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Research article

Use of derivatives, financial stability and performance in Turkish banking sector

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Abstract: Recent financial turmoil raised suspicions about the impact of derivatives usage on banking stability. Considering the period between 2007 and 2017, this paper analyzes the impact of derivatives on the financial stability and performance of the Turkish banking system. The stability of the banking is measured by considering the Z-index, which shows the probability of and calculated for each bank. The second aim of this paper is to determine the impact of bank specific characteristics on the derivatives usage of banks. Panel regression models and factorial ANOVA analysis is adopted to perform the analysis. The results show that derivatives usage of banks decrease the profitability of banking system and increase the bank risk. The determinants of derivative usage also suggest that banks do not use derivatives to hedge their risks.

Keywords: bank risk; Z-index; derivative usage; bank profitability; Turkish banking sector

JEL Codes: G30, G32, M41

1. Introduction

The global financial crisis pointed to the importance of banking system risks on the sustainability of the countries. The rapid extension of credit lines was considered a triggering factor or had a role in magnifying the outcomes of the crisis in both developed and emerging countries (Claessens et al., 2013). The underlying reasons of the financial crisis were mostly systemic, which are inherent in the structure of the banking system in developed countries as a result of the

accumulation of mortgage debt. The crisis also elicited second-generation effects when it spread to other countries, that have no relation to the mortgages but has tight connections with the financial system in developed markets (Oatley et al., 2013). Jo et al. (2009) blamed the derivatives usage of banks as the main cause for the global crisis and their excess usage initiated an abrupt volatility in the financial markets, which was followed by market collapse.

Banks have two motives for holding derivatives instruments in their portfolios. One of the motivations for holding derivatives is to hedge the risks of the banks (e.g., Koppenhaver, 1985). Banks may hold derivatives, especially for systematic risk exposures like interest rate risk, exchange rate risk and credit risk, those exposures that cannot be diversifies in the financial markets (Li and Marinc, 2014). The use of derivatives by banks is blamed for leading the banks to carry more risk and decrease the financial stability of the banking system (Instefjord, 2005). Like the case in the global crisis, some derivatives holdings of banks, like credit default swaps, contribute to the systemic risk (Stulz, 2010). Another motive for banks to hold derivatives portfolio is for speculative reasons. The derivative portfolio holdings may be associated with higher profits for banks, but the speculative purpose might increase the risks of the banks (Li and Yu, 2010). Conversely, findings of some papers suggest that the returns of banks are negatively affected from the off-balance sheet activities of banks, and those activities increase the systematic risk by increasing the volatility of operating revenues (Calmes and Theoret, 2010).

The aim of this paper is to analyze the relationship between financial derivatives usage and their impact on performance and risk in the banking sector of Turkey and also to understand whether the performance and risk of the banks impact the size of derivatives portfolio. While we investigate these relationships, we also consider whether the bank ownership (state-owned, domestic or foreign) is a determining factor in derivatives usage. Foreign banks has better access to international markets, accordingly bank ownership may significantly affect the usage of derivatives. Turkish banks report their derivatives portfolio by distinguishing the derivatives as derivatives held for trading purposes and derivatives for hedging purposes. This differentiation in the aim of banks may also be a factor in their motivation for holding, derivatives; hence, we also consider the different motives and their relationship with bank performance and risk. Lastly, bank size might affect the derivative holdings of banks, as larger banks might have more funds to consider derivatives in their portfolios.

Turkey is a bank-based emerging economy providing lots of opportunities along with its risks. The banking industry is still not considered as reaching its maturity, which makes it attractive for foreign banks. Seeing these opportunities many foreign banks performed merger and acquisitions and entered the market after 2005. Turkish financial system was liberalized after 1980s, but the establishment of a derivatives exchange is new. Turkish Derivatives Exchange (Turkdex) was established in 2005 and provides different kinds of derivatives instruments. Banks used derivatives contracts before the initiation of the derivatives exchange, yet the usage of derivatives is increased after the establishment. The foreign existence in Turkish banking system is approximately fifty percent, thus the analysis of the risks and profits the derivatives portfolio holdings of banks is significant not only from a domestic perspective, but also from an international perspective.

Thus, the aim of this paper is to investigate the impacts of derivatives usage on the stability and performance of Turkish Banking System between 2007 and 2017, by considering the derivatives portfolio held for hedging purposes and trading purposes. The analysis period considers a highly volatile period and collides with the aftermath of the global financial crisis. The contribution of the study to the literature is twofold. The paper is one of the pioneer papers that investigate the impact of

derivatives portfolio holding aims (hedging or speculating) on the profitability and the risk of the banks simultaneously. Secondly, the analysis also differentiate the impact of ownership and size on holding derivatives by factorial ANOVA models. The paper proceeds as follows: second part presents a brief information about the Turkish banking system, third section provides a brief literature review, fourth and fifth sections will present the empirical model and the results and finally section 6 will conclude.

2. Developments in Turkish banking sector and derivatives usage

The Turkish economy is a bank-based economy as in many European countries, in which most of the financial transactions are fulfilled by banks. The liberalization of the financial system started in 1980s and Turkish economy and the banks went through structural, legal and institutional changes. With the release of interest rate controls, barriers into the banking sector was diminished, which endorsed the competition and increased the efficiency of banking (Denizer, 1998).

The liberalization efforts, initiated integration to world financial markets, which caused higher volatility and competition in the market. The financial system of Turkey was still open to fragilities, as a result of weak macroeconomic fundamentals, poor banking supervision, low efficiency and relying on the high returns of government securities. These vulnerabilities ended up with three significant crises in years 1994, 1999 and 2001, which were the outcomes of high foreign exchange risk and interest rate risk. Given the importance of risk management, banks began to adopt some techniques to hedge their risks and derivatives became important tools for foreign exchange rate and interest rate exposures.

The use of foreign exchange contracts and currency swap contracts were allowed in 1984 and 1985, respectively. In 1985, Development Bank of Turkey issued bonds amounting to 10 billion yen with maturities of 10 years in Japan, which then used swap contracts to exchange the proceeds with Central Bank of Turkey. In 1991, the first cross current interest rate swap transaction is carries out between a bank and non-financial organization. Again, a municipality raised 8.5 billion yen bonds and swapped the yen proceeds with US Dollars with Ziraat Bank (biggest state-owned bank in Turkey) (Akçaoğlu, 1998). The derivatives market in Turkey is established in 2005 and became a market that offer various kinds of derivatives instruments on various underlying assets. Prior to the establishment of Turkdex, banks were already undertaking derivatives transactions in international markets. Obviously, a derivatives market in Turkey facilitated the use of derivatives instruments. The total outstanding notional value of derivative contracts increased rapidly from 1991 to 2000 from 5.974 billion TL to 60.235.429 billion TL. After the recovery of crises in 2003 and 2004 a gradual increase was achieved, more than 6524 % in 13 years. The increase from 2001 to 2014 is about 20 times of 2001 usage. The increase in derivatives usage is of vital importance, hence the banking industry is a keystone in economic growth in Turkey, like in other emerging economies.

3. Literature review

Following the global financial crisis, many studies addressed the underlying reasons of the crisis and ways to prevent it. Some of the studies focused on the role of derivative products and their role as a triggering factor and spillover of the crisis. Vast amount of papers investigates the economic

consequences of using derivatives products by the banking system and their impact on the stability and the crisis (Stulz, 2010).

The importance of financial markets and finance sector is becoming clearer with the introduction of new financial instruments and financial sector became dominant on various countries' macroeconomic policies (Szunke, 2014). The introduction and evolution of derivatives instruments were boosted by the deregulations and relaxation of financial activities of banking sectors all over the world. The speculations on derivatives instruments increased all over the world and these speculations increased the risk of the banking sector in many countries. The extension of the banking activities and the increase of new growth opportunities across national borders, provide room for gaining market power, which also raise the concerns among regulators about moral hazard and excessive risk taking of banks (Turk Ariss, 2010).

Papers focusing on the impact of derivatives usage on profitability is relatively less than paper focusing on the impacts of bank risk. Angbazo (1997) considered the off-balance sheet activities of banks and reported a positive impact of these activities on bank performance. Said (2011) analyzed the sensitivity of performance indicators for US banks to derivatives usage and suggested a positive correlation between derivatives usage and firm performance and the efficiency of banks. Shen and Hartarska (2013) noted that the profitability of agricultural banks increased as a result of derivatives activity and they are less affected from credit risk and interest risk. Shen and Hartarska (2018) also focused on the small community banks derivative usage and profitability before and after the 2008 crisis. They pointed to conflicting results and concluded that high compliance cost discourages hedging and may have a negative impact on profits of specialists banks, but in general, they have neutral impacts on profits of the community banks.

Some papers posit that derivatives products diminish banking risks. Shanker (1996) investigated largest 55 bank holding companies in US and concluded that the interest rate derivatives of the banks were associated with lower betas. Gorton and Rosen (1995) concluded that, interest rate swaps of the banks left out only a little amount of net interest-rate risk for the total banking system. Some papers also stress that the amount of derivatives portfolio held by the banks are in proportion to their risk levels, suggesting that the banks use these products to hedge their risks (Booth et al., 1984; Koppenhaver, 1990; Carter and Sinkey, 1998). Recently, Ghosh (2017) used 5491 commercial bank data in US between the years 2001 and 2016. Findings of the paper reveal that both interest rate and exchange rate derivatives and their different constituent categories reduce banks' insolvency risk significantly. In addition, risk adjusted returns of the banks increase parallel to aggregate derivative portfolio.

Some line of research focus on the negative impact of derivatives on the risk of banks. Many papers noted that the derivatives product create huge profits, but their impact on the risks of banks is immense (Gibson and Murawski, 2013; Apatachioae, 2014; Mayordomo et al, 2014; Buston, 2015). Between the late 1990s and late 2000s, the risk of the banking sectors was associated with innovated financial products, namely derivatives (Gibson and Murawski, 2013; Apatachioae, 2014; Mayordomo et al, 2014; Li and Marinc, 2014; Buston, 2015). Li and Marinc (2014) and Apatachioae (2014) stated that some banks were not capable of risk management related to the derivatives instruments due to the misleading information of some bureaucrats and risk reporting institutions at the beginning of the global financial crisis. Some studies also point to the fact that to manage the risks, bank-holding companies increased their derivatives positions and this increase might increase the overall risk of the banks (Li and Yu, 2010).

Last line of research suggest that derivatives products have no impact on banking system stability and values. Hentschel and Kothari (2001) focus on corporations and conclude that derivative usage neither increase nor decrease their risks with the use of derivatives. Gilkeson and Smith (2006) reported a weak systematic relationship between interest rate sensitivity and interest rate derivatives positions of the 65 US bank-holding companies. Yong et al. (2009) mention no impact of derivatives portfolio on the Asia-Pacific banks' exchange rate risks. Cyree et al. (2012) calculated the values of the banks and concluded that derivative instruments have no effect on bank values both in times of growth and in times of the global crisis. Regardless of their findings, it is unwise to ignore the risks associated with derivative products and their profit opportunities.

Papers that deal with the bank stability and financial fragility consider various factors as measures of risk and instability. Berger et al. (2009) use non-performing loans to total loans ratio, Z-index and bank-level capitalization ratio, which is the ratio of equity to total assets, to proxy for bank stability. Beck et al. (2006) define banking fragility as the occurrence of a banking crisis. Alternatively, De Nicolo et al. (2004) calculate a probability of failure measure for the five largest banks in a country as a representative of systemic risk. Leavene and Levine (2009) use bank's volatility of return on assets, volatility of equity returns, volatility of bank earnings, and capital asset ratio, besides focusing on each bank's Z-index. Demirgüç-Kunt and Huizinga (2010) and Boyd and De Nicolo (2005), Ntarmah et al. (2019) are one of the many studies that use solely Z-index as a measure of bank stability. Ntarmah et al. (2019) also considered several other measures for bank stability, like banking system capital to total assets ratio, bank credits to total bank deposits ratio, bank liquid assets to deposits and short-term funding ratio and banking system regulatory capital to risk-weighted assets. We also adopted the capital ratio as a control variable in our analyses. There are also some papers that evaluate the risk in the banking system by focusing on the interconnectedness between banks and the contribution to risk of the relationships between banks (see for example, Yin et al., 2019). Despite the size and impact of the derivatives market, the research related to their impact on banking system is still scarce. To the best of authors' knowledge, no paper directly evaluates the impact of derivatives portfolio by differentiating for the different motivations of banks, hedging or speculating. This paper aims to fulfill this gap in an emerging economy considering both the risk impacts and profitability impacts of derivative portfolios and focus on the determinants of derivative holdings of the banks by considering their ownership types.

4. Methodology

In the first part of the analysis, we applied panel regression models to understand the impact of derivatives usage on the financial stability and performance of banks. In the second part of the analysis, our goal is to show the differences in dependent variables (ROA, ROE, NIM and derivatives) based on the size and ownership of the bank and we performed factorial ANOVA tests. To measure the banking system stability, we focus on the risk of the banking system by considering Z-index, which is an inverse measure for a bank's probability of failure. Z-index is defined as the inverse of the probability of insolvency. As Berger et al. (2008) other measures like non-performing loans to total loans ratio measure only loan risk, thus Z-index is a better measure for capturing bank stability. Following Yeyati and Micco (2007), we defined the bank risk as the probability of default for a given bank. In order to measure the probability of default for a bank, or insolvency risk Chebishev inequality is used, such that

$$P\left(ROA_{i,t} \leq -\frac{EQ_{i,t}}{A_{i,t}}\right) \leq \frac{\sigma^2_{ROA\ i,t}}{\left(\mu_{ROA\ i,t}+\frac{EQ_{i,t}}{A_{i,t}}\right)^2} \equiv \frac{1}{Z^2} \quad (1)$$

where ROA represents the net income over total assets, EQ the total equity over total assets, A is the total assets, σ_{ROA} is the standard deviation of ROA over the last 6 quarters and μ_{ROA} is the average of ROAs for the last 6 quarters of bank i at time t. The smaller Z values stand for a larger risk exposure and points to narrower returns or larger return volatility or higher financial leverage.

4.1. Panel regression models

The first models in the paper focus on the impact of derivatives usage on the performance of banks. To proxy the performance of the banks we focused on three measures, which is Return on Assets (ROA), return on equity (ROE) and Net Interest Margin (NIM). ROA and ROE shows the profitability of a bank which is calculated by dividing net income by total assets and total equity of the banks, respectively. NIM, on the other hand, shows an overall effectiveness of the banking system. Basically, it is the difference between the borrowing rate and lending rate. Following the literature, we calculate it by dividing net interest income (interest income minus interest expenses) to total assets.

The first models adopt ROA as the dependent variable, and analyzes its determinants: (Model 1&3)

$$ROA_{i,t} = \alpha_i + \beta_{i,t}DER_{i,t} + \tau_{i,t}LIQ_{i,t} + \delta_{i,t}Loans_{i,t} + \theta_{i,t}NPL_{i,t} + \gamma_{i,t}Size_{i,t} + \varphi_{i,t}EQ_{i,t} + \rho_{i,t}D_{i,t} + \varepsilon_{i,t} \quad (2)$$

where *DER* is the ratio of derivatives portfolio to total assets, *LIQ* is the amount of liquid assets over total assets, *Loans* is the ratio of total loans in total assets, *NPL* is the percentage of non-performing loans in total assets, *Size* is the natural logarithm of total assets, *EQ* is the ratio of total equity over total assets, and *D* stands for the dummy variable, *DFor (in Model 2)* that takes the value of 1 if the bank is a foreign-owned bank or 0 otherwise; and *DPriv (in Model 3)* that takes the value of 1 if the bank is a privately owned bank or 0 otherwise. The amount of loans points to the level of traditional banking activities at a bank, but still we are not sure about its effect on bank risks.

Secondly, we focus on the components of derivatives portfolio, the amount of derivatives held for hedging purposes (*Hedging-Der)* and the amount of derivatives held for trading purposes *(Trading-Der).* Turkish banks report the constituents of the derivatives portfolio in their financial statements as derivatives held for trading purposes and derivatives held for trading purposes, which allows us to distinguish the impact of each portfolio distinctively on profits and risks of the banking system. (Models 4–6)

$$ROA_{i,t} = \alpha_i + \beta_{i,t}DRV_{i,t} + \tau_{i,t}LIQ_{i,t} + \delta_{i,t}Loans_{i,t} + \theta_{i,t}NPL_{i,t} + \gamma_{i,t}Size_{i,t} + \varphi_{i,t}EQ_{i,t} + \rho_{i,t}D_{i,t} + \varepsilon_{i,t} \quad (3)$$

In these models, *DRV* stands for the *Hedging-Der* in Models and for *Trading-Der* in Models 4–6. Model 4 runs the regressions without considering the private and foreign ownership variable.

Following the determinants of ROA, we apply the same models for the determinants of ROE in Models 7–12, keeping ROE as the dependent variable.

(Models 7–9)

$$ROE_{i,t} = \alpha_i + \beta_{i,t}DER_{i,t} + \tau_{i,t}LIQ_{i,t} + \delta_{i,t}Loans_{i,t} + \theta_{i,t}NPL_{i,t} + \gamma_{i,t}Size_{i,t} + \varphi_{i,t}EQ_{i,t} + \rho_{i,t}D_{i,t} + \varepsilon_{i,t} \quad (4)$$

(Models 10–12)

$$ROE_{i,t} = \alpha_i + \beta_{i,t}DRV_{i,t} + \tau_{i,t}LIQ_{i,t} + \delta_{i,t}Loans_{i,t} + \theta_{i,t}NPL_{i,t} + \gamma_{i,t}Size_{i,t} + \varphi_{i,t}EQ_{i,t} + \rho_{i,t}D_{i,t} + \varepsilon_{i,t} \quad (5)$$

Net interest margin (NIM) is adopted as another measure of bank performance. NIM cannot be considered as a direct performance measure, but it shows the overall efficiency of the banking system. Moreover, it shows the trust of the investors to a specific bank. A more trusted bank will be able to pay lower interests for the deposits invested. Models 13–18 consider NIM as the dependent variable, pursuing the impact of derivatives portfolio of the banks.

(Models 13–15)

$$NIM_{i,t} = \alpha_i + \beta_{i,t}DER_{i,t} + \tau_{i,t}LIQ_{i,t} + \delta_{i,t}Loans_{i,t} + \theta_{i,t}NPL_{i,t} + \gamma_{i,t}Size_{i,t} + \varphi_{i,t}EQ_{i,t} + \rho_{i,t}D_{i,t} + \varepsilon_{i,t} \quad (6)$$

(Models 16–18)

$$NIM_{i,t} = \alpha_i + \beta_{i,t}DRV_{i,t} + \tau_{i,t}LIQ_{i,t} + \delta_{i,t}Loans_{i,t} + \theta_{i,t}NPL_{i,t} + \gamma_{i,t}Size_{i,t} + \varphi_{i,t}EQ_{i,t} + \rho_{i,t}D_{i,t} + \varepsilon_{i,t} \quad (7)$$

Next part of the analysis focus on the impact of derivatives usage on the risk, Z-index, of the banks. Models 19–21 analyze the impact of total derivatives usage on the risk of the banks. Models 22–24 focus on the impact of derivatives usage depending on the aim for holding derivatives, hedging or trading.

(Models 19–21)

$$Z_{i,t} = \alpha_i + \beta_{i,t}DER_{i,t} + \tau_{i,t}LIQ_{i,t} + \delta_{i,t}Loans_{i,t} + \theta_{i,t}NPL_{i,t} + \gamma_{i,t}Size_{i,t} + \varphi_{i,t}EQ_{i,t} + \rho_{i,t}D_{i,t} + \varepsilon_{i,t} \quad (8)$$

(Models 22–24)

$$Z_{i,t} = \alpha_i + \beta_{i,t}DRV_{i,t} + \tau_{i,t}LIQ_{i,t} + \delta_{i,t}Loans_{i,t} + \theta_{i,t}NPL_{i,t} + \gamma_{i,t}Size_{i,t} + \varphi_{i,t}EQ_{i,t} + \rho_{i,t}D_{i,t} + \varepsilon_{i,t} \quad (9)$$

The last part of the panel regression analysis investigates the determinants of derivative usage. We are specifically interested whether the risk of the bank measured as Z has a significant impact on the amount of derivatives usage. The models run in this part is thus:

(Models 25–42)

$$DRVT_{i,t} = \alpha_i + \beta_{i,t}Z_{i,t} + \gamma_{i,t}EQ_{i,t} + \delta_{i,t}LIQ_{i,t} + \theta_{i,t}Loans_{i,t} + \tau_{i,t}NPL_{i,t} + \vartheta_{i,t}PERF_{i,t} + \varphi_{i,t}Size_{i,t} + \rho_{i,t}D_{i,t} + \varepsilon_{i,t} \quad (10)$$

In these models, *DRVT* stands for *DRV*, derivatives usage in Models 25 to 30; for *Hedging-Der*, derivatives for hedging purposes in Models 31 to 36; for *Trading-Der*, derivatives held for trading purposes in Models 37 to 42. We expect that bank risk should be a significant determinant of derivatives

held for hedging purposes. In these models, the paper adopts a panel regression framework and the decision of the fixed effect or random effect model will be based on the Hausman test statistics.

4.2. Factorial ANOVA models

In this part, our goal is to show the differences in dependent variables of this study (ROA, ROE, NIM and derivatives) based on the size and ownership of the bank. Between subject factorial ANOVA is used for this analysis. By using this method, we are not only be able to find out if size or ownership of the bank has an effect on our dependent variables, but also we are able to see if any interaction effect exists between different size and ownership types.

According to their ownership types, banks are categorized in three groups as public, private and foreign ownership banks. Size of the bank is determined based on total assets. Total assets of each of the bank in our analysis for each quarter during the study period is considered. The main descriptive statistics on the total asset is calculated (see Table 1).

Banks that have a lower total asset value compared to first quartile (Q1) are categorically labeled as small sized in our analysis. Similarly, the ones having a higher total asset value compared to third quartile (Q3) are labeled as large sized banks. For the remaining, medium sized is used to define the size category of the bank. We formulate the set of hypotheses for the purpose of this research in Table 2.

Since both size and ownership attributes/variables have three levels/categories, we formulate 3*3 between subject factorial ANOVA design to test all set of our hypotheses.

Table 1. Descriptive statistics on total assets.

Variable	N	Mean	SE Mean	StDev	Q1	Median	Q3
Total asset	1149	1280350	235368	7978234	2948	14018	91583

Table 2. Set of hypotheses for the factorial ANOVA models.

Dependent variable	Independent variables	Set of hypotheses
ROA	Size & ownership of the bank	H_{11}: Size of the bank has an effect on ROA H_{12}: Ownership of the bank has an effect on ROA H_{13}: An interaction effect of size and ownership exists on ROA
ROE	Size & ownership of the bank	H_{21}: Size of the bank has an effect on ROE H_{22}: Ownership of the bank has an effect on ROE H_{23}: An interaction effect of size and ownership exists on ROE
NIM	Size & ownership of the bank	H_{31}: Size of the bank has an effect on NIM H_{32}: Ownership of the bank has an effect on NIM H_{33}: An interaction effect of size and ownership exists on NIM
Derivatives	Size & ownership of the bank	H_{41}: Size of the bank has an effect on derivatives H_{42}: Ownership of the bank has an effect on derivatives H_{43}: An interaction effect of size and ownership exists on derivatives

5. Data and empirical results

The data for the study is collected from the financial statements of the banks that are available in the website of Turkish Banking Association (TBA). The panel regression analysis and factorial ANOVA models cover the quarterly data starting from 2007 to 2017. The variable definitions of the data that are used in the analysis is presented in Table 3.

Table 3. Variable definitions.

Variable	Definition
DER	The ratio of total derivatives portfolio of the banks to total assets ratio
TRADING_DER	Derivatives portfolio held for trading purposes to total assets ratio
HEDGING_DER	Derivatives portfolio held for hedging purposes to total assets ratio
LIQ	The liquidity of a bank measured by the ratio of total liquid assets to total assets
LOANS	Represents the overall risk taking of the banks measured by the total loans to total assets ratio
NPL	Non-performing loans, ratio of non-performing loans to total loans, represents loan portfolio risk
SIZE	The natural logarithm of total assets
EQ	Equity to total assets ratio, that represent the capitalization ratio of banks
Z	The bank-level Z-index; the probability that the losses exceed the capital, larger value indicates higher banking stability
ROA	Represents bank profitability, the ratio of net income to total assets
ROE	Represents bank profitability, the ratio of net income to total equity
NIM	Represents the efficiency of the banking system, the ratio of net interest income to total assets
D-For	Dummy variable, takes the value of 1 if the bank is a foreign bank or zero otherwise
D-Priv	Dummy variable, takes the value of 1 if the bank is a privately-owned bank or zero otherwise

To calculate the Z-index however, prior 6-quarters of data is necessary. Thus, data from 2005 is used to compute Z-index measure. The data is important since it coincides with the period 2005, the year when the Turkish Derivatives Exchange market was established. We did not run the analysis starting from 2005, since until 2007, the banks do not report their aim for holding derivatives. The banks that are operating as deposit banks and have a minimum 3 years of operation during the analysis period are adopted[§] and the banks, which do not meet these criteria, are omitted from the study. The number of banks covered in the paper is 39. Table 4 presents the descriptive statistics for the data.

The descriptive statistics show that average bank uses derivative instruments that are equal to about 74% of total assets. Among the derivatives portfolio, 69% of it is kept for trading purposes and only 5% of it is for hedging purposes. Based on their magnitude of usage, analysis of the possible effects of derivatives on the bank risk and performance is of crucial significance. The D-For has a mean of 54%, which shows that there are more foreign banks than domestic banks. The existence of

[§] In order to calculate the Z values minimum 6 quarters of data are required, thus minimum 3 years of operation is necessary in order to be qualified for the analysis.

the foreign ownership may lead the banks to access derivatives products easily. Foreign banks may have access to international derivatives markets and the existence of more profound managers in terms of derivatives usage may lead those banks to hedge their risks more than the domestic peers. The average of the NPL in the banking system for the analyzed period is 2%. This percentage represents a risk, which causes the risks of the banking system increase.

Table 4. Descriptive statistics.

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Sum	Sum Sq. D.
DER	0.74	0.55	7.60	0.00	0.85	3.08	18.15	12816	853.31	830.19
TRADING_DER	0.69	0.51	6.73	0.00	0.82	3.27	19.48	15065	801.1	764.46
HEDGING_DER	0.05	0.00	1.48	0.00	0.13	5.28	39.84	70305.1	52.21	20.73
LIQ	0.1	0.1	0.8	0.003	0.05	5.45	84.61	324557	112.28	3.09
LOANS	0.53	0.60	0.89	0.001	0.19	−0.98	3.13	185.98	610.1	43.48
NPL	0.02	0.019	0.08	0.00	0.03	23.43	699.68	23342	25.85	1.22
NIM	0.028	0.024	0.28	−0.04	0.02	3.58	28.05	32491	33.04	0.58
ROA	0.009	0.008	0.101	−0.13	0.012	−0.39	27.12	27895	11.20	0.154
ROE	0.067	0.06	0.37	−0.73	0.07	−2.23	24.99	24123	77.16	7.17
Z	3.77	3.32	28.21	0.002	2.42	2.59	20.52	15983.3	4326.4	6747.4
SIZE	4.201	4.14	7.89	1.68	1.12	0.49	3.78	76.26	4826.6	1443.8
EQ	0.16	0.12	0.89	0.04	0.12	3.13	13.62	7275.1	182.09	17.13
D-For	0.54	1.00	1.00	0.00	0.49	−0.16	1.02	191.53	620	285.44
D-Priv	0.35	0.00	1.00	0.00	0.48	0.63	1.39	198.8	403	261.65

The result of the regressions that keeps ROA as the dependent variable is presented in Table 5. In the first three models, the coefficient for the derivatives usage is negative and statistically significant at 10%. The usage of derivatives shrinks the ROA of the banks by about 0.2% in the first model and 0.1% in the second and third models. Percentage of liquid assets has a statistically significant negative impact on the return on assets, since there is a trade-off between being liquid and being profitable. With the similar logic, the percentage of loan portfolio has a statistically significant and positive impact on ROA, at 5% level. Equity ratio of the banks increase the profitability by about 3.3% at 1 percent statistical significance in three models. Lastly, the dummies for foreign banks shows a negative sign, whereas for the private banks it shows a positive sign. In models 4 to 6, we analyzed the impact of derivatives depending on their aim for holding that portfolio. Derivatives for hedging and derivatives for trading variables display a negative, but statistically insignificant sign.

Table 5. Determinants of ROA (Models 1–6).

Dependent Variable: ROA												
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
Variable	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
HEDGING_DER							−0.004	0.003	−0.003	0.003	−0.003	0.003
TRADING_DER							−0.001	0.001	−0.001	0.001	−0.001	0.001
DER	−0.002*	0.001	−0.001*	0.001	−0.001*	0.001						
LIQ	−0.020*	0.012	−0.019*	0.012	−0.019*	0.012	−0.019	0.012	−0.019	0.012	−0.019	0.012
LOANS	0.009**	0.004	0.009**	0.004	0.009**	0.004	0.009**	0.004	0.009**	0.004	0.009**	0.004
NPL	−0.008	0.017	−0.009	0.017	−0.009	0.017	−0.007	0.017	−0.008	0.017	−0.008	0.017
SIZE	0.0003	0.001	0.0003	0.001	0.0003	0.001	0.0002	0.001	0.0002	0.001	0.0003	0.001
EQ	0.033***	0.008	0.033***	0.008	0.033***	0.008	0.033***	0.008	0.033***	0.008	0.033***	0.008
D-For			−0.006***	0.002					−0.006***	0.002		
D-Priv					0.006***	0.002					0.006***	0.002
C	0.002	0.006	0.005	0.006	−0.001	0.006	0.002	0.006	0.005	0.006	−0.001	0.006
R-squared	0.388		0.39		0.39		0.388		0.39		0.39	
Adjusted R-squared	0.363		0.365		0.365		0.363		0.365		0.365	
S.E. of regression	0.009		0.009		0.009		0.009		0.009		0.009	
Sum squared resid	0.094		0.094		0.094		0.094		0.094		0.094	
Log likelihood	3776.1		3778.2		3778.2		3776.3		3778.3		3778.3	
F-statistic	15.8992		15.679		15.679		15.544		15.332		15.332	
Prob (F-statistic)	0		0		0		0		0		0	

Note: *, ** and *** represent statistical significance at 10%, 5% and 1%, respectively. All models are calculated using fixed-effect panel regressions. Hausmann test statistics is 33.71, 33.89, 35.96, 31.69, 32.13, 33.88; respectively (all significant at 1% level).

Table 6 presents the results of the Models 7 to 12 that focus on the determinants of ROE. Derivatives portfolio in Models 10 to 12 has a significant negative effect on the ROE of banks. NPL reduce the ROE significantly and EQ has a negative sign due to the nature of ROE calculation (Net Income/Total Equity). In model 7, derivatives held for hedging purposes has a negative coefficient, implying a lessening impact on ROE. In models 7 to 9, derivatives held for trading purposes also diminish the ROE. The negative and statistically significant coefficient points that the banks cannot use the derivatives effectively and they cannot generate returns high enough to boost profitability. Lastly, similar to the results in ROA, foreign banks dummy has a negative, private banks have a positive and significant coefficient.

Table 6. Determinants of ROE (Models 7–12).

Dependent Variable: ROE												
	Model 7		Model 8		Model 9		Model 10		Model 11		Model 12	
Variable	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
HEDGING_DER							−0.153*	0.09	−0.149	0.091	−0.149	0.091
TRADING_DER							−0.015**	0.006	−0.015**	0.006	−0.015**	0.006
DER	−0.022**	0.009	−0.02**	0.01	−0.021**	0.009						
LIQ	−0.084	0.086	−0.08	0.09	−0.081	0.085	−0.058	0.087	−0.056	0.086	−0.056	0.086
LOANS	0.035	0.029	0.04	0.03	0.037	0.029	0.032**	0.029	0.034	0.029	0.034	0.029
NPL	−0.187**	0.088	−0.18**	0.09	−0.180**	0.088	−0.247***	0.094	−0.240**	0.094	−0.240**	0.094
SIZE	0.003	0.007	0.003	0.01	0.003	0.007	0.002	0.007	0.002	0.007	0.002	0.007
EQ	−0.085**	0.04	−0.08**	0.04	−0.084**	0.04	−0.092**	0.04	−0.091**	0.04	−0.091**	0.04
D-For					−0.047***	0.013			−0.040***	0.014		
D-Priv			0.05***	0.01							0.040***	0.014
C	0.069	0.043	0.05	0.04	0.092**	0.043	0.073*	0.044	0.092**	0.044	0.057	0.045
R-squared	0.399		0.402		0.402		0.413		0.415		0.415	
Adjusted R-squared	0.375		0.377		0.377		0.389		0.391		0.391	
S.E. of regression	0.063		0.062		0.062		0.062		0.062		0.062	
Sum squared resid	4.314		4.294		4.294		4.213		4.198		4.198	
Log likelihood	1.578.042		1.580.800		1.580.800		1.591.759		1.593.774		1.593.774	
F-statistic	16.652		16.464		16.464		17.253		17.006		17.006	
Prob(F-statistic)	0.000		0.000		0.000		0.000		0.000		0.000	

Note: *, ** and *** represent statistical significance at 10%, 5% and 1%, respectively. All models are calculated using fixed-effect panel regressions. Hausmann test statistics is 34.65, 33.49, 36.73, 29.76, 28.33, 31.04; respectively (all significant at 1% level).

The results of the regressions of Models 13 to 18 that focus on the determinants of NIM is given in Table 7. According to the results, the usage of derivatives in all these models statistically significantly cutback the NIM. The reason to this result is ambiguous, since the negative sign may be due to a lower interest income or higher interest expense (on deposits). Ignoring the reasons, the existence of derivative portfolios, direct the banks to be more efficient, since lower NIMs are associated with a more efficient banking system. The results indicate that the loan portfolio upsurge the NIMs and the increase in NPLs is another factor that increase the NIMs charged by the banks. As the equity ratio increase, the percentage of margins charged by the banks increase statistically significantly by about 5.7% in all of the regressions. This result can be clarified by the way that, banks that have a higher capital base built higher trust to the investors and they are able to pay less interest for the deposits.

Table 7. Determinants of NIM (Models 13–18).

Dependent Variable: NIM												
	Model 13		Model 14		Model 15		Model 16		Model 17		Model 18	
Variable	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
HEDGING_DER							−0.025***	0.008	−0.024***	0.007	−0.024***	0.007
TRADING_DER							−0.006**	0.004	−0.006**	0.004	−0.006*	0.004
DER	−0.007**	0.003	−0.007**	0.003	−0.007**	0.003						
LIQ	0.028	0.047	0.02s9	0.047	0.029	0.047	0.032	0.047	0.032	0.047	0.032	0.047
LOANS	0.028***	0.008	0.028***	0.008	0.028***	0.008	0.028***	0.008	0.028***	0.008	0.028***	0.008
NPL	0.121**	0.047	0.120**	0.047	0.120**	0.047	0.129***	0.046	0.128***	0.046	0.128***	0.046
SIZE	−0.002	0.002	−0.002	0.002	−0.002	0.002	−0.002	0.002	−0.002	0.002	−0.002	0.002
EQ	0.058***	0.018	0.058***	0.018	0.058***	0.018	0.057***	0.018	0.057***	0.018	0.057***	0.018
D-For			−0.005	0.004					−0.004	0.004		
D-Private					0.005	0.004					0.004	0.004
C	0.014	0.014	0.017	0.014	0.012	0.014	0.014	0.014	0.017	0.014	0.013	0.014
R-squared	0.282		0.283		0.283		0.286		0.286		0.286	
Adjusted R-squared	0.254		0.254		0.254		0.256		0.256		0.256	
S.E. of regression	0.019		0.019		0.019		0.019		0.019		0.019	
Sum squared resid	0.413		0.412		0.412		0.411		0.411		0.411	
Log likelihood	2.926.381		2.926.749		2.926.749		2.928.978		2.929.224		2.929.224	
F-statistic	9.871		9.665		9.665		9.797		9.59		9.59	
Prob(F-statistic)	0.00		0.00		0.00		0.00		0.00		0.00	

Note: *, ** and *** represent statistical significance at 10%, 5% and 1%, respectively. All models are calculated using fixed-effect panel regressions. Hausmann test statistics is 55.94, 56.92, 56.41, 53.58, 54.28, and 53.75, respectively (all significant at 1% level).

Results of the models from 19 to 24 that focus on the bank stability, Z, is presented in Table 8. As explained in the methodology part, probability of default is calculated by dividing "1" by the Z-index, suggesting that higher values of Z point to a lower default-probability and lower values of Z points to higher default probability. According to the results, increase in total derivatives portfolio, reduces Z index. The percentage increase in size also expands the probability of default at 1% statistical significance in all of the models. Enlarging the loan portfolio by 1%, upsurges the stability of banks by about 1.3% in all of the models with a 5% statistical significance. The expansion of the loan portfolio is likely to boost profits, which diminish the probability of default. The coefficients for the derivatives held for trading and derivatives held for hedging has negative but statistically insignificant signs.

Table 8. Determinants of Z (Models 19–24).

Dependent Variable: Z												
	Model 19		Model 20		Model 21		Model 22		Model 23		Model 24	
Variable	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
DER	−0.311*	0.177	−0.306*	0.177	−0.306*	0.177						
HEDGING_DER							−0.564	0.646	−0.53	0.633	−0.53	0.633
TRADING_DER							−0.298	0.182	−0.295	0.183	−0.295	0.183
LIQ	−0.151	2.513	−0.126	2.495	−0.126	2.495	−0.102	2.469	−0.083	2.456	−0.083	2.456
LOANS	1.358**	0.709	1.376**	0.695	1.376**	0.695	1.352*	0.713	1.370*	0.699	1.370**	0.699
NPL	−0.867	4.222	−0.917	4.203	−0.917	4.203	−0.75	4.339	−0.813	4.317	−0.813	4.317
SIZE	−0.615***	0.151	−0.615***	0.151	−0.615***	0.151	−0.617***	0.153	−0.616***	0.153	−0.616***	0.153
EQ	1.263	1.279	1.271	1.279	1.271	1.279	1.25	1.28	1.259	1.28	1.259	1.28
D-For			−0.343	0.645					−0.331	0.64		
D-Priv					0.343	0.645					0.331	0.64
C	5.694***	1.192	5.862***	1.332	5.556***	1.136	5.700***	1.199	5.861***	1.331	5.567***	1.147
R-squared	0.122		0.122		0.122		0.122		0.122		0.122	
Adjusted R-squared	0.087		0.086		0.086		0.086		0.085		0.085	
S.E. of regression	2.317		2.317		2.317		2.318		2.318		2.318	
Sum squared resid	5925		5923.9		5923.9		5924.7		5923.6		5923.6	
Log likelihood	−2572.7		−2572.6		−2572.6		−2572.7		−2572.6		−2572.6	
F-statistic	3.483		3.407		3.407		3.404		3.332		3.332	
Prob(F-statistic)	0.000		0.000		0.000		0.000		0.000		0.000	

Note: *, ** and *** represent statistical significance at 10%, 5% and 1%, respectively. Hausman test statistics is 37.49, 33.40, 36.43, 36.66, 33.25, and 35.59, respectively. Based on the Hausman test statistics, all models are run using fixed effects model.

This part of the results focuses on the reasons that explain derivatives holdings of the banks in Turkey. Table 9 illustrates the determinants of total derivatives portfolio from Model 25 to 30. According to the results, increase in equity ratio has a negative impact on the total derivatives portfolio. Most of the models also indicate that 1 percent increase in loans increase the derivatives usage by about 0.23%. Negative and statistically significant coefficients on ROA and ROE suggest that the tendency to use derivatives products decline, as the profitability of the banks increase. At 1% statistical significance, D-For has a positive, D-Priv has a negative coefficient. Lastly, NPL existence has a crucial impact on derivative holdings. As the NPL increase by 1%, derivatives portfolio is boosted by 6.9% approximately. Despite our expectations, banking stability as measured by Z-index, has no statistically significant effect on the derivative usage.

Table 9. Determinants of DER (Models 25–30).

Dependent Variable: DER												
	Model 25		Model 26		Model 27		Model 28		Model 29		Model 30	
Variable	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
Z	−0.01	0.008	−0.007	0.008	−0.009	0.006	−0.007	0.006	−0.01	0.006	−0.007	0.006
EQ	−0.415	0.359	−0.593*	0.331	−0.450**	0.223	−0.611***	0.216	−0.436*	0.224	−0.603***	0.217
LIQ	0.092	0.513	0.057	0.509	0.052	0.338	0.018	0.334	0.06	0.338	0.026	0.334
LOANS	0.248*	0.148	0.249*	0.145	0.227	0.142	0.231*	0.14	0.240*	0.142	0.243*	0.141
NPL	6.855***	0.455	6.956***	0.433	6.918***	0.562	7.006***	0.557	6.893***	0.563	6.986***	0.557
ROA	−2.9	2.462			−2.580*	1.495			−2.674*	1.495		
ROE			−1.065**	0.415			−1.010***	0.215			−1.024***	0.215
SIZE	0.005	0.024	0.009	0.025	0.007	0.02	0.011	0.02	0.006	0.02	0.01	0.02
D-For					0.443***	0.124	0.411***	0.123				
D-Priv									−0.368***	0.129	−0.338***	0.127
C	0.765***	0.283	0.804***	0.289	0.488**	0.191	0.545***	0.19	0.871***	0.183	0.900***	0.181
R-squared	0.168		0.183		0.176		0.189		0.174		0.188	
Adjusted R-squared	0.163		0.178		0.17		0.184		0.169		0.182	
S.E. of regression	0.457		0.453		0.456		0.452		0.455		0.451	
F-statistic	32.999		36.417		30.468		33.251		30.116		32.951	
Prob(F-statistic)	0		0		0		0		0		0	

Note: *, ** and *** represent statistical significance at 10%, 5% and 1%, respectively. Hausman test statistics is 13.16, 12.82, 10.78, 13.32, 12.85, and 11.19, respectively. The test statistics are insignificant, thus all models are run using random effects model.

Table 10 presents the results of the regressions that focus on the determinants of derivatives held for hedging purposes (Models 31–36). Similar to the prior regressions, equity ratio negatively influences hedging-der, as well. Liquid assets percentage has a positive effect on hedging-der at 1% statistical significance. Conservative banks that keep higher amount of liquid assets tend to hold derivatives products to hedge their risks. Models 34 to 36 suggest that ROE and hedging-der is negatively related. Banks with higher profitability is less likely to keep hedging-der. NPL and hedging-der is positively related at 1% significance in all models. Moreover, the ownership dummies, points to a positive and significant coefficient for foreign banks and negative and significant coefficient for private banks. This finding is also consistent with our prior expectations.

Table 10. Determinants of HEDGING-DER (Models 31–36).

Dependent Variable: HEDGING_DER												
	Model 31		Model 32		Model 33		Model 34		Model 35		Model 36	
Variable	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
Z	−0.001	0.001	−0.001	0.001	−0.001	0.001	0.0003	0.001	0.0003	0.001	0.0003	0.001
EQ	−0.066*	0.036	−0.070*	0.036	−0.069*	0.036	−0.094***	0.035	−0.096***	0.035	−0.097***	0.035
LIQ	0.182***	0.055	0.176***	0.055	0.177***	0.055	0.168***	0.054	0.164***	0.054	0.163***	0.054
LOANS	0.004	0.023	0.003	0.023	0.002	0.023	0.006	0.023	0.005	0.023	0.005	0.023
NPL	0.770***	0.091	0.778***	0.091	0.776***	0.091	0.787***	0.09	0.791***	0.09	0.793***	0.09
ROA	−0.333	0.243	−0.296	0.242	−0.296							
ROE						0.242	−0.230***	0.035	−0.224***	0.035	−0.224***	0.035
SIZE	−0.005	0.003	−0.005	0.003	−0.005	0.003	−0.004	0.003	−0.004	0.003	−0.003	0.003
D-For			0.060***	0.02							0.051**	0.02
D-Priv					−0.057***	0.021			−0.050**	0.02		
C	0.052*	0.029	0.014	0.031	0.069**	0.029	0.059**	0.028	0.074**	0.029	0.026	0.031
R-squared	0.123		0.129		0.129		0.154		0.158		0.159	
Adjusted R-squared	0.118		0.123		0.123		0.149		0.152		0.153	
S.E. of regression	0.074		0.074		0.073		0.072		0.072		0.072	
F-statistic	22.880		21.165		21.086		29.660		26.791		26.845	
Prob(F-statistic)	0.000		0.000		0.000		0.000		0.000		0.000	

Note: *, ** and *** represent statistical significance at 10%, 5% and 1%, respectively. Hausman test statistics is 10.23, 12.26, 11.81, 8.96, 10.08, and 10.18, respectively. The test statistics are insignificant suggesting the use of random effects models.

Last part of the regression analysis focus on the determinants of derivatives held for trading purposes in Models 37 to 42 and the results are displayed in Table 11. Similar to the two prior sets of models, equity ratio and the trading-der is negatively associated. Loans to total assets ratio has a positive relationship to trading-der. This finding reveals that banks with higher loan portfolios is more likely to invest in derivatives. NPL has a positive and significant impact on the trading-der at 1% statistical significance in all models. ROE and trading-der is also negatively and significantly associated. Lastly, like the prior regressions, foreign bank ownership has a positive and private banks ownership has negative coefficients.

In the last part, the results of the factorial ANOVA models are presented in Table 12.

Table 11. Determinants of TRADING-DER (Models 37–42).

Dependent Variable: TRADING_DER

	Model 37		Model 38		Model 39		Model 40		Model 41		Model 42	
Variable	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
Z	−0.009	0.006	−0.007	0.006	−0.007	0.006	−0.007	0.006	−0.009	0.006	−0.009	0.006
EQ	−0.349	0.216	−0.499**	0.21	−0.507**	0.21	−0.514**	0.21	−0.379*	0.215	−0.367*	0.216
LIQ	−0.089	0.326	−0.111	0.323	−0.138	0.324	−0.145	0.323	−0.124	0.326	−0.117	0.326
LOANS	0.243*	0.137	0.242*	0.136	0.238*	0.136	0.227*	0.136	0.225*	0.137	0.237*	0.137
NPL	6.085***	0.543	6.169***	0.539	6.195***	0.539	6.212***	0.539	6.139***	0.542	6.118***	0.543
ROA	−2.566*	1.441							−2.288	1.442	−2.378*	1.442
ROE			−0.835***	0.208	−0.800***	0.208	−0.786***	0.208				
SIZE	0.01	0.019	0.013	0.019	0.014	0.019	0.014	0.019	0.011	0.019	0.011	0.019
D-For							0.358***	0.12	0.382***	0.12		
D-Priv					−0.288**	0.123					−0.311***	0.124
C	0.713***	0.171	0.745***	0.17	0.826***	0.175	0.519	0.184	0.474**	0.185	0.802***	0.176
R-squared	0.729		0.730		0.730		0.732		0.733		0.733	
Adjusted R-squared	0.718		0.719		0.719		0.721		0.722		0.722	
S.E. of regression	0.432		0.432		0.432		0.430		0.430		0.430	
F-statistic	66.147		64.888		64.888		67.150		203.975		203.979	
Prob(F-statistic)	0.000		0.000		0.000		0.000		0.000		0.000	

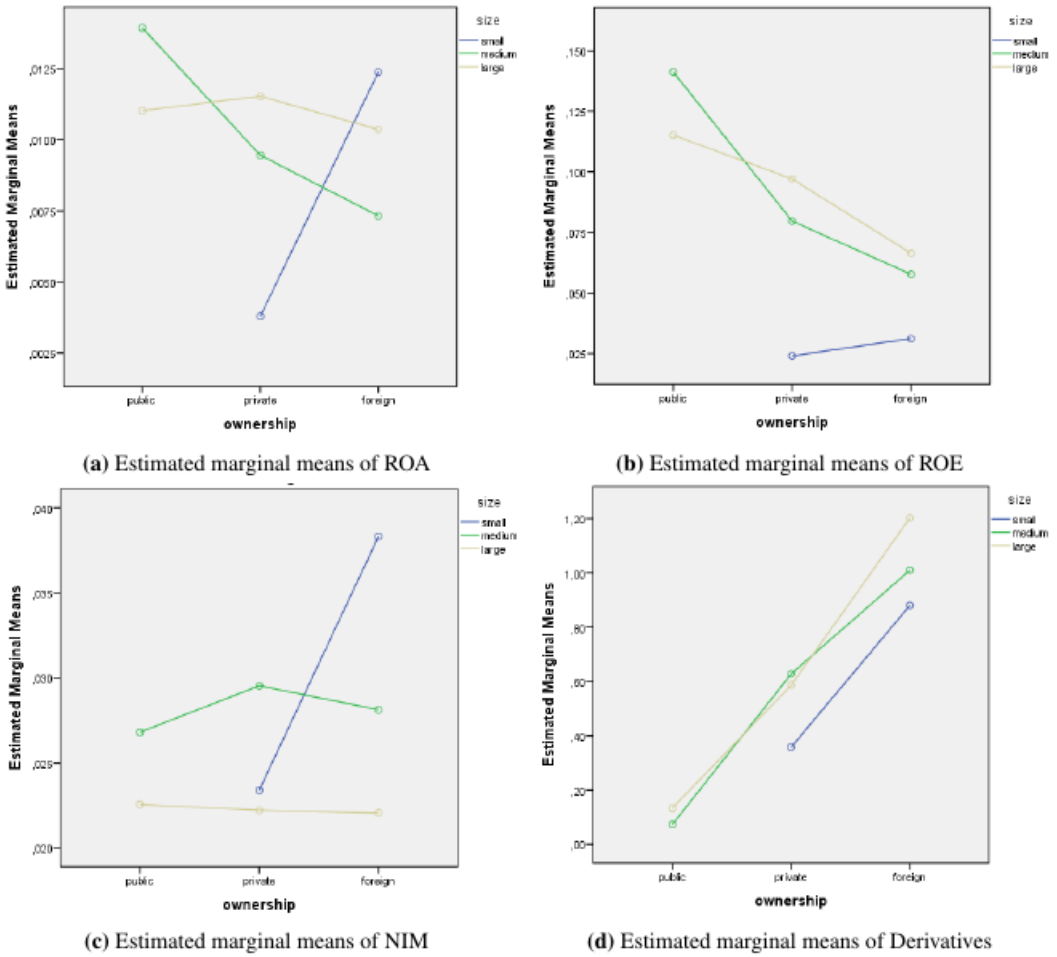
Note: *, ** and *** represent statistical significance at 10%, 5% and 1%, respectively. The Hausman test statics is 17.33 (5% statistical significance), 16.56 (5%), 14.28(10%), 16.76(5%), 15.48 (5%), 13.64 (10%). The test statistics suggest running fixed effect models.

In Table 12, it is observed that the main effect of ownership is significant for all sets of hypotheses in 95% confidence interval, because p values are smaller than 0.05. While the main effect of bank size is also significant for ROE, NIM and Derivatives, it is insignificant for ROA. From these results, it is concluded that three main variables of this study (ROE, NIM, Derivatives) differed based on ownership type (public, private, foreign) and size (small, medium, large) of the bank, remaining variable, ROA, significantly differed based only on ownership type. The interaction effects between ownership and size of the bank on the main variables of this study are also tested in third group hypothesis. While the interaction effects on ROA, ROE, and NIM are significant, the interaction effect on Derivatives is insignificant. Interaction effect occurs when the effect of ownership type on the dependent variable for one level of size significantly differs from the effect of ownership type on the dependent variable for the other levels of size.

The interaction plots for each set of variables were shown in Figure 1 below. Figures a, b and c show that average values of dependent variables significantly differ based on the values of independent variables. However, in Figure 1d, it was observed that the average values of the dependent variable were similar for levels of the two independent variables.

Table 12. Results on between-subject effects for hypotheses (Factorial ANOVA Models).

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Test of between-subject effects for H_{11}, H_{12}, H_{13} (R Squared = 0.044; Adjusted R Squared = 0.038)					
Corrected Model	0.007[a]	7	0.001	7.444	0.000
Intercept	0.058	1	0.058	448.790	0.000
size	0.000	2	0.000	1.311	0.270
ownership	0.001	2	0.001	4.984	0.007
size * ownership	0.005	3	0.002	11.806	0.000
Error	0.147	1141	0.000		
Total	0.263	1149			
Corrected Total	0.154	1148			
Test of between-subject effects for H_{21}, H_{22}, H_{23} (R Squared = 0.139; Adjusted R Squared = 0.134)					
Corrected Model	1.000[a]	7	0.143	26.371	0.000
Intercept	3.385	1	3.385	625.102	0.000
size	0.295	2	0.147	27.198	0.000
ownership	0.256	2	0.128	23.678	0.000
size * ownership	0.074	3	0.025	4.558	0.004
Error	6.178	1141	0.005		
Total	12.360	1149			
Corrected Total	7.178	1148			
Test of between-subject effects for H_{31}, H_{32}, H_{33} (R Squared = 0.062; Adjusted R Squared = 0.056)					
Corrected Model	0.036[a]	7	0.005	10.725	0.000
Intercept	0.414	1	0.414	875.278	0.000
size	0.007	2	0.003	7.016	0.001
ownership	0.003	2	0.002	3.283	0.038
size * ownership	0.009	3	0.003	6.209	0.000
Error	0.540	1141	0.000		
Total	1.525	1149			
Corrected Total	0.575	1148			
Test of between-subject effects for H_{41}, H_{42}, H_{43} (R Squared = 0.124; Adjusted R Squared = 0.118)					
Corrected Model	102.825[a]	7	14.689	23.042	0.000
Intercept	179.609	1	179.609	281.745	0.000
size	7.144	2	3.572	5.603	0.004
ownership	80.240	2	40.120	62.935	0.000
size * ownership	1.874	3	0.625	0.980	0.401
Error	727.372	1141	0.637		
Total	1463.912	1149			
Corrected Total	830.196	1148			



(a) Estimated marginal means of ROA

(b) Estimated marginal means of ROE

(c) Estimated marginal means of NIM

(d) Estimated marginal means of Derivatives

Figure 1. Interaction plots.

6. Conclusion

The banking system has an immense role to support the economic growth in many countries. Traditional banking activities, channeling the deposits to financing of big projects are considered as one of the most important factors for growth. Nevertheless, in the last decades banks started to focus on off-balance sheet activities and non-interest income. The increase in derivatives usage increased significantly and banks report those derivatives portfolio as either held for speculative purposes and for hedging purposes.

The derivatives holdings of financial institutions are highly discussed, whether they decrease the risks of banks by hedging various types of exposures. On the other hand, one of the outcomes of the global financial crisis pointing the derivatives instruments, especially credit default swaps as the one of the main underlying cause for the spillover of the risk.

In this paper, we analyzed the reciprocal relationship of derivatives usage on banking stability and profitability in Turkey, which attracts lots of FDI from many countries. The paper contributed to the literature by also considering the different impacts of derivatives that were reported as “held for speculative purposes” and derivatives “held for hedging purposes”. Wealso considered if speculative purposes cause higher risk and profits in the banking system and if the hedging purposes increase the

stability in the banking system. The derivatives market of Turkey, Turkdex, started to operate in 2005 and the establishment of the bank increased the derivatives holdings of banks.

The paper analyzes the period between 2007 and 2017, which coincides with the period after the derivatives market started operating. Using the balance sheet data of banks, panel regressions models are used to understand the possible effects of derivatives usage on bank risk and profitability and net interest margins. Further, the determinants of derivative usage are analyzed to understand if bank risk is a significant determinant of derivate usage. Finally, factorial ANOVA models are applied to prove the robustness of prior regressions. In these models, performance variables and derivatives usage were tested against the possible impacts of different size scales and ownership.

According to the results of the regressions, derivatives portfolio of banks, irrespective of the reason for holding, has a negative impact on the profitability of the banks as measured by ROA and ROE. In contrast, the derivatives usage causes the Turkish Banking System to run more efficiently, since it decreases the net interest margins charged by the banks. The results of the regressions that considers the determinants of bank risk express that derivatives usage has a significant impact on default probability of banks. Even if for the derivatives held for hedging, regression results point to negative impacts on bank stability. In the last part of the panel regressions, we analyzed the determinants of derivatives usage. The results revealed that bank risk is not a significant factor in explaining the amount of derivatives portfolio in a bank. Bank ownership dummies display significant coefficients here. In all models, foreign ownership has a significant impact on derivatives usage, on derivatives held for trading and derivatives held for hedging. Factorial ANOVA models also confirm these results. Size and foreign ownership is significant determinants of derivatives usage.

Despite the significant increase in derivatives usage in Turkish banking system, the results point out that, banks do not use derivatives products to hedge their risks. Moreover, derivatives portfolio diminishes the profitability of the banks. The authorities should be aware of this fact and should take some measures to control the increasing risks of banks due to their derivative holdings. If the vulnerabilities persist in the financial system, authorities must monitor the fragility of the banks and may present several legislations to control the level of derivatives portfolio for each bank. An early warning system is necessary for monitoring institutions to evaluate the risks the derivatives convey the banking system. Another important finding is that the use of derivatives is more common for large and foreign banks. This result points to the importance of existence of a local derivative market in emerging economies. If the policy makers make these tools available for every financial institution and provide sound regulations, these instruments can lead to a sound financial industry. Thus, for other emerging countries as well, the existence and product diversity of the derivatives markets is essential.

Conflict of interest

All authors declare no conflicts of interest in this paper.

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