentiment indices have economic and statistical predictability power on stock market returns in the United States. The EU findings were weak. Jiang et al. (2019) sought to determine the relationship between manager sentiment and stock returns in the United States using a sample covering the period 2003-2014. The results of the regression analysis documented that manager sentiment had a negative and strong impact on the forecast of future total stock returns.

The Relationship between Systemic and Systematic Risks and Investor Behavior

Investor sentiment and changes or risks in asset prices are often examined in terms of stock returns. In this respect, there is very limited literature on the relationship between investor sentiment and systematic and systemic risks. Dash and Mahakud (2012) examined the relationship between investor sentiment, risk factors, and stock return across 392 firms in India from 1995-2011. The results of regression analysis showed that it is difficult to value and arbitrage stocks with characteristics significantly affected by sentiment risk. Yang and Copeland (2014) analyzed the effects of sentiment on market excess return, the permanent component of market volatility, and the temporary component of market volatility, using the sensitivity-enhanced EGARCH component model in the UK for the period from 1987 to 2012. The researchers found that bull sentiment leads to higher market excess returns, while bearish sentiment leads to lower excess returns. Antoniou et al. (2016) discussed the relationship between investor sentiment, beta and cost of equity in the United States over the period 1966-2010. In the study where regression analyses were applied, it was shown that earnings expectations for high beta stocks were significantly higher in optimistic periods. Hussain and Shah (2017) examined the relationship between investor sentiment and firm downside systematic risk in 230 non-financial firms from 2003-2014. The System-GMM analysis indicated that investor sentiment increased firms' systematic risk.

Behavioral finance theories have shown that psychological behavior can influence market risks, risk-taking behaviors, and financial market stability. Tarashev et al. (2003) estimated how investors' attitudes towards risk changed based on a sample covering the period 1995-2002. The study showed that financial market dynamics change systematically with investors' effective risk aversion level. Bandopadhyaya and Truong (2010) have discussed the relationship between investor sentiment and financial crises in their study. Researchers have found that stock market participants can see the 2008 Financial Crisis coming. Barone-Adesi et al. (2013) analyzed the relationship between investor sentiment and systemic risk in the period from 2002 to 2009. Researchers have shown that sensitivity has a significant impact on systemic risks. The results revealed that the long-term perceived level of low-risk increases systemic risks associated with optimism and increased leverage. Borovkova et al. (2017) examined global markets from 2003 to 2016. In the study where VAR and Granger causality analyses were applied, it was shown that the investment-based systemic risk indicator predicted other systemic risk measures, such as SRISK or VIX, while indicating stressful times. Paraboni et al. (2018) estimated the relationship between market sentiment and risk in the U.S., Germany, and China from 2010 to 2015. The results of the correlation analysis showed a stronger correlation between optimism and risk in the developed US and German markets. In contrast, there has been a stronger correlation between pessimism and risk in the emerging Chinese market. Ahmed et al. (2020) examined the relationship between investor sentiment and financial stability of insurance firms in Australia, the United States, Canada, and the United Kingdom during 2007-2016. The findings of the regression analysis showed that investors exhibited rational buying behavior and that low investor sentiment did not affect firms' financial soundness.

Data and Method

In this section, the research data set is introduced and the econometric methods used are explained.

Data

This research analyzed the impact of individual, systemic, and systematic risks of nine deposit banks operating in the Turkish banking sector on investor behavior. The banks that make up the research sample are Akbank, Finansbank, Halkbank, Vakıfbank, Garanti Bank, Yapı Kredi Bank, Şekerbank, İş Bank, and Denizbank. The investor sensitivity variable was used in the predicted models to represent investor behavior. The investor sensitivity variable was used in the predicted models to represent investor behavior. When the literature is examined, it is seen that consumer confidence indices (CCI) are widely used to represent investor sentiment (Kandır, Çerçi and Uzkaralar, 2013; Keles and Arat, 2016; Akkuş and Zeren, 2019). This index can be defined as an economic measure that shows consumers' opinions about their current situation and expectations for the future (Kandır et al., 2013). CCI is an index based on a consumer trend survey. It has been calculated regularly every month by TUIK since December 2003 in cooperation with the Central Bank of the Republic of Turkey (CBRT). (Https://tuikweb.tuik.gov. en/PreHaberBultenleri.do?id=37522). In the research, the Real Sector Confidence Index (RKGE), which is calculated within consumer trend surveys, was used to represent investor sentiment. RKGE is a key indicator of the attitude of representatives of the real sector towards the economy. This index is a leading indicator used to determine future GDP expectations, as it reflects firms' tendencies in how they see the economy in the future and how they will shape their production and investment decisions accordingly (https://www.paragaranti.com/detay-kutuphane-reel-sektor-guven-endeksi). In the research, SRISK (US Dollar) and LRMES (Long-Run Marginal Expected Shortfall) indices were used to represent the systemic risks of nine deposit banks. The SRISK index proposed by Brownlees and Engle (2017) is used in the literature to represent systemic risk. Similarly, LRMES is one of the standard indicators used in the literature.

Table 1.
Research Variables (2008Q3-2019Q3)

Variables	**Description**	**Type**	**Source**
LNGUVEN	Real sector confidence index	The natural logarithm of the seasonally adjusted value is taken.	TUIK
SR	Stock returns on banks	Monthly stock returns are averaged quarterly.	Denizbank data is İnvesting.com and other bank data is taken from https://www.borsaistanbul.com/veriler/verileralt/gunluk-bulten website.
BETA	Indicator of market risk (systematic risk)	Quarterly averaging of monthly data.	https://vlab.stern.nyu.edu/
SRISK	Systemic Risk Indicator	Quarterly average of monthly data	https://vlab.stern.nyu.edu/
LRMES	Long-run marginal expected shortfall	Quarterly average of monthly data	https://vlab.stern.nyu.edu/
TÜFE	Consumer price ındex	Annual percentage change rates were taken.	CBRT
CID	Current balance	The ratio to GDP is taken.	CBRT
LNVIX	VIX uncertainty index	Its natural logarithm is taken.	Yahoo Finans
LNMSCI-E	MCSI-Europe index	Its natural logarithm is taken.	https://www.msci.com/

Table 1 provides information on the variables used in the study. While the natural logarithm of the dependent variable RKGE and the control variables VIX and MSCI-E were taken, the proportional values of the other variables were used.

Method

In the study, the period covering 2008Q3-2019Q3 was estimated using the panel data analysis method. Linear models showing the long-term relationship between banking and risks and investor behavior are given below:

$$LNGUVEN_{it}=\beta_0 + \beta_1 X_{it} + \beta_2\ Controls + \mu i_t \quad (1)$$

X_{it} here represents the explanatory variables SR, LRMES, SRISK, and BETA. The controls show inflation, current balance, LNVIX, and LNMSCI-E variables used as control variables. LNGUVEN is the natural logarithm of the dependent variable, RKGE. Where i is the unit dimension and t is the time dimension. μ is the error term, while β represented the coefficient parameters.

Empirical Analysis

Diagnostic Tests

Table 2 provides descriptive statistics on the variables used in the study. The mean value of the dependent variable LNGUVEN series was calculated as 4.626, and the maximum and minimum values were found as 4.722 and 4.166. The mean values of SRISK, BETA, LRMES, and SR variables were -784.646, 1.208, 45.042, and 0.015. The maximum values of these series were 4351.000, 2.716, 73.100, and 0.712. The minimum values were -9374.133, 0.460, 20.910, and -0.182. The mean values of the TUFE, CID, LNVIX, and LNMSCI-E series, the control variables, were 9.588, -27.542, 2.901, and 7.309. The maximum values of these series were calculated as 22.368, 254.895, 3.945, and 7.507, and the minimum values were calculated as 4.344, -849.745, 2.314, and 6.832.

Table 2.
Descriptive Statistics

	LNGUVEN	SRISK	LRMES	BETA	SR	TUFE	CID	LNVIX	LNMSCI_E
Mean	4.626	-784.646	45.042	1.208	0.015	9.588	-27.542	2.901	7.309
Median	4.657	-308.033	46.130	1.220	0.004	8.598	4.277	2.805	7.338
Max.	4.722	4351.000	73.100	2.716	0.712	22.368	254.895	3.945	7.507
Min.	4.166	-9374.133	20.910	0.460	-0.182	4.344	-849.745	2.314	6.832
Std. Dev.	0.110	2191.835	8.832	0.334	0.083	3.804	166.683	0.350	0.142
Obs.	405	405	405	405	405	405	405	405	405

First Generation Panel Unit Root Test

In the study, the stationarity of LNGUVEN and control variables was first examined using panel unit root tests of LLC, Hadri (2000), Breitung (2000), Im, Pesaran and Shin (2003), Maddala and Wu (1999) and Choi (2001). In the first-generation unit root tests, which are generally based on the fixed effects model, the first-order autoregressive process is AR (1) (Tatoğlu, 2017, p. 21):

$$Y_{it}= \mu_i+ \tau_i t+ \alpha_i Y_{it-1}+ \varepsilon_{it} \quad (2)$$

It is defined as. Here, µi unit effects, τi is the parameter of the trend. Stationarity can be tested by testing the αi=1 hypothesis using appropriate techniques. The above equation can also be written using the Dickey-Fuller (DF) regression as follows:

$$\Delta Y_{it}= \mu_i+ \tau_i t+ p_i Y_{it-1}+ \varepsilon_{it} \quad (3)$$

In the firstgeneration panel unit root tests, the null hypothesis is established that there is a unit root in all units (Kappler, 2006, p.6, Burdisso & Sangi´acomo, 2016, p. 426):

$H_0: \delta=0$

$H_1: \delta<0$

Traditional panel unit root test results are given in Table 3. It has been determined that all series become stationary both in level values and in first differences.

Table 3.
First Generation Panel Unit Root Tests

	LLC	Hadri	Breitung	IPS	Maddala ve Wu	Choi (2001)
LNGUVEN	-20.223***	8.609	-5.671***	-18.953***	41.299***	34.911***
ΔLNGUVEN	-14.487***	-2.351**	-1.455*	-22.942***	321.999***	303.872***
LNVIX	-6.196***	43.873	-4.309***	-4.151***	46.340***	46.340***
ΔLNVIX	-14.468***	-2.644**	-5.570***	-19.111***	275.111***	399.979***
TUFE	-3.962***	32.535	-4.397***	-3.399***	38.916***	20.604***
ΔTUFE	-9.056***	-0.903**	-10.451***	-14.363***	202.945***	101.636***
LNMSCI-E	-8.798***	37.876	-5.592***	-7.638***	30.555***	35.134***
ΔLNMSCI-E	-15.339***	-1.966**	-1.583**	-20.551***	250.933***	280.6014***
CID	-0.982	8.130	-10.064***	-1.884**	96.248***	104.274***
ΔCID	-36.980***	-2.656**	-16.152***	-34.548***	404.101***	404.013***
***, ** and * represented significance at p<=0.01, p<=0.05 and p<=0.10, respectively.						

Cross-Sectional Dependence Test

Panel data cross-sections are likely to affect each other. This problem, defined as a cross-sectional dependency, is especially common in countries with the same economic characteristics or companies operating in the same sector. In this respect, whether the risk variables contain a cross-sectional problem was examined using the Breusch-Pagan LM, Baltagi, Feng, and Kao (2012) Bias-corrected scaled LM and Pesaran (2015) CD tests.

Breusch-Pagan LM Statistics: In the case of N constant (finite) and T → ∞, Breusch and Pagan (1980) proposed a Lagrange multiplier (LM) statistic to test the null value of zero cross-equation error correlations, which are simple to calculate and do not require system estimation of the SURE model (Pesaran, 2004:4). This test can be seen as a standard tool developed to test parametric constraints for various models (Greene and McKenzie, 2). Test statistics (Pesaran, 2004, p. 4, Pesaran, 2015, p.1092, Tatoğlu, 2016, p .227):

$$\lambda_{LM}=T\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{p}_{ij}^{2} \quad (4)$$

It is calculated as. where $\hat{p}_{ij}^{2}$: i,j is the correlation coefficient of residue i,j (between the residues of i and j. units): $\hat{p}_{ij}$

$$\hat{p}_{ij}=\hat{p}_{ji}=\frac{\sum_{t=1}^{T}\hat{v}_{it}\widetilde{v_{jt}}}{\left(\sum_{t=1}^{T}\hat{v}_{it}\right)^{1/2}\left(\sum_{t=1}^{T}\hat{v}_{jt}\right)^{1/2}} \quad (5)$$

It is calculated by the formula.

Pesaran (2015) CD Test Statistics: While the Pesaran (2004) CD test is effective in cases where the observation size is larger than the time dimension (N>T), the Breusch-Pagan LM test is more effective in panel datasets where the time dimension is larger than the observation dimension (T>N). Pesaran (2015) adapted the Pesaran (2004) CD test, whose null hypothesis is weak cross-sectional independence, to the situation where the unit size (N) is 10 and smaller and the observation size (T) is large (Pesaran, 2015, pp. 1097-1099, Tatoğlu, 2017, pp. 316-317):

For balanced panels,

$$CD_{NT}=\sqrt{\frac{2T}{N(N-1)}}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{p}_{ij} \quad (6)$$

For unbalanced panels,

$$CD_{NT}=\sqrt{\frac{2T}{N(N-1)}}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\sqrt{T_{ij}\hat{p}_{ij}} \quad (7)$$

It is calculated as. where $\hat{p}_{ij}$=$T^{-1}\sum_{t=1}^{T}\zeta_{it}\zeta_{jt}$. ζ_{jt} is a scaled residue and is calculated as follows:

$$\zeta_{it}=\frac{e_{it}}{(T^{-1}e\prime_{i}e_{i})^{\frac{1}{2}}} \quad (8)$$

Baltagi, Feng, and Kao (2012) Bias-corrected scaled LM: Another cross-section dependence test used in the study is the bias-corrected scaled LM test developed by Baltagi et al. (2012). This test statistic is calculated as follows (Baltagi et al., 2012, pp. 165-167):

$$LM_{BC}=LM_{P}-\frac{n}{2(T-1)}=\sqrt{\frac{1}{n(n-1)}}\sum_{i=1}^{n-1}\sum_{j=1}^{n}\left(T\hat{p}_{ij}^{2}-1\right)-\frac{n}{2(T-1)} \quad (9)$$

Corrected from the scaled asymptotic deviation of the LM test in the context of fixed-effect homogeneous panel data models, the basic assumption of this test is established as n/T →c ε (0.∞) and (n, T) → ∞. The hypothesis of the bias-corrected scaled LM test proposed by Baltagi et al. (2012) is established as follows, similar to other tests:

H_0: $\sigma^2_{ij}=0$ For i≠j,

Ya da

H_1: $p_{ij}=0$ For i≠j is calculated as follows.

Where pij, pij=$\frac{\sigma_{ij}}{\sqrt{\sigma_i^2\sigma_j^2}}$ is the correlation coefficient of errors.

Table 4 shows the cross-section dependence test results of corporate variables of selected banks. According to all three test statistics, all series contain the cross-section dependence problem.

Table 4.
Cross-Section Dependence Test

Variables	Breusch-Pagan LM		Bias-Corrected Scaled LM		Pesaran (2015) CD	
	Statistics	Prob.	Statistics	Prob.	Statistics	Prob.
SR	525.079	0.000	57.638	0.000	19.322	0.000
BETA	711.397	0.000	79.494	0.000	39.588	0.000
SRISK	868.311	0.000	97.986	0.000	19.921	0.000
LRMES	732.991	0.000	82.038	0.000	39.924	0.000

Second Generation Panel Unit Root Test

In the presence of the cross-section dependency problem, traditional first-generation panel unit root tests remain weak. Therefore, the stationarity of the series was analyzed using Pesaran (2007) CADF, Taylor and Sarno (1998) MADF tests. In addition, Breitung (2000) and IPS (2003) panel unit root tests, which have been updated to consider cross-section dependence, were used for comparison.

Pesaran CADF (2007): Pesaran (2007) proposed a simple method in which standard augmented Dickey–Fuller (ADF) regressions are increased by cross-section means of delayed levels and first differences of individual series. The simple heterogeneous model established by the author in his study in which he proposed the cross-section extended Dickey-Fuller (CADF) test is defined as follows (Pesaran, 2007, pp. 268- 276):

$$Y_{it}= (1-\phi_i)\, \mu i + \phi i Y_{i,\,t-1} + \mu_{it},\ i=1, \ldots N,\ t=1, \ldots T \quad (10)$$

It is defined as. Here, the initial value, Y_{i0}, has a definite density function with a finite mean and variance. The error term, μ_{it}, has a single factor structure.

$$\mu_{it}= \gamma_i f_t + \varepsilon_{it} \quad (11)$$

Here f_t is the unobserved common effect and εit is the idiosyncratic error. Models (10) and (11),

$$\Delta Y_{it}= \alpha_i + \beta i Y_{i,\,t-1} + \gamma_i f_t + \varepsilon_{it} \quad (12)$$

It can be written as. Where $\alpha_i=(1-\varphi_i)$ μi, $\beta_i=-(1-\varphi_i)$ ve $\Delta Y_{it}=Y_{it}-Y_{i,\,t-1}$. In this case, the null hypothesis in the CADF test is that,

H_0: β_i for all i

The alternative hypothesis is,

H_1: $\beta_i<0$ i=1, …N1, βi=0, i=N1+1, N1+2, …N

It is established in the form of.

Pesaran (2007) CADF is calculated as follows:

$$\Delta Y_{it}= a_i + biY_{i,\,t-1} + ci\bar{Y}_{t-1} + d_i\Delta\bar{Y}_t + e_{it} \quad (13)$$

where t is the ratio denoted by ti (N, T),

$$t_i\,(N,T)= \frac{\Delta Yi'\bar{M}_\omega Yi-1}{\sigma'\left(Y_{i,-1}'\bar{M}_\omega Y_{i,-1}\right)^{1/2}} \quad (14)$$

is in the form.

MADF: Multivariate Extended Dickey-Fuller (MADF) test developed by Taylor and Sarno (1998) Given the (N×1) dimensional vector process produced in discrete time:

$$q_{it}= \mu_i + \sum_{j=1}^{k} p_{ij}\, q_{it-j} + \mu_{it} \quad (15)$$

The equation is obtained. Here, it indicates the unit and number of observations that can be expressed as i=1…N ve t=1…T. It is also assumed that the error term is independently normally distributed with the non-scalar covariance matrix $\mu_t = (\mu_{1t}..\mu_{Nt})$

$$\mu_{t\sim}\ IN\ (0, \wedge) \tag{16}$$

The standard, single-equation ADF unit root test will involve estimating each N equation separately and performing N individual tests of the null hypothesis:

$$H_{0i}: \sum_{j=1}^{k} p_{ij}\ -1=0 \tag{17}$$

The power of univariate ADF tests may be weakened in cases where the root of each individual autoregressive process is close to unity but less. Considering the above equations, the resulting Wald statistic is considered the MADF test:

$$H_{0i}: \sum_{j=1}^{k} p_{ij}\ -1=0,\ \forall i=1\ldots N \tag{18}$$

Based on this equation, the unit root hypothesis is calculated as follows:

$$MADF=\frac{(\mathrm{l}-\psi\hat{\beta})\{\psi[Z'(\hat{\Lambda}^{-1}\otimes I_T)Z]^{-1}\Psi'\}(\mathrm{l}-\psi\hat{\beta})N(T-k-1)}{(Y-Z\hat{\beta})\prime(\hat{\Lambda}^{-1}\otimes I_T)(Y-Z\hat{\beta})} \tag{19}$$

Here β̂ and Λ̂ are consistent estimators of β and Λ, respectively. In general terms, to test N constraints, the Wald statistic tested NULL hypothesis has a limiting X distribution with N degrees of freedom (Taylor and Sarno, 1998, pp. 287-288). Table 5 gives the unit root test results. The test results showed that the SR, BETA, SRISK, and LRMES series were stationary at both level and first difference.

Table 5.

Second Generation Panel Unit Root Tests

Variable	Breitung		IPS		CADF		MADF	
	I [0]	**I [1]**	**I [0]**	**I [1]**	**I [0]**	**I [1]**	**I [0]**	**I [1]**
SR	-6.165***	-8.806***	-20.525***	-22.092***	-5.254***	-6.190***	562.851**	1372.287**
BETA	-3.497***	-10.052***	12.071***	-23.543***	-3.780***	-6.040***	270.384**	895.477**
SRISK	-2.585***	-9.056***	-2.691***	-15.550***	-1.606	-5.056***	38.410**	438.117**
LRMES	-3.623***	-10.710***	-11.019***	-23.490***	-3.880***	-5.954***	249.288**	927.908**
***, ** and * represented significance at p<=0.01, p<=0.05 and p<=0.10, respectively.								

Analysis of the Effects of Banking Risks on Investor Behavior

The estimation results showing the econometric relationship between LNGUVEN and SRISK are given in Table 6. The Hausman test showed that the FE estimator was more efficient than the RE estimator. Diagnostic tests showed autocorrelation and cross-section dependency problems in the FE model to be estimated. Therefore, the econometric relationship between the variables was estimated using the Driscoll-Kraay FE (DK-FE) standard error estimator. The estimation results showed that SRISK affects LNGUVEN, the real sector confidence index, negatively. The effects of inflation and current account balance on LNGUVEN are negative. The effect of LNMSCI-E, which represents the MSCI-Europe index, on LNGUVEN is meaningless. Wald tests, which showed the significance of the models as a whole, were significant. The estimation results of the study showing the econometric relationship between LNGUVEN and LRMES are given in Table 7.

Table 6.

DK-FE Estimation of The Relationship between LNGUVEN and SRISK

Variables	**Coefficient**	**Std. Error**	**Prob.**
SRISK	-.00001	5.63e	0.027**
TUFE	-.005	.001	0.012***
CID	-.0001	.000	0.003***
LNVIX	-.156	.064	0.041**
LNMSCI-E	.251	.139	.110
C	3.284	1.035	0.013***
OBS	405		
BANK	9		
R2	0.632		
Wald (F-İstatistik)	11.04 (0.002) ***		
	Diagnostic Tests		
F Test	2.07 (0.038)	**Pesaran (2004) CD**	37.380 (0.000)
VIF	1.84	**Friedman (1937)**	344.003 (0.000)
Hausman Test	16.19 (0.000)	**Frees (1995, 2004)**	6.445 (0.000)
Green (2000) Wald Test	1.03 (0.999)		
Baltagi-Wu (1999) LBI	1.076		
DW Test	1.061		
***, ** and * represented significance at p<=0.01, p<=0.05 and p<=0.10, respectively.			

Table 7.

Estimation of The Relationship between LNGUVEN and LRMES

Variables	**AFR POLS**	**FGLS**	**PCSE**	**DK-FE**
LRMES	-.001*** (.000)	-.001*** (.000)	-.001 (.000)	-.003*** (.001)
TUFE	-.007*** (.000)	-.008*** (.001)	-.008*** (.003)	-.007*** (.002)
CID	-.0001*** (1.14e)	-.00006*** (.000)	-.00006 (.000)	-.0001*** (.000)
LN (VIX)	-.149*** (.002)	-.085*** (.016)	-.085* (.048)	-.159** (.059)
LN (MSCI-E)	.237*** (.005)	.384*** (.041)	.384*** (.122)	.237 (.161)
C	3.455*** (.048)	2.202*** (.339)	2.202** (1.006)	3.558*** (1.182)
OBS	405	405	405	405
BANK	9	9	9	9
R2	0.600		0.942	0.614
Wald (F)	81726.55 (0.000)	401.94 (0.000)	46.26 (0.000)	8.93 (0.004)
		Diagnostic Tests		
F Test	1.72 (0.093)	Pesaran (2004) CD	39.219 (0.000)	
LR Test	0.00 (1.000)	Friedman (1937)	371.610 (0.000)	
VIF	1.75	Frees (1995, 2004)	7.604 (0.000)	
Hausman Test	13.53 (0.000)	White (1980)	375.680 (2.2e)	
Green (2000) Wald Test	0.38 (1.000)	Woolridge (2002)	12125.309 (0.000)	
Baltagi-Wu (1999) LBI	1.153			
DW Test	1.148			
***, ** and * represented significance at p<=0.01, p<=0.05 and p<=0.10, respectively.				

The F test showed that at a significance level of 90% (*p*<=0.10), the FE estimator was valid. However, the POLS estimator was preferred because this rate was low for regression analyses. The LR test confirmed that the classical model was valid. Since an autocorrelation problem was identified in the POLS estimator, the econometric relation of LRMES to LNGUVEN was estimated using the AFR-POLS[1] estimator as well as the Feasible Generalized Least Squares (FGLS) proposed by Parks (1967) and Kmenta (1986) and the Panel Corrected Standard Errors (PCSE) estimator proposed by Beck and Katz (1995). Applied F and LR tests showed that the POLS estimator was more effective. Autocorrelation problems were detected in the predicted POLS model. Therefore, the econometric relationship between the variables was estimated using AFR-POLS, FGLS, and PCSE estimators. It has been shown that market risk affects LNGUVEN negatively. Inflation and current account balance have negative effects on LNGUVEN, while the MSCI-Europe index has positive effects. The estimation results showing the

[1]Arellano (1987), Froot (1989) and Rogers (1993) estimator

econometric relationship between LNGUVEN and SR are given in Table 9.

Table 8.
Estimation of the Relationship between LNGUVEN and BETA

Variables	AFR POLS	FGLS	PCSE
BETA	-.036*** (.007)	-.032*** (.010)	-.032 (.023)
TUFE	-.007*** (.000)	-.008*** (.001)	-.008*** (.003)
CID	-.0001*** (1.10e)	-.00006*** (.000)	-.00006 (.000)
LN (VIX)	-.148*** (.002)	-.084*** (.016)	-.084* (.048)
LN (MSCI-E)	.239*** (.004)	.386*** (.041)	.386*** (.122)
C	3.424*** (.039)	2.169*** (.338)	2.169** (1.004)
OBS	405	405	405
BANK	9	9	9
R^2	0.600		0.943
Wald (F)	9999.000 (0.000)***	402.19 (0.000) ***	46.11 (0.000) ***
	Diagnostic Tests		
F Test	1.25 (0.265)	**White (1980)**	376.831 (1.3e)
LR Test	0.00 (1.000)	**Woolridge (2002)**	10073.528 (0.000)
VIF	1.75		
***, ** and * represented significance at p<=0.01, p<=0.05 and p<=0.10, respectively.			

Table 9.
Estimation of the Relationship between LNGUVEN and SR

Table 9.
Estimation of the Relationship between LNGUVEN and SR

Variables	AFR POLS	FGLS	PCSE
SR	.062* (.028)	.089*** (.030)	.089* (.051)
TUFE	-.007*** (.000)	-.009*** (.001)	-.009*** (.003)
CID	-.0001*** (1.25e)	-.00006*** (.000)	-.00006 (.000)
LNVIX	-.140*** (.001)	-.068*** (.015)	-.068 (.047)
LNMSCI-E	.240*** (.004)	.387*** (.041)	.387*** (.122)
C	3.345*** (.036)	2.072*** (.336)	2.072** (.999)
OBS	405	405	405
BANK	9	9	9
R2	0.590		0.945
Wald (F)	99999.00 (0.000) ***	397.85 (0.000) ***	46.88 (0.000) ***
	Diagnostic Tests		
F Test	0.01 (1.000)	**White (1980)**	371.178 (1.9e)
LR Test	0.00 (1.000)	**Woolridge (2002)**	4646.601 (0.000)
VIF	1.73		
***, ** and * represented significance at p<=0.01, p<=0.05 and p<=0.10, respectively.			

F and LR tests showed that POLS was more effective. However, an autocorrelation problem was identified in the predicted POLS model. In this regard, the econometric relationship between the variables was estimated using AFR-POLS, FGLS, and PCSE estimators. Stock returns impact LNGUVEN positively. It was observed that the effects of inflation and current account balance on investor sentiment were negative and the effect of the MSCI-Europe index was positive.

Conclusion and Recommendations

This research examines how and to what extent banking risks affect real sector investors' behavior. Research results showed that systemic and systematic risks negatively affect real sector investor sentiment. Pessimism among investors has increased due to increased systemic and market risks. The findings showed that the real sector confidence index can be used as an effective early warning system for financial instabilities. At the same time, it has shown that banking sector risks have the potential to spread to the entire economy through real sector investment behavior. The results revealed that stock returns increased real-sector investment behaviors. Positive stock market developments have encouraged the real sector to invest. When the research results are evaluated in general, it is shown that the link between banking risks and investor behaviors is extremely strong. In this context, the role of investor sentiment in financial stability has been revealed.

In the research, the effects of selected macro variables on investor sentiment were analyzed. The forecast results documented that inflation rates, the current account balance, and the VIX uncertainty index negatively affected real sector investor behavior. Analysis findings have shown that inflation increases uncertainties about the future and investor pessimism. On the contrary, it was determined that the effect of the MSCI Europe index on investor sentiment was positive. Regression estimates also showed that investment decisions are sensitive to developments in international markets. The results revealed a strong interaction between macro variables and investor behavior.

Various inferences can be made from the research results. Market participants and policymakers can use the real sector confidence index to observe the banking sector’s relationship between financial stability and the real economy. They can make precise balance adjustments to the decisions they make and the policies they implement. Policymakers can make decisions that support financial stability. Bank managers can avoid high risk-taking behaviors by observing the reaction of investors to systemic risks. Investors can diversify their portfolios by considering the link between banking returns and real sector investment behaviors. They may also avoid high-risk-taking behaviors.

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