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An Investigation of the Relationship Between Banks' Use of Derivative Products and Sectoral and Macroeconomic Factors: An Application on the Turkish Banking Sector *

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Abstract

This study aims to identify the factors determining the use of derivatives in the banking sector. The study sample consists of 23 deposit banks operating continuously in the Turkish banking sector between 2009 and 2022. Derivative products classified as forward foreign exchange transactions, swap currency transactions, swap interest rate transactions, futures transactions, and option transactions are analyzed in terms of selected financial indicators of banks, their characteristics, and their relationship with macroeconomic variables such as inflation. In the study, the random effect panel Tobit regression model is used as a method. The study's findings demonstrate that banks' derivative activities are significantly influenced by their on-balance sheet FX position. Size, capital, credit risk pressure, inflation, and foreign ownership strongly influence banks' use of derivatives. According to the study's findings, banks primarily use derivatives for hedging in over-the-counter market transactions and for speculation in organized market transactions. However, it has been observed that the drive for speculative trading is dominant in large banks. To counteract this trend, regulators could impose limits on how much banks can use derivative products, with the limits varying based on the bank's size, thereby reducing the incentives for large banks to engage in such practices.

Keywords: Turkish Banking Sector, Deposit Banks, Derivatives, Hedging, Speculation.

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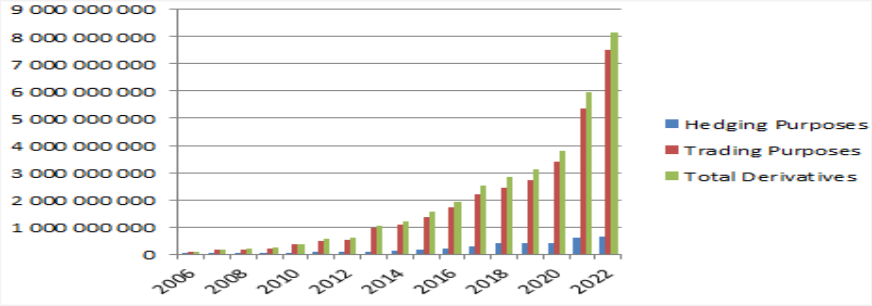
1. INTRODUCTION

Individuals, companies, and governments have utilized derivatives for many years. The significance of derivatives, particularly in financial markets, has grown due to developments following the Bretton Woods agreement. An important user of derivatives is banks. One of the purposes for which banks use derivatives is hedging. In addition, banks increase their commission income through derivative transactions or aim to increase their profits through speculative transactions. Criticisms regarding using derivatives for speculation and its potential to increase firm risks have intensified, particularly following the 2008 Global Mortgage Crisis. However, due to increasing competition and declining bank profits, derivatives have become increasingly important in the banking sector. The increased use of derivative instruments highlights its significance.

Graphic 1. Derivative Product Usage Volume in the Turkish Banking Sector



Note: Created by the authors with data received from the Banks Association of Türkiye (TBB)

Chart 1 illustrates the trend of derivatives utilization in the Turkish banking sector over the years. While the total value of derivative product utilization exceeded TL 8 billion in 2022, the highest utilization was observed in trading derivative transactions, accounting for approximately 92%.

This study seeks to uncover the key factors influencing derivatives transactions banks in Turkiye. The study's sample group includes 23 deposit banks that have operated without interruption from 2009 to 2022. Deposit banks hold an 85% share in the Turkish banking sector by asset size (BDDK, 2023). Deposit banks handle about 93% of derivative transactions in the Turkish banking sector (BDDK, 2024). It could be argued that it represents the banking sector due to the significant share of deposit banks.

The study analyzes deposit banks' derivative transactions for trading purposes. Derivative transactions are categorized as forward foreign exchange, futures, swap and option transactions. Due to the extensive use of swap transactions, they have been categorized into swap currency and interest rate transactions. Five classes representing derivative operations were created.

In Panel I, the determinants of derivatives are analyzed using five different models, each with 17 independent variables. Each derivative transaction is included as a separate dependent variable in the models. In Panel II, derivative transactions other than the dependent variable have been added as independent variables to each model constructed in Panel I. This section explores the influence of

derivatives on each other. Panel III analyzes derivative transactions of large banks. A new dummy variable has been generated to distinguish large banks. The variables in Panel I have interacted with this dummy variable. The study's final section involves interpreting the analysis findings and providing recommendations for the future.

2. THEORETICAL BACKGROUND AND LITERATURE REVIEW

2.1. Hedging Theory

The primary purpose of using derivatives is to hedge risk. Derivatives provide firms, banks, and investors with protection against financial risks. Capital market imperfections caused by growth opportunities, higher tax rates, the possibility of financial distress and managerial incentives increase firms' incentives to hedge. Hedging theory suggests that a company can enhance its value by implementing a hedging program (Smith & Stulz, 1985).

Financial distress occurs when companies lack adequate cash flows to meet their current obligations (Wruck, 1990, p. 421). Firms facing difficulties in meeting their financial obligations have higher financial risk. The company may face bankruptcy as a result. The probability of financial distress associated with firms' leverage decisions increases at higher debt levels. Banks generally operate with high leverage. The probability of banks experiencing financial distress may be high. From this perspective, banks with high leverage levels may need to hedge more as the probability of financial distress will increase. Banks may be encouraged to use derivatives for hedging purposes.

2.2. Bank Capital

Capital financing in banks is a complex issue. High capitalization reduces the likelihood of financial distress and thus lowers external financing costs, suggesting a positive relationship between bank capital and bank earnings (Naceur, 2003). On the other hand, equity financing reduces the tax shield advantage of borrowing and reduces after-tax profits (Berger, 1995, p. 432). Managers may face increased pressure from shareholders as profits decline. Risky transactions by bank management to meet shareholder demands may lead to increased speculative derivative activities within banks (Khasawneh & Hassan, 2009, p. 11).

The capital's ability to reduce the likelihood of financial distress provides a safeguard against the risk of bankruptcy (Merton & Bodie, 1992, pp. 95-96). This function of capital enhances firms' creditworthiness in the eyes of third parties. However, it may also provide an alternative to the monitoring activities of investors who have assumed capital counterparty risk. These characteristics may provide an incentive for investors to deal with well-capitalized firms. High capitalization can give firms an advantage, especially in over-the-counter market transactions. High creditworthiness may enable banks to transact more easily, especially in derivative transactions in over-the-counter markets (Anbar & Alper, 2011, p. 86).

International banking regulations require banks to maintain a minimum capital for risky transactions. Within the Basel criteria framework, banks must maintain a minimum regulatory capital of 8% to cover market, credit, and operational risks. The recommendation is implemented through the domestic legislation of countries. The minimum regulatory capital requirement imposes an additional cost on banks. This cost also plays a role in stabilizing banks' risky transactions. According to the regulatory market hypothesis, the minimum regulatory capital requirement reduces the risk appetite of undercapitalized banks. Accordingly, a decline in speculative derivative activities of low-capitalized banks can be expected.

2.3. Deposit Insurance and Moral Hazard

Deposit insurance programs are designed to prevent depositors from rushing to banks to withdraw their deposits in a banking crisis. During times of crisis, these programs have a stabilizing effect (Anginer et al., 2014). Colomiris and Jaremski (2016, p. 98) acknowledge the benefits of deposit insurance but argue that these programs may incentivize banks to take excessive risks. The study by Kusairi et al. (2018) demonstrates the impact of deposit insurance on excessive risk-taking.

Carter and Sinkey (1998, p. 19) argue that banks may misprice risks due to deposit insurance, which may encourage banks to take excessive risks and direct them to speculative derivative activities. However, the authors of the same study also emphasize that the minimum regulatory capital requirement may reduce banks' incentives to engage in high-risk transactions. Banks with low capital adequacy may experience a more significant impact from this effect. Anbar and Alper (2011, p. 86) argue that undercapitalized banks may not want to hold risky assets to avoid regulatory supervision.

2.4. Risk Exposure

Banks encounter interest rate, credit, and foreign exchange risks due to their operations. The increase in these risks may prompt banks to act against them. Derivatives are an effective tool that banks can use to hedge these risks.

2.4.1. Interest Rate Pressure

Financial activities are closely linked to market interest rates. Deposits comprise a large portion of a bank's resources and are typically short-term. Loans, which make up the assets of banks, are typically long-term investments. This maturity mismatch between banks' assets and resources makes them vulnerable to an unexpected change in interest rates. An increase in short-term interest rates will cause banks' interest expenses to rise, while their interest income will not be affected to the same extent (Drechsler et al., 2021, p. 1091).

The income gap (GAP), which reflects the difference between banks' interest rate-sensitive assets and interest rate-sensitive liabilities at a given maturity, is used to measure banks' sensitivity to interest rates. Banks facing high income gap and significant pressure from interest rates can use

derivatives as a means of protection. Carter and Sinkey (1998), Sinkey Jr. and Carter (2000), and Shyu and Reichert (2002) provide evidence supporting the positive relationship between interest rate pressure and hedging derivative activity.

A significant portion of the bank's earnings comes from interest income. However, interest expenses are also a critical liability item for banks. Banks' profits increase when the net interest margin is positive, representing the difference between interest income and expenses. In this case, banks can use derivatives to lock in interest earnings. If the situation were reversed, banks' interest earnings would decrease. Banks may turn to speculative derivative transactions to compensate for reduced interest earnings in this case. Hudman (1999), Sinkey Jr. and Carter (2000), Shyu and Reichert (2002), and Sinha and Sharma (2016), find evidence that banks' declining interest earnings encourage the use of derivatives for speculative purposes.

2.4.2. Credit Risk Pressures

A significant portion of traditional banking activities consists of loans. Loans reflect banks' asset quality. Having a large loan portfolio is a sign of high asset quality. Banks with high asset quality also have higher creditworthiness. Creditworthiness can be an advantage for using derivatives, especially in over-the-counter markets. However, an expansion in the customer base of banks with high loan portfolios can also be expected. Since the cross-selling opportunities of banks with an expanding customer base will increase, banks with this potential may target an increase in commission earnings by directing their customers to derivative products. Khasawneh and Hassan (2009, p. 9-10) argue that a high loan portfolio may encourage banks' speculative derivative activities.

Expanding loan portfolios positively affects banks' asset quality but also increases banks' credit risk (Foos et al., 2010; Dang, 2019). If loan repayments do not materialize, it can lead to the bank's capital collapsing. The expansion in banks' loan portfolios increases the likelihood of this unfavorable scenario. Banks can use derivatives to hedge against this possibility. Credit derivatives are more attractive products for hedging credit risk. For this reason, banks may prefer credit derivatives instead of derivatives consisting of forwards, futures, options, and swaps. However, the relationship between loans and interest rates may also reveal the need to address credit and interest rate risks together. Sinkey Jr. and Carter (2000, p. 434) note that certain derivative banks use to hedge against interest rate risk may also be linked to credit risk.

Another indicator of banks' asset quality is non-performing loans. As the ratio of non-performing loans increases, the quality of banks' assets decreases (Yıldırım, 2024, p. 512). When non-performing loans increase, banks' credit risk also increases. Banks may increase their derivative activities for hedging purposes as a result of this. On the other hand, banks with high follow-up rates may face increased pressure from supervisory authorities. Banks may choose to avoid risky activities and decrease speculative derivatives trading to avoid supervisory pressure (Hundman, 1999, p. 86-87).

2.4.3. Exchange Rate Risk Pressure

One of the critical risk types affecting the Bank's operations in foreign exchange risk. Foreign exchange rate risk is the likelihood of financial loss resulting from exchange rates moving in the opposite direction of the banks' position. Exchange rate risk, which may increase bank costs, decrease profits, and cause capital loss, is related to banks' foreign currency positions (Cirlan, 2022, p. 82-83). When a bank has more foreign exchange (FX) liabilities than FX assets, it is said to have a deficit in its net FX position. Banks that have a shortage of foreign currency are negatively impacted by the increase in foreign currency exchange rates. Banks may prefer derivatives as a hedging instrument against exchange rate pressure. However, Yong et al. (2014) demonstrate that banks with low exchange rate risk may also experience an increase in derivative activities. Accordingly, low exchange rate risk may encourage banks' risk appetite and support speculative derivative activities.

2.5. Liquidity Management

Liquidity management involves finding a balance between low-yielding assets that offer high liquidity and high-yielding assets that offer low liquidity. Since banks holding highly liquid assets are less likely to default, they may have less motivation to hedge. High liquidity could serve as an alternative to hedging with derivative activities. Shiu and Moles (2010) obtained results that confirm this expectation. However, Sinha and Sharma (2016), and Yong et al. (2014) demonstrate a positive correlation between high liquidity portfolios and derivative activities. These results also suggest that a robust liquid asset portfolio may increase risk appetite and encourage speculative derivative activities in banks.

2.6. Dividend Payments

Carter and Sinkey (1998) argue that dividend payments may be one factor affecting banks' use of derivatives. By stabilizing cash flow volatility through derivatives, banks can pay higher dividends to shareholders or pay bond creditors. According to this approach, a positive relationship can be expected between high dividend payments and derivative activities. Shiu and Moles (2010), and Yong et al. (2014) also provide evidence supporting this approach.

2.7. Profitability

Banks, like other commercial firms, operate to maximize their profits. The use of derivatives for speculative purposes can be a factor in banks’ realizing these objectives . Highly profitable banks may also have an impact on customer preferences. Khasawneh and Hassan (2009, p. 9) emphasize in their study that banks that announce high profits will become more reputable in customers' eyes. This reputation may attract customers who want to trade in derivatives markets to these banks. Hundman (1999, p. 87) states in his study that banks that reduce their risks through derivative products will have the opportunity to invest in high-risk projects with higher return potential, which may positively impact bank profitability.

Approaches explaining the relationship between bank profitability and derivative products generally point to a positive relationship. However, results contrary to expectations can be seen in empirical studies (Adkins et al.,2007; Akkaynak & Yıldırım, 2019).

2.8. Bank Size

The size of a bank is expected to have a positive impact on its use of derivative products. This positive effect may result from the high reputation of large banks among customers, the cost advantages brought by economies of scale, and their confidence in taking risks.

There is a belief that larger banks are more reliable. Large banks can take use this trust to trade more easily in over-the-counter markets. This advantage may positively the derivative activities of large banks (Anbar & Alper, 2011, p. 84).

Derivatives are inherently complex products. The transactions require a certain level of expertise. However, there is a need for a robust technical infrastructure and an audit system to ensure proper execution and monitoring of transactions. The requirements for derivatives transactions impose a certain level of cost on banks. Large banks are easily placed to absorb these costs. Large banks can take advantage of the benefits of economies of scale in this regard. Large banks' advantages are expected to positively impact their derivatives activities (Carter & Sinkey, 1998, p. 21; Hundman, 1999, p. 87).

Pais and Stork (2013) argue that the concept of "too big to fail" incentivizes large banks to take on excessive risks. Carter and Sinkey (1998, p. 19) emphasize that bank managers who believe they are too big to fail may aggressively engage in derivative transactions for speculative purposes. Accordingly, bank size may create a moral hazard problem, as in the case of deposit insurance.

2.9. Ownership Structure

TBB classifies deposit banks as publicly and privately owned banks according to ownership structure. Privately owned banks are divided into domestic privately owned or foreign privately owned. Yong et al. (2014, p. 439) argue that state-owned banks may be less sensitive to hedging due to their state guarantee. This may result in fewer hedging derivative transactions in state-owned banks. On the other hand, foreign privately owned banks may be more experienced in derivatives transactions due to their international banking experience. Taşkın and Sarıyer (2020) provide evidence of a positive relationship between foreign-owned banks and derivatives transactions.

2.10. Macroeconomic Factors – Inflation

An inflationary business cycle impacts the purchasing power of economic agents and reduces the incentive to save. These effects may hurt banks' on-balance-sheet and off-balance-sheet activities and may lead to a decline in the volume of derivative transactions (Khasawneh & Hassan, 2009, p. 11; Anbar & Alper, 2011, p. 86). On the other hand, inflation increases uncertainty about the future and raises risks. At this point, derivatives can be instruments that banks can turn to with their risk-reducing

effects. In this scenario, inflationary conditions might lead to an increase in banks' derivative activities for hedging (Oktar & Yüksel, 2016, p. 41; Şimşek, 2015, p. 81).

Table 1. Summary of the Literature

Author(s)	Sample	Conclusion
Carter and Sinkey (1998)	1990-1993 Asset size $100 Million - $1 Billion 279 US Bank	Capital and bank size are important factors for participation in interest rate derivatives. Interest rate pressure is also effective in interest rate derivative utilization.
Hundman (1999)	1995:IV-1997:III Asset size > $500 Million 38 different countries	Bank size, capital and credit risk pressure are positively related to banks' derivatives activities, while net interest margin is negatively related
Sinkey Jr. and Carter (2000)	1996 Commercial banks operating in the US	Derivative activities of end-user banks are associated with riskier capital structure, higher maturity mismatch, lower net interest margin, and higher credit risk. Bank size is an essential determinant of derivatives activity.
Shyu and Reichert (2002)	1995-1997 7 Holding Banks and 25 International Banks operating in the US	Bank profitability negatively affects banks' derivative activities, while bank capital, asset size, maturity gap, and rating score have a positive impact.
Khasawneh and Hassan (2009)	1992:3-2008:11 Commercial banks operating in the US	Economic business cycles do not impact banks' use of derivatives. The size of the bank and loan placements have a positive effect on the derivative activities of banks.
Shıu and Moles (2010)	1998:Q2-2005:Q1 34 banks listed on the Taiwan stock exchange	Banks' derivatives activities are effectively influenced by risk management, information, and economies of scale.
Anbar and Alper (2011)	1999-2010 7 Turkish Banks traded on the ISE	Net interest margin and return on equity have a positive impact on banks' derivative activities, while loan loss provisions, size, and interest rates have a negative impact on them.
Yong, Faff and Chalmers (2014)	2002-2003 Banks operating in the Asia-Pacific Region	The derivatives activities of banks in the Asia-Pacific region are significantly influenced by the probability of financial distress and the size of the banks.
Şimşek (2015)	2006-2014 Turkish Banking Sector	Off-balance sheet risks, inflation, market risk, central bank reserves, and the volume of TL deposits are critical factors affecting the use of FX swap transactions.
Sinha and Sharma (2016)	2013 46 Bank of India	Derivatives are effective tools for hedging against exchange rate and interest rate risks. Capital, low net interest margin, size, and high liquidity contribute to the increased use of derivatives.
Oktar and Yüksel (2016)	2003:1-2015:3 Deposit banks operating in Turkiye	The NPL ratio has a positive impact on banks' derivative activities, while specific provisions have a negative impact on them.
Khan, Arif ve Tahir (2018)	2004-2006 Banks in Pakistan	The presence of high capital has a positive impact on the use of derivatives but a negative impact on the loan portfolio.
Vo vd. (2020)	2017 17 Emerging Economies	Public expenditures and trade deficits increase derivative activity. Growth and inflation are less critical for derivative activity.
Akkaya and Torun (2020)	2002-2018 Turkish Banking Sector	Return on assets has a significant impact on derivative activities and can have a negative effect on their use.
Yenisu, Traş and Saygın (2021)	2005-2021 Turkish Banking Sector	Bank size, financial risk, and exchange rate risk increase the use of derivatives while return on equity decreases.
Zeddoun and Bendima (2022)	2006-2020 25 Gulf-Arab Banks	Derivatives are successful tools for mitigating financial risks.

(Table 1 cont.)

Author(s)	Sample	Conclusion
Pala (2023)	2014-2021 Deposit Banks and Development and Investment Banks Operating in Türkiye	Capital and non-performing loans have a positive impact on deposit banks' use of interest rate derivatives, while liquidity has a negative effect. The size factor is a key determinant of interest rate utilization by development and investment banks.
Lestari and Pratiwi (2023)	2016-2018 23 Foreign Exchange Banks Listed on the Indonesian Stock Exchange	Firm size, debt level, and cash flow volatility positively affect banks' hedging behavior, while liquidity negatively impacts it.
Coşkun and Gürbüz (2024)	2010-2020 104 Banks From 21 Developed Countries and 41 Banks From 12 Developing Countries	Interest rates and bank size are generally positively associated with FX derivative use. Deposit size increases the use of FX derivatives in developed countries, but it decreases in developing countries.

3. METHODOLOGY

3.1. Data Set

This study aims to identify the factors influencing the use of derivatives by deposit banks in Türkiye. In this study, 2009-2022 is used as the sample period. 23 deposit banks that continued their activities uninterrupted during this period are examined. Forward foreign exchange transactions, swap money transactions, swap interest transactions, futures transactions, and options transactions reported under the heading of banks' derivative transactions for trading purposes are modeled and analyzed separately.

Variables commonly used in the literature were used to select factors that potentially affect banks' use of derivatives. Studies analyzing the use of derivatives in the Turkish banking sector do not find income gaps, deposit insurance, or dividend payout ratios**.** This study analyzes these variables for the first time in the Turkish banking sector. Unconsolidated financial statements of banks published by the TBB are used to obtain data on variables. Inflation data is obtained from the EVDS data system of the Central Bank of the Republic of Turkey (TCMB). The definition and calculation methods of the variables are shown in Table 2.

Table 2. Variable Definitions and Calculation Method

Variable Code	Variable(s)	Calculation Method
VDİ	Forward Foreign Exchange Trading	(Forward Foreign Exchange Trading/Total Assets)*100
SPİ	Swap Currency Trading	(Swap Currency Trading/Total Assets)*100
SFİ	Swap Interest Rate Trading	(Swap Interest Rate Trading/Total Assets)*100
TOİ	Total Options Trading	(Currency, Interest Rate and Security Options Trading/Total Assets)*100
TFİ	Total Futures Trading	(Currency Futures and Interest Rate Futures/Total Assets)*100

(Table 2 cont.)

Variable Code	Variable(s)	Calculation Method
LNAKT	Asset Size	Natural Logarithm of Total Assets
SYO	Capital Adequacy Ratio	(Equity/Total Risk Weighted Amounts)*100
KLD	Equity/Total Assets	(Equity/Total Assets)*100
BİDP	On-Balance Sheet Foreign Exchange Position	(On Balance Sheet FX Position/ Equity)* 100
KRED	Total Loans Ratio	(Total Loans/Total Assets)*100
TKRD	Non-Performing Loans	(Non-Performing Loans/Total Loans)*100
LKT	Liquid Assets Ratio	(Liquid Assets/Short Term Liabilities)* 100
NİM	Net Interest Margin	([Interest Income-Interest Expense]/Total Assets)* 100
ROE	Return on Equity	(Net Profit (Loss)/Equity)*100
ROA	Return on Assets	(Net Profit (Loss) for the Period / Total Assets) * 100
GAP12	Gap Analysis	(| Interest Rate Sensitive Assets up to 12 Months - Interest Rate Sensitive Liabilities up to 12 Months | / Total Assets)*100
TMTT	Dividend Ratio	(Dividend Payments/Total Assets)*100
MSİG	Deposit Insurance Ratio	(Total Deposits Covered by Insurance/Total Assets)*100
TÜFE	Consumer Price Index	Consumer Price Index Rate of Change Compared to the Previous Year*100
MYY	Ownership 1	Dummy Variable that takes the value “1” if there is a foreign share in the bank's capital or “0” otherwise
MKO	Ownership 2	Dummy Variable that takes the value “1” if there is a Public Share in the Bank's Capital or “0” otherwise
BBK	Bank Size Dummy	Dummy Variable that takes the value “1” if the Asset Size of a Bank is equal to or greater than the Median Value of Total Banks in the Relevant Year and “0” otherwise

Here are the descriptive statistics for the variables used in the study, as presented in Table 3. The total assets of 23 deposit banks reached a peak of approximately TL 2.311 Billion during the analyzed period. The highest average trading volume among the dependent variables was observed in currency swap transactions. This was followed by interest rate swaps, options, forward foreign exchange, and futures transactions.

Table 3. Descriptive Statistics

Variables	Number of Observations	Mean	Std. Deviation	Minimum	Maximum
AKT	322	145683.8	277065.2	895.765	2311665
LNAKT	322	10.45225	1.873563	6.797678	14.65348
KLD	322	11.72107	4.0456	2.881049	39.69888
SYO	322	18.33859	5.252743	12.57037	50.71908
BIDP	322	74.69301	67.90346	-137.338	384.8947
KRED	322	58.85989	12.97522	3.609701	84.71611
TKRD	322	4.510097	4.883282	0	48.58791
LKT	322	50.92489	24.99119	13.54083	164.3204
ROA	322	1.334609	1.515638	-.11.48341	8.026964
ROE	322	10.22853	25.07267	-398.5842	46.61223
NIM	322	4.119463	1.725114	0.1223414	19.28724
MSIG	322	12.15131	11.31061	0	147.9958
GAP12	322	12.95391	10.34046	0	57.88303
TMTT	322	0.1382598	0.3857065	0	3.825218
TUFE	322	14.915	16.40858	6.25	72.31
GSYİH	322	23.21857	24.87433	0.36	106.88
MKO	322	0.1304348	0.3373053	0	1
MYY	322	0.4813665	0.5004303	0	1
BBK	322	0.5217391	0.5003047	0	1
VDI	322	10.52699	19.23755	0	194.972
SPI	322	38.93249	35.13986	0	212.6651
SFI	322	10.70931	15.16786	0	79.81931
TOI	322	10.5708	14.53559	0	95.62286
TFI	322	0.3903167	2.556005	0	34.87224

3.2. Research Method and Econometric Model

This stud uses the random effect panel Tobit regression model to analyze the determinants of banks' use of derivative products. This method considers the amount of a bank's use of derivatives and allows banks that do not use derivatives to be monitored through independent variables. Thus, a bank that did not use derivatives for a certain period is not excluded from the sample group, and data loss is prevented. The Tobit model is one of the preferred models in studies of derivatives. Carter and Sinkey (1998), Sinkey Jr. and Carter (2000), Shıu and Moles (2010), and Anbar and Alper (2011) investigated the factors influencing derivative product usage using the Tobit model.

Tobit models were first used by Tobin (1958). These models, known as censored or discrete models, were named Tobit models by Goldberger (1964) due to their similarity to probit models (Amemiya, 1984:3). The Tobit model can be considered a combination of the OLS and probit models.

In probit models, the dependent variable takes 0 and 1 values, while in tobit models, it can take any value, provided that it is greater than 0.

In the Tobit model, some dependent variable observations are censored because they are unobservable. These values are left-censored if they fall in the left tail of the parametric distribution and right-censored if they fall in the right tail. Tobit models can feature censoring on both ends.

In panel data sets, Tobit models are suitable when some dependent variable values are zero and others are positive. However, inconsistent parameter estimates occur when T < N in models built with fixed effects assumption (Tatoğlu Yerdelen, 2020: 240). Panel Tobit models constructed with the fixed effects method are unsuitable because they cause random parameter problems and give inconsistent results. The random effect panel Tobit model, which is widely used in econometric analyses, is represented by the following equation (Saçıldı & Genç, 2018: 248-249):

$$y_{it}^{*} = \alpha_i + \beta' X_{it} + u_{it}, \qquad i: 1,2,....,N \qquad t: 1,2....,T \qquad (1.1)$$

$$u_{it} = v_{it} + \varepsilon_{it} \qquad (v_{it} \sim N(0, \sigma_v^2)) \qquad (\varepsilon_{it} \sim N(0, \sigma_\varepsilon^2))$$

X_{it}, denotes the independent variables, β denotes the vector of unknown parameters, u_{it} denotes the error term, and the error term should be time-independent.

$$y_{it} = \begin{cases} y_{it}^{*} > 0 & \text{ise} \quad y_{it} = y_{it}^{*} \\ Y_i^{*} \leq 0 & \text{ise} \quad 0 \end{cases}$$

The study involves creating 15 models that are grouped into 3 different panels. In Panel I, banks' use of derivatives is analyzed with five different models constructed according to five different derivative transactions.

In Panel II, derivative transactions other than the dependent variable are added as independent variables to the models constructed in Panel I. Panel II models, based on Carter and Sinkey (1998), and Shyu and Reichert (2002), investigate the impact of derivatives on each other.

Panel III analyzes the derivatives activities of large banks. A dummy variable is created with the code BBK to represent large banks. Interaction variables are created between the BBK dummy variable and the independent variables in Panel I models, and the effect of these interaction variables on derivatives transactions is analyzed. This study is based on Sinkey Jr. and Carter (2000), and Sinha and Sharma (2016). Since the correlation between the LNAKT variable used in Panel I and the BBK variable is high, the LNAKT variable is not used in the models constructed in Panel III. In addition, since the calculation could not be made for the interaction variable of BBK*MYO, this variable was excluded from the models.

4. EMPIRICAL FINDINGS

This section analyzes the results of the models examined. Models 1 through 5 are reported in Panel I, Models 6 through 10 are reported in Panel II, and Models 11 through 15 are reported in Panel III. There are 16 independent variables in Panel I, 20 in Panel II, and 30 in Panel III. All models include 322 observations. 26 observations in VDI models, 14 in SPI models, 107 in SFI models, 245 in TFI models, and 262 in TOI models censored from the left. In all models, Wald test results reject the null hypothesis H0, which states that the model is statistically insignificant at the 1% statistical significance level. The Wald test results indicate that each model is significant. The LR test results in all models reject the null hypothesis H0, which states no difference between the unit effect and standard error at the 1% level. Accordingly, the random panel Tobit regression model should be used instead of the pooled model in the analyzed models.

Table 4. Panel I Results

VARIABLES	VDI (Model 1)	SPI (Model 2)	SFI (Model 3)	TFI (Model 4)	TOI (Model 5)
LNAKT	-2,828104 [1440917] (0.050)**	0.7152758 [2.257635] (0.751)	4.46343 [1.498488] (0,003)***	2.065607 [0.6100717] (0,001)***	-1.328035 [1.362637] (0.330)
KLD	-0.9090744 [0.5449667] (0.095)*	-0.3987443 [0.7939908] (0.616)	0.0214098 [0.543439] (0.969)	0.7027822 [0.3817844] (0.066)*	0.1816143 [0.461289] (0.694)
SYO	-0.9707306 [0.3584574] (0.007)***	0.376609 [0.5434352] (0.488)	0.8420769 [0.3579971] (0,019)**	-0.0158095 [0.1853007] (0.932)	-1.317644 [0.3335737] (0,000)***
BIDP	0.0351324 [0.0171632] (0.041)**	0.1331984 [0.0264829] (0,000)***	0.0266369 [0.0147918] (0,072)*	0.0352852 [0.009639] (0.000)***	-0.0265424 [0.0135264] (0.050)**
KRED	-0.0734184 [0.1528326] (0,631)	0.5094025 [0.229985] (0,027)**	0.2464469 [0.1351956] (0,068)*	-0.1513385 [0.0880915] (0.086)*	0.043266 [0.1235713] (0.726)
TKRD	0.4925244 [0.268647] (0.067)*	0.8790508 [0.4191085] (0.036)**	-0.4938964 [0.4371775] (0.259)	0.2756299 [0.1718951] (0.109)	-0.2664881 [0.2490189] (0.285)
LKT	-0.0977519 [0.0656653] (0.137)	-0.0859164 [0.0921087] (0.351)	-0.1626138 [0.0589024] (0,006)***	0.027002 [0.0391714] (0.491)	-0.0171906 [0.0509739] (0.736)
ROA	6.72481 [1.511262] (0.000)***	3.71439 [2.313676] (0.108)	-1.269085 [2.037304] (0.533)	-2.248747 [1.467912] (0.126)	0.741935 [1.392282] (0.594)
ROE	-0.0845747 [0.059992] (0.159)	0.0194419 [0.0928379] (0.834)	0.0238852 [0.1356567] (0,860)	0.3063342 [0.1834196] (0.095)*	-0.0768341 [0.0477997] (0.108)
NIM	-1.779942 [0.8317563] (0.032)**	-2.641341 [1.267556] (0.037)**	-0.8774023 [1.059732] (0.408)	0.1150359 [0.4114168] (0.780)	-0.4147886 [0.9157654] (0.651)
MSIG	0.0131763 [0.102016] (0,897)	0.1314336 [0.1586159] (0.407)	0.0997364 [0.0773984] (0.198)	-0.0216391 [0.0365657] (0.554)	-0.0711946 [0.0777167] (0.360)
GAP12	0.0440861 [0.1078553] (0.683)	-0.1678437 [0.1661476] (0.312)	-0.081773 [0.104004] (0.432)	-0.0662721 [0.0563373] (0.239)	-0.1255631 [0.0929816] (0.177)
TMTT	5.348836 [2.864356] (0,062)*	3.615996 [4.302406] (0.401)	-6.761554 [5.691875] (0,235)	-1.125069 [1.736877] (0.517)	-4.980784 [3.235747] (0.124)

(Table 4 cont.)

VARIABLES	VDI (Model 1)	SPI (Model 2)	SFI (Model 3)	TFI (Model 4)	TOI (Model 5)
TUFE	0.2279996 [0.0757512] (0.003)***	0.2935795 [0.1160865] (0.011)**	-0.027781 [0.0707782] (0.695)	0.0126061 [0.037566] (0.737)	0.1314771 [0.0623984] (0.035)**
MKO	-7.405028 [9.605816] (0.441)	-19.40372 [15.40458] (0.208)	-10.43432 [9.97576] (0.296)	-2.931541 [2.969711] (0.324)	-16.39331 [9.543505] (0.086)*
MYY	1.565513 [4.22823] (0.711)	19.0187 [6.5404] (0.004)***	7.047594 [3.895984] (0,070)*	0.1144621 [1.866742] (0.951)	-6.61306 [3.459072] (0.056)*
C	65.87514 [21.06106] (0.002)***	-16.2412 [31.76327] (0.609)	-60.92026 [21.65284] (0,005)***	-32.87177 [12.2099] (0.007)***	52.50166 [19.17181] (0.006)***
Number of Observations	322	322	322	322	322
Number of Left-Censored Observations	26	14	107	245	262
Log Likelihood	-1255.6836	-1443.3571	-869.48965	-290.74098	-1048.1436
Wald chi2 (16)	69.24	73.52	99.83	37.58	49.87
Prob. > chi2	0.0000	0.0000	0.0000	0.0017	0.0000
LR chi2(01)	57.15	109.68	138.87	7.44	134.34
Prob. > chi2	0.000	0.000	0.000	0.003	0.000

Note: ***, **, * indicate statistical significance levels of 1%, 5%, 10% respectively. [ ] denotes standard errors, and ( ) denotes probability values.

Panel 1 results are displayed in Table 4. In the VDI model, the variables SYO, ROA, and TUFE are found to be significant at the 1% statistical significance level, LNAKT, BIDP, and NIM are found to be significant at the 5% statistical significance level, KLD, TKRD, and TMTT are found to be significant at the 10% statistical significance level. The constant term C in the model is statistically significant at a 1% level and has a positive coefficient. Other independent variables did not produce statistically significant coefficients.

Based on Model 1, increases in banks' FX open positions, non-performing loan ratios, return on assets, cash dividend distributions, and inflation rates increase forward foreign exchange trading by banks. The BIDP variable supports the hypothesis of hedging exchange rate risk; the TKRD variable supports the hypothesis of hedging credit risk, and the TUFE variable supports the hypothesis of hedging uncertainty due to inflation. The ROA variable supports the hypothesis that banks that hedge their risks through forward foreign exchange transactions will be able to invest in more profitable projects. This result may also be related to customers preferring banks with high profitability to make Forward Foreign Exchange transactions. The positive result of TMTT variable's supports the hypothesis that banks reducing their risks through derivative transactions may distribute more dividends.

Model 1 shows that increased LNAKT, KLD, SYO, and NIM variables decrease forward foreign exchange transactions. This result of the LNAKT variable is inconsistent with expectations. In addition, Yong et al. (2014), and Khasawneh and Hassan (2009) obtained similar results. The results for the KLD and SYO variables support the probability of financial distress hypothesis. The NIM variable indicates that banks with low net interest margins tend to engage in forward foreign exchange transactions to increase their profitability.

According to Model 2's results, swap currency transactions are the dependent variable, and the BIDP and MYY variables are statistically significant at a 1% level. At the same time, the KRED, TKRD, NIM, and TUFE are statistically significant at a 5% level. The NIM variable with a negative sign indicates that banks with low net interest margins have increased currency swap transactions. Swap currency transactions have a positive relationship with the BIDP, KRED, TKRD, TUFE, and MYY variables. Accordingly, currency swap transaction volumes of banks with increasing FX open positions, expanding loan volume, and increasing loan follow-up rates increase. Similarly, rising inflation and foreign ownership also increase banks' currency swap transaction volumes. The TUFE variable indicates that banks' currency swap transactions increase with inflation. This finding can be considered a result of the motivation to hedge risk. The results unequivocally show that an escalation in risk pressure directly results in a surge in currency swap transactions, as indicated by the BIDP, KRED, and TKRD variables. However, the positive result for the KRED variable can also be explained by customer preferences and the expansion of cross-selling opportunities.

The dependent variable in Model 3 is the swap interest rate transactions. LNAKT, LKT, and the model's constant term are the variables found to be significant in Model 3 at the 1% level, SYO at the 5% level, and BIDP, KRED, and MYY at the 10% level. LKT has a negative sign, which implies that swap interest rate transactions are reduced in banks with highly liquid assets. This result supports the liquidity hypothesis, which suggests that highly liquid assets can serve as an alternative to derivatives for hedging purposes. LNAKT, SYO, BIDP, KRED, and MYY variables have positive signs. The BIDP and KRED variables indicate that swap interest rate transactions increase with rising exchange rate risk and credit risk pressure, supporting the risk pressure hypothesis. The positive sign of the KRED variable may be related to interest rate pressure as well as credit risk pressure. The MYY variable indicates that foreign ownership increases swap interest rate transactions. The result for the LNAKT variable supports the economies of scale hypothesis. The positive sign of the SYO variable indicates that banks with higher capital adequacy ratios increase swap interest transaction volume. This result supports the credibility hypothesis. It can also be explained by the fact that banks with high SYO are more willing to take risks. An alternative interpretation is that banks with low capital adequacy ratios avoid engaging in speculative derivative transactions. Accordingly, the regulatory market hypothesis is valid for swap interest rate transactions.

The dependent variable in Model 4 is the futures transactions. In Model 4, LNAKT, BIDP, and the model's constant term are statistically significant at the 1% level, while the KLD, KRED, and ROE variables are statistically significant at the 10% level. The KRED variable with a negative sign indicates that a decrease in credit volume increases the volume of futures transactions. This result is in line with Khasawneh and Hassan (2009) and is attributed by the authors to speculative use. LNAKT with a positive sign is consistent with the economies of scale hypothesis. The positive sign of the BIDP variable can be explained by exchange rate risk pressure. The positive result for the KLD variable is consistent

with the hypotheses of creditworthiness, regulatory market, and incentive to take additional risk. The positive sign of the ROE variable indicates that return on equity increases banks' futures trading volume. The results of Anbar and Alper (2011), and Özer (2020) are consistent with this result of the ROE variable.

According to the results of Model 5, where option transactions are the dependent variable, SYO and the model's constant term are statistically significant at the 1% level, BIDP and TUFE variables at the 5% level, and MKO and MYY variables at the 10% level. The positive sign of the TUFE variable implies that high inflation increases option transactions. This result points to hedging purposes. The negative sign of the SYO variable supports the hypothesis of the probability of financial distress. Accordingly, banks with low capital adequacy ratios increase option transactions due to bankruptcy risks. Contrary to other models, the BIDP variable produced a negative coefficient. Accordingly, banks with low FX open positions have higher option trading volumes. The speculative trading motive can explain this result. Banks with low foreign exchange (FX) open positions are more likely to take risks. The sign of the MYY variable indicates that foreign ownership reduces option utilization compared to swap transactions. The sign of the MKO variable similarly indicates that public ownership reduces option trading volume. This result can be explained by the fact that state-owned banks feel less need to hedge.

Table 5. Panel II Results

VARIABLES	VDİ (Model 6)	SPİ (Model 7)	SFİ (Model 8)	TFİ (Model 9)	TOİ (Model 10)
LNAKT	-2.22084 [1.1255] (0.048)**	1.639055 [1.75317] (0.350)	5.080374 [1.355651] (0.000)***	2.449811 [0.7348144] (0.001)***	-0.8349183 [1.339466] (0.533)
KLD	-0.5075961 [0.4499699] (0.259)	-0.2778835 [0.6643089] (0.676)	0.3806555 [0.5339258] (0.476)	0.6937729 [0.3725272] (0.063)*	0.3877287 [0.4586667] (0.398)
SYO	-0.8925234 [0.3045624] (0.003)***	1.050555 [0.4615462] (0.023)**	0.640747 [0.3427943] (0.062)*	0.0051782 [0.187692] (0.978)	-1.378248 [0.3352137] (0.000)***
BIDP	-0.0030161 [0.0152769] (0.843)	0.0891712 [0.0228762] (0.000)***	0.0251666 [0.014815] (0.089)*	0.0279066 [0.0100162] (0.005)***	-0.0279551 [0.0139271] (0.045)**
KRED	-0.2524031 [0.1283678] (0.049)**	0.5724223 [0.1905633] (0.003)***	0.1452688 [0.1314516] (0.269)	-0.1498653 [0.0875841] (0.087)*	0.0120083 [0.1246621] (0.923)
TKRD	0.191485 [0.232276] (0.410)	0.4318685 [0.3648775] (0.237)	-0.2573267 [0.3814839] (0.500)	0.2168326 [0.1791429] (0.226)	-0.3170099 [0.2604491] (0.224)
LKT	-0.0698327 [0.0564266] (0.216)	0.0319709 [0.0786386] (0.684)	-0.1304181 [0.0555924] (0.019)**	-0.0005699 [0.0406677] (0.989)	0.0158472 [0.050366] (0.753)
ROA	4.984013 [1.291765] (0.000)***	-1.144852 [2.017147] (0.570)	-2.024198 [2.385275] (0.396)	-2.465987 [1.505621] (0.101)	0.3593555 [1.385766] (0.795)
ROE	-0.0854449 [0.0512732] (0.096)*	0.0678944 [0.0789203] (0.390)	0.0763355 [0.2114463] (0.718)	0.2975973 [0.1854757] (0.109)	-0.0866482 [0.0465457] (0.063)*
NIM	-0.8720578 [0.7037935] (0.215)	-0.4883427 [1.091741] (0.655)	-0.3209831 [1.01137] (0.751)	0.1790213 [0.4014201] (0.656)	0.0949268 [0.9204014] (0.918)

(Table 5 cont.)

VARIABLES	VDİ (Model 6)	SPİ (Model 7)	SFİ (Model 8)	TFİ (Model 9)	TOİ (Model 10)
MSIG	-0.011433 [0.0851532] (0.893)	0.0976989 [0.1317112] (0.458)	0.0992252 [0.0734361] (0.177)	0.0140289 [0.0364066] (0.700)	-0.0710588 [0.0755759] (0.347)
GAP12	0.1100095 [0.0909515] (0.226)	-0.1204646 [0.1418337] (0.396)	-0.0415861 [0.0999914] (0.677)	-0.0695661 [0.0561726] (0.216)	-0.1073619 [0.0912069] (0.239)
TMTT	4.961743 [2.470213] (0.045)**	0.2606097 [3.614169] (0.943)	-5.082777 [5.14318] (0.323)	-1.581361 [1.696218] (0.351)	-5.337121 [3.134747] (0.089)*
TÜFE	0.1171457 [0.0635223] (0.065)*	0.0822039 [0.0976927] (0.400)	-0.0386539 [0.0655434] (0.555)	-0.0025848 [0.0389882] (0.947)	0.0991158 [0.0614176] (0.107)
MKO	0.8209425 [6.598562] (0.901)	-8.097236 [10.20515] (0.428)	-8.186355 [8.78935] (0.352)	-5.06408 [3.639618] (0.164)	-13.97831 [9.459576] (0.139)
MYY	-2.361146 [3.490361] (0.499)	12.34781 [5.459944] (0.024)**	5.963032 [3.68948] (0.106)	0.4569643 [2.097101] (0.828)	-7.059881 [3.436929] (0.040)**
VDI		0.8463951 [0.0771787] (0.000)***	-0.0572026 [0.1055097] (0.588)	-0.0041113 [0.035527] (0.908)	0.151149 [0.0626277] (0.016)**
SPI	0.345894 [0.0319981] (0.000)***		0.0926488 [0.0347979] (0.008)***	0.0223921 [0.0224286] (0.318)	0.0085405 [0.0336611] (0.800)
SFI	-0.1273005 [0.0812464] (0.117)	0.4715349 [0.1237988] (0.000)***		-0.1553609 [0.0504335] (0.002)***	0.0871964 [0.0722566] (0.228)
TFI	-0.305329 [0.3143328] (0.331)	0.7882904 [0.4948147] (0.111)	-1.034812 [0.2871018] (0.000)***		-0.5097217 [0.3026124] (0.092)*
TOI	0.1300379 [0.0701685] (0.064)*	0.0638872 [0.1092928] (0.559)	0.1202747 [0.0685901] (0.080)*	-0.0450254 [0.0528005] (0.394)	
C	54.2661 [18.00198] (0.003)***	-56.69136 [26.87372] (0.035)**	-69.84919 [21.11336] (0.001)***	-33.09575 [13.43317] (0.014)**	42.5087 [18.99752] (0.025)**
Number of Observations	322	322	322	322	322
Number of Left-Censored Observations	26	14	107	245	60
Log Likelihood	-1203.1755	-1384.373	-856.64264	-284.62847	-1040.5865
Wald chi2 (20)	222.59	257.59	136.70	45.21	67.77
Prob. > chi2	0.0000	0.0000	0.0000	0.0010	0.0000
LR chi2(01)	29.96	41.11	93.31	7.08	101.74
Prob. > chi2	0.000	0.000	0.000	0.004	0.000

Note: ***, **, * indicate statistical significance levels of 1%, 5%, 10% respectively. [ ] denotes standard errors, and ( ) denotes probability values.

Table 5 reports Panel II results. Shyu and Reichert (2002) explain that positive outcomes in derivatives transactions result from the substitution effect, while adverse outcomes stem from the alternative relationship. According to Model 6, a positive relationship exists between forward foreign exchange transactions and swap currency and options transactions. Accordingly, SPI and TOI are substitutes for forward foreign exchange transactions. According to Model 7, there is a positive relationship between swap currency transactions, forward foreign exchange transactions and swap interest rate transactions. VDI and SFI can be used interchangeably for currency swap transactions. In Model 8, there is a negative relationship between swap interest rate transactions and TFI. A positive

relationship exists between swap interest rate transactions, SPI and TOI. According to these results, futures are an alternative to interest rate swaps. Swap currency and option transactions are substitutes for swap interest rate transactions. In Model 9, there is a negative relationship between TFI and SFI. Accordingly, interest rate swaps are an alternative to futures. In Model 10, there is a negative relationship between TOI and TFI and a positive relationship between TOI and VDI. According to these results, futures transactions are an alternative to option transactions, and forward foreign exchange transactions are an alternative to option transactions.

Table 6. Panel III Results

VARIABLES	VDİ (Model 11)	SPİ (Model 12)	SFİ (Model 13)	TFİ (Model 14)	TOİ (Model 15)
KLD	-0.4962368 [0.5502209] (0.367)	-0.5195766 [0.7626276] (0.496)	-0.7340686 [0.5867534] (0.211)	0.0310006 [0.4233522] (0.942)	0.7624572 [0.4841244] (0.115)
SYO	-1.813973 [0.3931435] (0.000)***	-0.0179715 [0.574245] (0.975)	0.4412701 [0.4604981] (0.338)	0.4026905 [0.3017352] (0.182)	-1.826932 [0.3871898] (0.000)***
BIDP	0.0690679 [0.0202954] (0.001)***	0.1293307 [0.0311708] (0.000)***	0.0702608 [0.017407] (0.000)***	0.0313998 [0.0149002] (0.035)**	-0.000308 [0.0164702] (0.985)
KRED	-0.3630762 [0.1769464] (0.040)**	0.3770001 [0.2576071] (0.143)	0.326854 [0.1529004] (0.033)**	-0.1435907 [0.1205877] (0.234)	-0.1074087 [0.1454014] (0.460)
TKRD	0.4249738 [0.2851135] (0.136)	0.6198826 [0.4415985] (0.160)	-0.9977348 [0.5354661] (0.062)*	-0.389461 [0.4712001] (0.409)	-0.2953978 [0.3027678] (0.329)
LKT	-0.1098283 [0.0784744] (0.162)	-0.048457 [0.1015358] (0.633)	-0.0538519 [0.0631366] (0.394)	-0.0313745 [0.0776956] (0.686)	-0.0779788 [0.0631346] (0.217)
ROA	7.958281 [1.658635] (0.000)***	3.739779 [2.518028] (0.137)	5.590359 [3.176671] (0.078)*	-0.4884396 [2.034622] (0.810)	-0.4447877 [1.687501] (0.792)
ROE	-0.1268668 [0.059198] (0.032)**	0.0031596 [0.0911534] (0.972)	-0.1388069 [0.258262] (0.591)	0.1387418 [0.2716528] (0.610)	-0.0675636 [0.0498893] (0.176)
NIM	-0.7436062 [0.8893224] (0.403)	-0.7056404 [1.336269] (0.597)	-2.678685 [1.389291] (0.054)*	0.1439462 [0.7257527] (0.843)	0.4246946 [1.128666] (0.707)
MSIG	0.1837328 [0.5194986] (0.724)	1.145851 [0.7626105] (0.133)	2.168768 [0.4488672] (0.000)***	0.3076805 [0.3465217] (0.375)	-0.8928094 [0.4008748] (0.026)**
GAP12	0.013758 [0.1397168] (0.921)	-0.1865659 [0.214934] (0.385)	-0.2315954 [0.1597022] (0.147)	-0.2027353 [0.1142942] (0.076)*	-0.2520822 [0.1267725] (0.047)**
TMTT	6.782968 [2.961626] (0.022)**	5.782224 [4.446328] (0.193)	-11.73241 [16.96589] (0.489)	-9.283967 [7.675132] (0.226)	-6.088448 [3.909311] (0.119)
TUFE	0.4053183 [0.0946502] (0.000)***	0.5771734 [0.1423115] (0.000)***	-0.0610154 [0.0960706] (0.525)	0.0389527 [0.0741073] (0.599)	0.2441824 [0.0787935] (0.002)***
MKO	-11.72488 [10.89199] (0.282)	-23.65443 [18.10116] (0.191)	-25.35963 [8.598651] (0.003)***	0.8377677 [2.850276] (0.769)	-20.56723 [10.18778] (0.044)**
MYY	3.274914 [5.095301] (0.520)	25.9265 [7.877288] (0.001)***	14.27981 [4.43258] (0.001)***	3.339458 [3.68636] (0.365)	-5.812427 [4.158646] (0.162)
BBK	-58.02794 [38.85479] (0.135)	73.8564 [60.03206] (0.219)	74.81742 [29.72768] (0.012)**	0.9288615 [20.75083] (0.964)	-47.61668 [30.73523] (0.121)

(Table 6 cont.)

VARIABLES	VDİ (Model 11)	SPİ (Model 12)	SFİ (Model 13)	TFİ (Model 14)	TOİ (Model 15)
BBK*KLD	-0.0783428 [1.614521] (0.961)	0.1777808 [2.47225] (0.943)	-2.855654 [1.159834] (0.014)**	1.663524 [0.74783] (0.026)**	-2.236458 [1.227871] (0.069)*
BBK*SYO	2.584876 [0.9157591] (0.005)***	-0.4230801 [1.409582] (0.764)	1.184142 [0.7251185] (0.102)	-0.6692725 [0.4677038] (0.152)	1.777861 [0.7445441] (0.017)**
BBK*BIDP	-0.0836981 [0.042946] (0.051)*	0.0439691 [0.0663372] (0.507)	-0.1526838 [0.0305707] (0.000)***	0.0334469 [0.0231277] (0.148)	-0.0774397 [0.0328446] (0.018)**
BBK*KRED	0.5760501 [0.3541583] (0.104)	-0.1130349 [0.5425064] (0.835)	-0.0405978 [0.259966] (0.876)	-0.1129449 [0.1850127] (0.542)	0.6082618 [0.2813965] (0.031)**
BBK*TKRD	-0.5011219 [1.169831] (0.668)	2.050157 [1.82771] (0.262)	1.648213 [0.9389182] (0.079)*	1.631269 [0.6422895] (0.011)**	-1.06174 [0.9301536] (0.254)
BBK*LKT	0.1406097 [0.1488343] (0.345)	-0.2531741 [0.2225424] (0.255)	-0.1228224 [0.1064224] (0.248)	0.0738704 [0.0935388] (0.430)	0.1575599 [0.1166399] (0.177)
BBK*ROA	-7.413887 [7.271592] (0.308)	13.24738 [11.27707] (0.240)	-0.5160324 [5.660238] (0.927)	-2.790994 [3.304221] (0.398)	7.19317 [5.595544] (0.199)
BBK*ROE	0.2224169 [0.7520172] (0.767)	-0.5993236 [1.166072] (0.607)	-0.6047032 [0.5616227] (0.282)	0.2894438 [0.39403] (0.463)	-0.7714346 [0.5698421] (0.176)
BBK*NIM	-1.072803 [2.193307] (0.625)	-11.07381 [3.385858] (0.001)***	1.163748 [1.921467] (0.545)	-1.29834 [1.152542] (0.260)	0.7129363 [1.885827] (0.705)
BBK*MSIG	-0.2037718 [0.5357553] (0.704)	-1.162053 [0.7862277] (0.139)	-2.279647 [0.4580644] (0.000)***	-0.315709 [0.3484154] (0.365)	0.8373559 [0.4117248] (0.042)**
BBK*GAP12	0.0128877 [0.2332893] (0.956)	-0.2977824 [0.3611595] (0.410)	-0.1031665 [0.2015501] (0.609)	0.233999 [0.1394527] (0.093)*	0.1762207 [0.188984] (0.351)
BBK*TMTT	-6.450488 [8.682065] (0.458)	-17.51373 [13.41387] (0.192)	2.519735 [17.85706] (0.888)	10.21206 [8.340579] (0.221)	2.962742 [7.49839] (0.693)
BBK*TUFE	-0.3894609 [0.149814] (0.009)***	-0.5213051 [0.2297802] (0.023)**	0.1053479 [0.1237257] (0.395)	0.10758 [0.0880386] (0.222)	-0.2464739 [0.1191311] (0.039)**
BBK*MYY	-1.02059 [8.519136] (0.905)	-16.03524 [14.02601] (0.253)	-14.73685 [6.542435] (0.024)**	-5.091584 [4.210906] (0.227)	1.98745 [6.941217] (0.775)
C	54.77734 [17.5068] (0.002)***	-14.63703 [25.7486] (0.570)	-35.57991 [18.12763] (0.050)**	-12.82847 [13.7937] (0.352)	55.0394 [15.2352] (0.000)***
Number of Observations	322	322	322	322	322
Number of Left-Censored Observations	26	14	107	245	60
Log Likelihood	-1239.4771	-1427.6189	-832.72916	-274.77485	-1036.0928
Wald chi2 (30)	110.70	115.10	209.93	53.05	77.09
Prob. > chi2	0.0000	0.0000	0.0000	0.0058	0.0000
LR chi2(01)	52.51	87.17	91.06	7.00	113.79
Prob. > chi2	0.000	0.000	0.000	0.004	0.000

NOTE: ***, **, * indicate statistical significance levels of 1%, 5%, 10% respectively. [ ] denotes standard errors, and ( ) denotes probability values.

Table 6 reports Panel III results. The dummy variable BBK, a proxy for bank size, is significant and positively signed at the 5% statistical significance level in Model 13, where only swap interest rate

transactions are the dependent variable. Accordingly, bank size is a factor that increases swap interest rate transactions.

In Model 11, the variables BBK*SYO, BBK*BIDP, and BBK*TUFE are significant at 1%, 10%, and 1% statistical significance levels, respectively. The positively signed variable BBK*SYO indicates that large banks with high capital adequacy ratios have high forward foreign exchange transaction volumes. High creditworthiness or the appetite for additional risk-taking by well-capitalized large banks could explain this result. The negatively signed variable BBK*BIDP indicates that large banks with low foreign exchange deficits increased the volume of forward foreign exchange transactions. This result points to speculative use. The negatively signed BBK*TUFE variable indicates that low inflation increases the use of VDI in large banks. This result can be explained by the speculative use.

In Model 12, BBK*NIM is statistically significant at the 1% level, and BBK*TUFE is statistically significant at the 5% level. The negatively signed BBK*NIM variable indicates that large banks with low net interest margins have rising swap transaction volumes. The negatively signed BBK*TUFE variable indicates that low inflation increases the swap currency transactions of large banks.

According to Model 13's results, BBK*BIDP and BBK*MSIG are interaction variables that are significant at 1%, BBK*KLD, BBK*MYY, and constant term C at 5%, and BBK*TKRD at the 10% statistical significance level. The positively signed BBK*TKRD variable implies that swap interest rate transactions of large banks increase as the NPL increases. The credit risk or interest rate pressure hedging hypothesis could explain this result. The negatively signed variable BBK*BIDP indicates that large banks with low foreign exchange deficits increased the volume of swap interest rate transactions. The negative sign of the variable BBK*MSIG indicates that large banks with low insured deposit rates increase swap interest rate transactions. The variable BBK*KLD has a negative sign and supports the hypothesis of the probability of financial distress for large banks. The negative sign of the variable BBK*MYY indicates that large banks with foreign ownership have low swap interest rate transactions.

According to Model 14's results, the interaction variables BBK*KLD and BBK*TKRD are significant at 5% and BBK*GAP12 at 10% statistical significance level. The positively signed BBK*KLD variable indicates that large banks with high capital have high futures trading volume. The positively signed BBK*TKRD variable supports the credit risk pressure hypothesis. The positive sign of the variable BBK*GAP12 is consistent with the interest rate pressure hypothesis. Accordingly, the futures trading volume of large banks with high-interest rate gaps increases.

According to Model 15's results, the constant term is significant at 1%. The variables BBK*SYO, BBK*BIDP, BBK*KRED, BBK*MSIG, and BBK*TUFE are significant at 5%, and BBK*KLD is significant at the 10% statistical significance level. The negative sign of the variable

BBK*KLD supports the financial distress hypothesis. The negative sign of the BBK*TUFE variable can be explained by speculative use. A positively signed BBK*SYO indicates that well-capitalized large banks have increased option transactions. The variable BBK*KRED indicates that the option utilization of large banks increases as credit risk increases. The number of credit-dependent customers and cross-selling opportunities may also be the reason for the relationship. The sign BBK*MSIG indicates that large banks with high insured deposits have high option transactions. This result can be considered as a sign of moral hazard.

5. CONCLUSION

This study has analyzed the derivative activities of 23 deposit banks operating in the Turkish banking sector and continuing their operations uninterruptedly during 2009-2022. We investigated the motivation behind the use of derivatives by banks and the factors affecting this motivation, categorized as forward foreign exchange transactions, swap currency transactions, swap interest rate transactions, futures transactions, and options transactions.

The study's findings show that on-balance sheet FX position is the most effective determinant of banks' derivative activities. Banks' on-balance sheet FX position indicates that derivatives are used in order to hedge in four models and speculation in one model. Other influential factors in derivative utilization were asset size, capital adequacy ratio, loan placement, inflation, and foreign ownership. Factors such as deposit insurance and interest rate gaps, examined for the first time in studies on derivatives transactions in the Turkish banking sector, are not influential in determining banks' derivatives activities. Dividend payments were significant in only one equation.

The study reveals that derivatives impact each other’s use. This effect can occur through the substitution effect or the effect of being an alternative. This finding reveals the importance of analyzing derivative products by grouping them.

The analyses show that banks use over-the-counter market transactions primarily for hedging purposes and organized stock market transactions mostly for speculation purposes.

The on-balance sheet FX position is found to be influential in determining the derivative transactions of large banks. Capital and inflation are other influential factors. The motive of speculation is predominant in large banks' derivatives transactions, whish is evident in forward foreign exchange, currency swap, and options transactions. Derivatives, which have risk-protective features, can also be a source of risk depending on their usage characteristics. Therefore, speculative activities of large banks in derivatives may impact the banking sector. Therefore, banks' derivative activities are carefully monitored by the competent authorities.

In response to unexpected fluctuations in exchange rates, the BDDK has taken measures between 2018 and 2022 to restrict banks' use of derivatives. These regulations stipulate that derivative

transactions must be scaled according to the bank's equity, with this ratio not exceeding the ceiling rates set for various maturities.

This study shows that the tendency to use derivative products for speculative purposes is dominant in large banks. It might be considered to introduce a factor related to the bank's size when setting rules limiting how much banks can use derivatives based on their equity. This approach could be more effective in curbing the speculative derivative activities of large banks.

In the Turkish banking sector, deposit banks are classified as publicly owned, domestic privately owned, and foreign privately owned banks. This study analyzes the effect of banks' ownership structure on derivatives use using dummy variables. The findings suggest that foreign ownership is an influential factor in derivatives use. For more detailed analyses, related bank groups can be examined separately in future studies. In addition, banks' use of derivatives in the context of corporate governance principles such as banks' free float ratios, the number of female members on boards of directors, the number of directors on risk committees, and the remuneration and commission income of executives, which are outside the scope of this study, may also be the subject of future research.

The study does not necessitate Ethics Committee permission.

The study has been crafted in adherence to the principles of research and publication ethics.

The authors declare that AI tools are only used for enhancing spelling and grammar, and augmenting the overall readability of the article.

The authors declare that there exists no financial conflict of interest involving any institution, organization, or individual(s) associated with the article. Furthermore, there are no conflicts of interest among the authors themselves.

The authors declare that the contribution of authors of the study is 60% and 40%, respectively.

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