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Articles

The Effect of Non-Interest Income on Bank Profitability and Risk: Evidence from Turkey

O efecto dos ingresos non financeiros na rendibilidade e o risco bancarios: evidencia de Turquía

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Abstract

There are three purposes of this article, the first of which is to investigate the impact of non-interest income (NNII) on the profitability of banks assessed by both return on assets (ROA) and return on equity (ROE). The second one is to investigate the impact of NNII on risk, assessed by the volatility of return on assets (SdROA) and the volatility of return on equity (SdROE). The final one is to analyze the impact of the COVID-19 pandemic on bank profitability and risk. To achieve the above, the dynamic panel technique, a two-step GMM estimator, was used with the data of 25 deposit banks operating uninterruptedly from 2002 to 2021. The empirical results show that the NNII was positive and significantly correlated with ROA and ROE. The effect of NNII on the risk level appears to be negative and significantly related. In addition, during the COVID-19 period, it was determined that profitability decreased and risk increased. This shows that NNII is a vital shock absorber during an external shock. Therefore, it could be said that banks should attach importance to income diversification, and sector regulators should encourage innovation to create non-traditional products. Under the adverse conjuncture created by increasing public intervention and the pandemic, in recent years, Turkish banks have been encouraged to diversify their activities further rather than focus solely on traditional activities. NNII appears to be associated with higher profitability and lower risk.

Keywords: Non-interest income; Profitability; Risk; Dynamic panel data model.

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Resumo

Este artigo ten tres obxectivos, o primeiro dos cales é investigar o impacto dos ingresos non financeiros (NNII) na rendibilidade dos bancos, avaliada tanto pola rendibilidade dos activos (ROA) como pola rendibilidade financeira (ROE). O segundo é investigar o impacto dos NNII no risco, avaliado pola volatilidade do rendemento dos activos (SdROA) e a volatilidade da rendibilidade financeira (SdROE). O último é analizar o impacto da pandemia da COVID-19 sobre a rendibilidade e o risco bancarios. Para lograr o anterior, utilizouse a técnica de panel dinámico cun estimador GMM de dous pasos, cos datos de 25 bancos de depósito que operaron ininterrompidamente desde 2002 ata 2021. Os resultados empíricos mostran que o NNII estaba positiva e significativamente correlacionado co ROA e o ROE. O efecto do NNII sobre o nivel de risco parece ser negativo e significativamente relacionado. Ademais, durante o período da COVID-19, determinouse que a rendibilidade diminuíu e o risco aumentou. Isto demostra que o NNII é un amortecedor vital durante un shock externo. Por tanto, podería dicirse que os bancos deberían conceder importancia á diversificación dos ingresos, e os reguladores do sector deberían fomentar a innovación para crear produtos non tradicionais. Na conxuntura adversa creada polo aumento da intervención pública e a pandemia, nos últimos anos animouse aos bancos turcos a diversificar máis as súas actividades en lugar de centrarse unicamente nas actividades tradicionais. A NNII parece asociarse a unha maior rendibilidade e un menor risco.

Palabras chave: Ingresos non financeiros; Rendabilidade; Risco; Modelo de datos de panel dinámico.
JEL: G21; C23; O16.

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1. INTRODUCTION

The banking sector, which has a significant weight among financial intermediaries, is one of the most important sectors for the stability of financial systems due to its mutual relations with other sectors. Disruptions in the proper functioning of the banking sector tend to exacerbate production fluctuations. Since financial crises can lead to significant production losses in the real economy, maintaining the stability of this sector is crucial.

Changes throughout history in economic structure on a global scale have also closely affected the banking sector. Financial liberalization, which started in the 1970s, led to the integration of financial services and the diversification of financial intermediary institutions and transaction types. In the 1990s, developments in information and communication technology became the driving force of non-traditional activities in the banking sector. Against this backdrop, many financial institutions created a new business model based on new banking operations. However, the weakening of the barriers to financial service integration and advances in communication technology have made the banking sector more open to competition and have increased its propensity to take risks. Therefore, the financial sector has become more sensitive to external and internal shocks (Chiorazzo et al., 2008).

While some argue that the Global Financial Crisis (GFC) was caused by activities which were considered to be "non-traditional" for banks (Williams, 2016), it is clear that the GFC increased their willingness to diversify their income streams to maintain profitability and stability. In a dynamic economic environment, traditional banking has become more vulnerable to interest rate fluctuations, credit risks, and insolvency. Anginer et al. (2019) have argued that portfolio diversification is the primary strategy to reduce risks in the sector. Lee et al. (2014) drew attention to the fact that the effect of NNII on bank profitability and risk differs according to bank specialization and the income level of countries based on a study conducted in 22 Asian countries. While NNII increases risk for banks in high-income countries, it increases profitability and reduces risk in middle- and low-income countries. For savings banks, NNII activities reduce profitability and increase risk. However, NNII activities increase profitability and decrease risk for commercial, co-operative and investment banks. According to Williams (2016), NNII generally increases the risk for Australian banks. However, similar to Lee et al. (2014), when the effects of bank specialization are taken into account, some types of NNII reduce risk. Considering that banks have focused on NNII activities to mitigate the increased risks in the banking sector since the GFC, it is essential to seek an answer as to whether the orientation of banks towards NNII activities is a source of risk or an area of activity to compensate for risks in the sector.

Commercial banks accounted for 91% of total financial sector assets in Turkey as of the end of 2020 and were, therefore, the most important intermediaries of the financial sector. In the period immediately after 2010, when the effects of the GFC started to be observed in the Turkish economy, economic uncertainty increased. 2020 was characterized by unprecedented turmoil both globally and in Turkey (Rueda Cantuche, 2021). To mitigate the economic impact of the pandemic, the government introduced regulations aimed at keeping lending rates and loan interest rates low, which resulted in a negative net interest margin at certain periods. The high inflation resulting from the low interest rate policy and substantial credit expansion has led to foreign currency being perceived as a savings instrument, with the proportion of deposits of this kind in the banking sector reaching 60%. In order to reduce said proportion in the banking sector, the has set targets so that banks convert their foreign currency deposits into local currency ones. Furthermore, banks that fail to meet these targets are obliged to

purchase long-term government bonds. While bank assets and liabilities have been regulated, interest rates and exchange rates have become increasingly volatile in recent years. This has significantly increased the interest rate risk for the sector. As a response, banks have been trying to maintain their profitability and reduce risks by increasing their NNII. The Banking Regulation and Supervision Agency's (BRSA) 2023 report states that operating costs for banks in Turkey have risen due to regulations, so they have turned to NNII-generating activities to deal with it, which has affected their profitability and risks. Although the regulatory authority recognizes NNII as one of the crucial factors behind the profitability of Turkish banks, whether the increase in yields leads to higher profit volatility needs to be known. The answer to this question will guide the asset liability management of Turkish banks.

In the literature, studies analyzing the relationship between NNII and bank performance (AlKhouri & Arouri, 2019; Berger et al., 2010; Chiarazzo et al., 2008; DeYoung & Rice, 2004; Elsas et al., 2010; Hidayat et al., 2012; Stiroh, 2006) have identified diversification and risk management, profitability and sustainability. Moreover, studies on the effects of regulations and NNII on bank performance (Abedifar et al., 2018; Bian et al., 2013; Chen et al., 2018; Cuong & Pham, 2021; Nguyen, 2012) have increased since the financial crises experienced in recent years. A great deal of extensive research has been conducted on how significant regulations such as the Basel frameworks affect the transactions and income structures of banks. While these measures aim to ensure global and local financial stability, the recent ones on the banking sector in Turkey have tended to reduce bank profits and heighten risks. In this respect, analyzing the effects of non-traditional operating income on bank performance in a regulated banking sector will make an essential contribution to the literature for the case of Turkey. Therefore, this study offers a unique perspective by considering Turkey-specific banking practices, a regulatory environment and macroeconomic factors.

The objectives of this paper are threefold. The first one is to analyze the effect of NNII, as measured by return on assets (ROA) and return on equity (ROE), on the profitability of Turkish banks. Secondly is to examine the relationship between NNII and risk-taking levels. The final objective is to investigate the impact of the COVID-19 pandemic on profitability and risk. Regarding methodology, we have provided a novel framework for controlling the endogeneity of the diversification choice that has not been applied in this context. Arellano and Bover (1995) detailed the System Generalized Method of Moments Estimators (System-GMM) technique for dynamic panel data, Blundell and Bond (1998) refining it further. This model tackles econometric issues induced by unobserved bank-specific effects, explanatory variable co-endogeneity, and autoregressive characteristics in the dependent variable.

The rest of this paper is organized as follows: the section that follows offers an overview of the Turkish banking industry; section 2 examines the empirical evidence on the relationship between bank performance and income diversification; section 3 explains the data and approach; the findings are discussed in Section 4; finally, section 5 provides ideas for bank managers, regulators, and policymakers on how to cope with revenue diversification.

2. AN OVERVIEW OF THE TURKISH BANKING SECTOR

The decisions made on January 24, 1980 to create internal and foreign financial liberalization led to a significant reform process in Turkey's banking industry. The competitive structure that was created increased product diversity, developed technology infrastructure benefitted advancements in the legal and institutional environment, all of which contributed to the sector's success. While the banking sector's total assets to GDP ratio was 31.4 per

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cent in 1980, by 2021 it had steadily expanded to 128 per cent. According to asset sizes, the banking industry had a 91 per cent stake in the financial sector as of 2021. As a result, banking transactions have dominated the Turkish financial sector for several decades.

Thanks to this liberalization process, banks were able to obtain funds from international markets more easily, and their foreign currency-denominated debts risen. Due to customers being allowed to create foreign currency deposit accounts (FCDs) in Turkish banks from 1984, the prevailing high inflation and increase in the value of foreign currencies to stimulate exports made FCDs an alternative savings instrument to Turkish lira (TL) deposit accounts. As a result, as certain deposits were converted into foreign currency time deposits, the share of time deposits in TL declined while that of FCDs grew. Therefore, debt dollarization in the banking sector in Turkey reached a substantially high level. The use of government debt securities (GDS) to finance public deficits increased the percentage of the former in bank assets during this process. Before 2000, the exchange rate and interest risk in the banking sector, which supported the public sector rather than the private sector, which was one of its essential functions, soared. Owing to Turkey's money and banking crises in November 2000 and February 2001, interest rates and exchange rates rose significantly, and exchange rate and interest rate risk became a reality. Numerous banks with financial difficulties were transferred to the Savings Deposit Insurance Fund (SDIF).

Comprehensive changes for public and private banks were implemented as part of the banking sector restructuring program launched in the aftermath of the 2001 crisis. Its aim was to improve competition in the sector by providing the surveillance and oversight of the operational and financial reform of public banks, resolve institutions that had been transferred to the SDIF, and improving the structure of private banks. Solid equity capital was able to cover losses from sector restructuring and actual and potential risks following the 2000 and 2001 crises, influencing the decision of the BRSA to maintain the limit for capital adequacy at 12 per cent, even though the legal limit was 8 per cent according to Basel II practices (BRSA, 2006).

Before the 2001 crisis, foreign bank admissions in Turkey entailed creating new banks or opening new branches; during the turbulent period, foreign capital purchased the shares of national banks, acquiring the majority of the capital or qualifying shares in these institutions. In addition to the subsequent significant increase in exchange rates, the financial weakening of banks and the adverse effects on market values, the privatization acceleration initiative, the increased openness of the Turkish economy, the expectations regarding the effect of Basel II, the propensity for mergers and acquisitions in the financial sector, and the participation of foreign capital in the banking sector all influenced how the crisis began and how it was dealt with.

The Turkish banking system comprises 57 banks, of which 35 are deposit banks, 3 of which are under the SDIF. Of the latter, three are public and eight are private. There are 21 foreign-capitalized financial institutions of this kind, three public development and investment ones, six local ones, and four foreign ones. Deposit banks own 86% of the sector's assets, while the development and investment type has possession of 7% of them and participation banks hold 7% of them. State-owned deposit banks account for 37% of total deposits, if they are privately owned ones they make up 29%, and if foreign-owned comprise 20%.

A stable growth environment was achieved following the crisis after eliminating structural problems. These had been increasing the vulnerability to crises in banking and had led to necessary measures being implemented, resulting in rapid credit growth. In spite of this, banks were prevented from taking excessive risks due to the regulations put in place. On the

other hand, in the 2000s, the banking sector in Turkey gained a more competitive structure with the acceleration of foreign bank entries. As a result, the net interest margins of deposit institutions began to fall. During this process, all types of banks were observed to have focused on activities that generated NNII.

In March 2020, Turkey was affected by the COVID-19 health crisis causing foreign resource inflows to be reversed due to increased macro-financial risks, resulting in exchange rate shocks, inflation and rising inflation expectations, economic growth not being achieved, company bankruptcies being postponed, and a failure to create enough employment. The first policy response of the Central Bank of the Republic of Turkey was to cut the policy rate, which continued for the rest of the year. Turkey was the first and fastest country in the world to bring down the policy interest rate. In addition to this cut, regulations were made that compelled the banking sector to offer loans, buy public debt securities and make foreign currency swap transactions with the central bank. By 2022, when the effects of the COVID-19 epidemic had disappeared, new regulations that shaped the balance sheet of the banking sector had come into effect. These aimed to reduce the share of foreign currency deposits in the sector, control loan and deposit interest rates, and make bank purchases of public debt securities a liability. Additional commission for banks with a 50 per cent or higher share of foreign currency deposits in their total deposits, the obligation to purchase long-term government debt securities of 90 per cent of the loan amount to banks that applied credit interest above the rate determined by the central bank, and forcing banks to sell foreign currency by reducing the upper limit for the share of the bank from 20 per cent to 5 per cent were just a few of the many regulations implemented. As a result, banks with foreign currency deposits exceeding 50% of total deposits in the sector were required to put deposit interest rates up to boost the number of Turkish lira deposits. In addition to raising these, regulations aimed at reducing loan interest rates caused the net interest margin to be negative at certain periods. To compensate for the decline in traditional operating income, banks shifted to NNII-generating activities.

3. THEORETICAL AND EMPIRICAL LITERATURE

3.1. Theoretical literature

There is no agreement in the literature regarding the effect of income diversification on profitability and risk in the banking sector. Banks have traditionally generated income from the difference between deposit and loan interest rates, known as " the margin". To offset the decline in traditional income sources due to increased competition, banks have turned to NNII sources. Allen and Santomero (2001) argued that banks have shifted towards these and developed new products in response to regulations to their industry. Banks are obliged to diversify their income streams to remain competitive and profitable. The potential benefits of diversification may primarily arise from economies of scope (Berger et al., 2010). According to financial intermediation theory, the efficiency of financial intermediaries depends mainly on the quality of the information they use. The financial sector is unique in its high dependence on information, which makes producing financial services costly. Banks that adopt diversification strategies can obtain high-quality information from a range of activities, including NNII ones such as securities underwriting and insurance services, helping banks overcome the problem of information asymmetry, facilitating lending as a consequence (Elyasiani & Wang, 2012). Diversifying banks can benefit from economies of scope, seeing

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their performance and stability increase while their overall risk is lowered (AlKhouri & Arouri, 2019). The main argument for combining non-banking sectors such as securities, insurance and real estate with traditional banking operations is that fee-based activities are less affected by interest rate changes and economic conditions (Hsieh et al., 2013). This means that banks can diversify their income if there is a negative or weak correlation between NNII and net interest income. Therefore, increasing the share of fee-based activities in the portfolio reduces the earnings volatility of banks (Stiroh, 2004).

Many scholars have argued that product diversification has limited benefits and that non-bank operations can potentially increase bank risk. The first reason is that diversification encourages managers to expand their businesses beyond the optimal size, forcing them to work outside their competence areas. This causes banks to move away from regions with a comparative advantage (Abedifar et al., 2018; Adesina, 2021; Vidyarthi & Mishra, 2020). According to DeYoung and Roland (2001), fee-based activities have a shorter time horizon and lower transition costs than traditional banking. Therefore, these institutions may be more inclined to lend to customers to establish longer-term relationships and strengthen their links with NNII customers, this policy potentially weakening their monitoring role. Additionally, the growth of NNII operations may lead to increased fixed costs, such as additional recruitment, and raise the operational leverage of banks. Fourthly, banks do not need to allocate capital against NNII operations, which may trigger higher financial leverage in the sector and, subsequently, income instability if the weight of NNII operations intensifies. Lastly, selling multiple products to the same consumer links interest and NNII (Stiroh, 2004). Thus, operations focusing on increasing NNII help stabilize the income and profitability of banks and reduce their risk. It is essential to maintain a balanced approach to income sources and avoid over-reliance on any one area.

3.2. Empirical literature

Several studies have demonstrated that NNII can increase profitability and reduce risk (Baele et al., 2007; Brahmana et al., 2018; Chiarazzo et al., 2008; Chronopoulos et al., 2011; Dempsey et al., 2013; Elsas et al., 2010; Meslier et al., 2014; Nisar et al., 2018; Sanya & Wolfe, 2011). Using a sample of 17 European countries, Baele et al. (2007) found empirical evidence of a positive relationship between diversification and franchise value. Meanwhile, Chiarazzo et al. (2008) investigated the relationship between NNII and profitability using annual data from Italian and other EU banks. They noticed that banks performed better when they allocated revenue sources to fee-based services, such as investment banking. Elsas et al. (2010) recorded that diversification increased bank profitability in nine countries from 2001 to 2007. Chronopoulos et al. (2011) examined the link between diversification and efficiency in 165 banks operating in ten new EU member states during the same period. The study revealed significant cost and profit inefficiencies among banks and differences in efficiency levels between countries. As for emerging markets, Dempsey et al. (2013) investigated how equity markets evaluated the diversification efforts of publicly traded public banks over twelve years using data from four South Asian countries. Income diversification was found to have a significant positive relationship between market-book value and a large negative correlation with returns volatility. Meslier et al. (2014) found that NNII-based diversification increased bank profits and risk-adjusted profitability in the Philippine banking sector, mainly during periods when government bonds were traded most frequently. Nisar et al. (2018) investigated how income diversification affected bank profitability and stability in South Asian

countries. Overall income diversification towards NNII was proven to benefit the profitability and stability of South Asian commercial banks. Using a panel data set of 226 banks from 11 emerging markets, Sanya and Wolfe (2011) examined how income diversification affected bank performance and risk. The main observation was that diversification reduced bankruptcy risk and increased profitability. Brahmana et al. (2018) used Malaysian banks to assess the impact of diversification on bank performance. The panel regression findings in their analysis showed that income diversification improved bank performance and confirmed the risk mitigation hypothesis. However, according to Brighi and Venturelli (2014), NNII positively impacted both unadjusted and risk-adjusted bank profitability in the Italian banking sector but not risk. Pennathur et al. (2012) investigated the impact of NNII on bank risk by ownership structure for Indian banks. Income diversification increased public bank risk but decreased private bank risk.

Numerous studies have demonstrated that NNII has a negative impact on profitability and heightens risk (Berger et al., 2010; DeYoung & Rice, 2004; Hidayat et al., 2012; Stiroh, 2006). DeYoung and Rice (2004) specifically examined the effect of NNII on bank performance and concluded that it was less profitable and more hazardous than interest income. It was believed that a significant proportion of banks' net interest income (NNII) was dependent on traditional banking activities. Therefore, there was no fundamental change in bank business models. Stiroh (2006) took a portfolio approach to NNII and noticed no correlation between NNII risk and bank stock performance. Therefore, the shift towards NNII was considered to have reduced bank profitability while intensifying bank risk. Additionally, the largest US banks were overexposed to this income stream. Acharya et al. (2006) analyzed the impact of diversification and the importance of the loan portfolio on the returns and risk of 105 Italian banks from 1993 to 1999, using bank-level data on exposure to a variety of industries and sectors. Their findings indicated that diversification did not lead to higher performance and/or increased safety for banks but rather reduced bank profits while providing riskier loans to high-risk banks. However, according to Hidayat et al. (2012), the degree of product diversification negatively correlated with bank risk for small banks in the Indonesian banking market. Similarly, in a sample of 88 Chinese banks, Berger et al. (2010) found that diversification led to reduced earnings and increased expenses. Furthermore, Stiroh (2004) analyzed the potential benefits of a long-term transition in the US banking sector towards NNII, corporate income, and other NNII-generating activities. He concluded that NNII had no impact on bank performance or risk, which implied that NNII had a detrimental effect on bank value. Similarly, Williams and Prather (2010) found no evidence in their Australian study of NNII ratio raising bank profitability or risk. Zhou's (2014) study on 62 Chinese banks were unable to detect a statistically significant relationship between these variables either.

4. DATA AND METHODOLOGY

4.1. Econometric specification and possibility of dynamic panel data estimation

The dynamic panel data model (for one lag) can be represented as follows:

$$y_{it} = \alpha y_{it} - 1 + \beta x_{it} + \mu_i + \nu_{it} \quad (1)$$

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Including the lagged dependent variable in the model violates the strict externality assumption, leading to inconsistent estimates. Random effects generalized least squares estimators in dynamic panel data models are also biased due to the correlation between the unit effect μi in the error term and one of the independent variables (Yit-1). As a result, the prediction of the dynamic model with the assumption of random effects is inconsistent (Matyas & Sevestre, 1996). Fixed effects and first difference estimators are commonly used when estimating dynamic panel data models. These estimators consider the unit effects and allow for correlation between the unit effects and independent variables. Intra-group transformation is used with the assumption of fixed effects to eliminate μi. According to Tatoğlu (2020), consistency can only be achieved if T approaches infinity due to the loss of the first period of each unit caused by Yit-1 and the addition of a shadow variable to the model for each unit.

Because the error term and the lagged dependent variable are correlated, the estimators obtained by conventional estimation methods are inconsistent. Therefore, an appropriate instrumental variable can be used instead of the lagged dependent variable associated with the error term. There are various approaches to the selection of the instrumental variable. In general, the vehicle variable must meet the following conditions:

-Instrumental variables must be unrelated to error terms.

-Instrumental variables must be related to the variable they will replace (Bond, 2002).

Nickell (1981) showed that when working with autoregressive panel data models, the shadow variable least squares estimator was inconsistent when N was large and T was small. This is known as the "Nickell Deviation" in the literature. Judson and Owen (1999) found, because of their simulations, that the deviation of parameter estimates was 20% even when T=30.

If the error terms of the difference model have constant variance and no autocorrelation, using the mean variables method to estimate the fixed effects model is reasonable. However, If the error terms of the difference model have constant variance and no autocorrelation, the GMM can be used. Arellano and Bond (1991) (AB) suggested using instrumental variables to derive the GMM of corresponding moment conditions with GMM difference. The lagging variable is then treated as the corresponding instrumental variable of the endogenous variables in the difference equation. However, in finite samples, the EU may face a severe problem of "weak instruments" and, thus, poor accuracy (Bond, 2002). Arellano and Bover (1995) and Blundell and Bond (1998) offered a solution to this problem by providing a "system-GMM" estimate (combining the additional torque constraints with the constraints in AB) in which GMM was applied to a two-equation system. An equation in differentials is based on lagged levels, and an equation in levels is based on differences. System-GMM can correct unobserved country heterogeneity issues, missing variable bias, measurement error, and potential internality issues that often affect growth patterns when using pooled OLS and fixed exposure methods (Bond, 2002). It can also reduce the potential bias and inaccuracy associated with a simple first difference estimation of GMM (Arellano & Bover, 1995; Blundell & Bond, 1998).

GMM can be a consistent estimation method if there is no autocorrelation in the error term. In addition, the number of vehicle variables should not exceed the number of endogenous variables so that torque conditions are not unduly limited. Arellano and Bond (1991) created an autocorrelation test for GMM. The Arellano-Bond autocorrelation test validates any GMM regression on panel data (Roodman, 2009).

4.2. Data

This body of research has empirically analyzed the relationship between net NNII and bank profitability and bank risk for 25 deposit banks operating uninterruptedly in Turkey throughout the period 2002-2021, the equations being as follows:

Model 1:

$$\mathrm{ROA}\pi_{i,t} = \alpha_0 + \alpha_1 \mathrm{ROA}\pi_{i,t-1} + \alpha_2 \mathrm{NNII}_{i,t} + \alpha_3 \mathrm{ControlVariables}_{it} + \varepsilon_{i,t} \quad (2)$$

Model 2:

$$\mathrm{ROE}\pi_{i,t} = \alpha_0 + \alpha_1 \mathrm{ROE}\pi_{i,t-1} + \alpha_2 \mathrm{NNII}_{i,t} + \alpha_3 \mathrm{ControlVariables}_{it} + \varepsilon_{i,t} \quad (3)$$

Model 3:

$$\mathrm{SDROA}\pi_{i,t} = \beta_0 + \beta_1 \mathrm{SDROA}\pi_{i,t-1} + \beta_2 \mathrm{NNII}_{i,t} + \beta_3 \mathrm{ControlVariables}_{it} + \eta_{i,t} \quad (4)$$

Model 4:

$$\mathrm{SDROE}\pi_{i,t} = \beta_0 + \beta_1 \mathrm{SDROE}\pi_{i,t-1} + \beta_2 \mathrm{NNII}_{i,t} + \beta_3 \mathrm{ControlVariables}_{it} + \mu_{i,t} \quad (5)$$

Where:

$\mathrm{ROA}\pi_{i,t}$: Bank profitability, measured by return on assets.
$\mathrm{ROE}\pi_{i,t}$: Bank profitability, measured by return on equity.
$\mathrm{SDROA}\pi_{i,t}$: Bank risk, measured by the standard deviation of ROA ($\mathrm{ROA_{it}}$ / $\sigma\mathrm{ROA_i}$).
$\mathrm{SDROE}\pi_{i,t}$: Bank risk, measured by the standard deviation of ROE ($\mathrm{ROE_{it}}$ / $\sigma\mathrm{ROE_i}$).
$\mathrm{NNII}_{i,t}$: The ratio of non-interest income to net operating income.
COVID: Dummy variable equal to 1 for the coronavirus period.
ε_{it}, μ_{it}: Error terms.

The control variables in the model given above are explained below:

LOANS: The ratio of loans to total assets.
DEPOSITS: Ratio of deposits to total assets.
EQUITY: Ratio of equity to total assets.
NPL: Non-performing loans to total credits.
SECURITY: Ratio of security portfolio to total assets.

Table 1 shows the variables used in the NNII study for banks in Turkey and their definitions. The research data was obtained from the official website of the Banks Association of Turkey.

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Table 2 summarizes the fundamental statistical values of the variables in the research models.

Table 1. Variable definitions

Variable	Definition
ROA	Return on assets
ROE	Return on equity
SDROA	Standard deviation of return on assets
SDROE	Standard deviation of return on equity
NNII	Ratio of non-interest income to net operating income
LOANS	Ratio of loans to total assets
DEPOSITS	Ratio of deposits to total assets
EQUITY	Ratio of equity to total assets
NPL	Non-performing loans to total loans
SECURITY	Ratio of security portfolio to total assets
COVID	Dummy variable equal to 1 for the coronavirus period

Bank-specific variables were used as control variables in our analysis. We used the ratio of non-performing loans to total loans to control for credit risk (the NPL ratio), which increases risk while reducing bank profitability due to lower interest income and provisioning (Athanasoglou et al. (2006); Menicucci & Paolucci, 2016; Ramadan et al., 2011; Vinh, 2016). A positive risk and a negative relationship was expected between the capital variable, which we took as the ratio of capital in total assets, and profitability. While high capital reduces the risk of insolvency (Adesina & Mwamba, 2016), lending to banks at high interest rates increases their profitability as it allows them to collect deposits at low interest rates (Bennaceur & Goaied, 2008; Demirgüç-Kunt & Huizinga, 1999). However, Porter and Chiou (2013) argued that the above-optimal capital ratio leads banks to high-risk activities and that bank profitability decreases due to the inability to benefit from the leverage effect. Similarly, Abdelaziz et al. (2022) have found that the capital adequacy ratio for banks in MENA countries has a negative effect on bank profitability. The ratio of loans to total assets is another controlling variable, as it is the primary source of income for banks and affects the riskiness of their portfolios (Craig & Dinger, 2013). Many studies have shown that loans positively affect bank profitability (Menicucci & Paolucci, 2016; Sufian & Habibullah, 2009; Saif-Alyousfi, 2022). However, there is also evidence that credit growth increases risk and reduces profitability by increasing the funding needs of banks and leads to a deterioration in credit quality (Thornton & Tommaso, 2021; Davydenko, 2011; Anbar & Alper, 2011). If credit growth is associated with a decline in credit standards, it causes an increase in bank risk. The direction of the relationship between the deposit ratio and bank profitability can differ. An increase in deposits, a cost element, also raises bank profitability to the extent that it can be converted into high-yield and low-risk loans (Kawshala, 2017). It has a negative impact on profitability (Dietrich & Wanzenried, 2011) if deposit growth is placed at low margins. As the deposit ratio is related to the liquidity risk of banks, it also affects their risk. Evidence shows

that an increase in the deposit rate reduces liquidity risk, encourages banks to lend more, and increases bank risk (Ivashina & Scharfstein, 2010; Acharya & Naqvi, 2012; Khan et al., 2017). Finally, the security variable, which constitutes a part of the assets of banks, was taken as the control variable. Banks hold some assets in government bonds to cover their statutory liquidity ratios. The impact of these assets on profitability, which reduce bank risk due to their being a safe investment tool, may be positive or negative (Islam et al., 2017). At crisis periods, when sovereign credit risk increases, bank balance sheets could suffer from the decline in the value of public debt instruments (Crosignani, 2021).

Table 2. Descriptive statistics

Variable	N	Mean	Standard Dev.
ROA	500	1.314	2.114
ROE	500	10.067	17.046
NNII	500	2.040	2.637
LOANS	500	50.849	18.976
DEPOSITS	500	59.049	17.183
EQUITY	500	14.274	9.972
NPL	500	6.971	13.758
SECURITY	500	24.486	15.751

The period 2002-2022 was used as the basis for the models to be tested, which was set by the subject at the empirical level. The study used 25 deposit banks, and the total number of observations was 500.

5. EMPIRICAL RESULTS

This section provides a detailed overview of this study's findings. Dynamic approaches were estimated for 25 deposit banks using the two-step system GMM (Blundell & Bond, 1998). We hypothesized that this process would yield robust results with consistent and equal standard errors. Based on this assumption, we continued with the GMM estimation findings, summarized in Table 3. We also analyzed first and second-order autocorrelation using the AR(1) and AR(2) statistics, respectively. These forms of autocorrelation were revealed to have had no significant effect on the results. Additionally, the Sargan test scores were insignificant across all models. This indicates that the null hypothesis of mutually valid instrumental variables was accepted, while the alternative hypothesis was rejected. Therefore, we can conclude that the instrumental indicators used in the equations were appropriate for this study.

Table 3. Correlation matrix

	ROA	ROE	NNII	LOANS	DEPOSITS	EQUITY	NPL	SECURITY
ROA	1							
ROE	0.7714	1						
NNII	0.0749	0.0732	1					
LOANS	-0.0422	0.0233	-0.3026	1				
DEPOSITS	0.0197	0.1377	-0.0743	0.2959	1			

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	ROA	ROE	NNII	LOANS	DEPOSITS	EQUITY	NPL	SECURITY
EQUITY	0.1016	-0.056	0.2717	-0.4766	-0.5128	1		
NPL	0.1215	-0.0666	0.0683	-0.3818	-0.1177	0.3558	1	
SECURITY	0.1639	0.1058	0.1488	-0.5311	0.0466	0.097	0.2689	1

Table 4. Two-step system GMM panel estimation regression results

Variable	Profitability measures		Risk measures	
	ΔROA	ΔROE	ΔSDROA	ΔSDROE
ROA(-1)	0.296*** (0.013)			
ROE(-1)		0.167*** (0.005)		
SDROA(-1)			-0.073*** (0.001)	
SDROE(-1)				-0.126*** (0.001)
NNII	0.193*** (0.007)	0.971*** (0.086)	-0.574*** (0.029)	-0.561*** (0.009)
LOANS	0.056*** (0.002)	0.194*** (0.020)	-0.076*** (0.002)	-0.094*** (0.005)
DEPOSITS	-0.017*** (0.002)	-0.023 (0.016)	-0.026*** (0.005)	0.011*** (0.002)
EQUITY	0.078*** (0.003)	0.418*** (0.141)	0.089** (0.013)	0.294*** (0.009)
NPL	-0.031*** (0.003)	-0.042*** (0.010)	0.015*** (0.003)	0.015*** (0.001)
SECURITY	-0.001 (0.001)	-0.015* (0.009)	-0.042*** (0.004)	-0.072*** (0.002)
COVID	-0.956*** (0.138)	-14.521*** (1.376)	0.188*** (0.041)	0.136 (0.099)
N	475	475	475	475
AR(1) p-value	0.0569	0.1330	0.1350	0.2642
AR(2) p-value	0.8753	0.9240	0.4471	0.3539
Sargan p-value	0.1463	0.1895	0.4450	0.3367

*p<0.1 **p<0.05 ***p<0.01

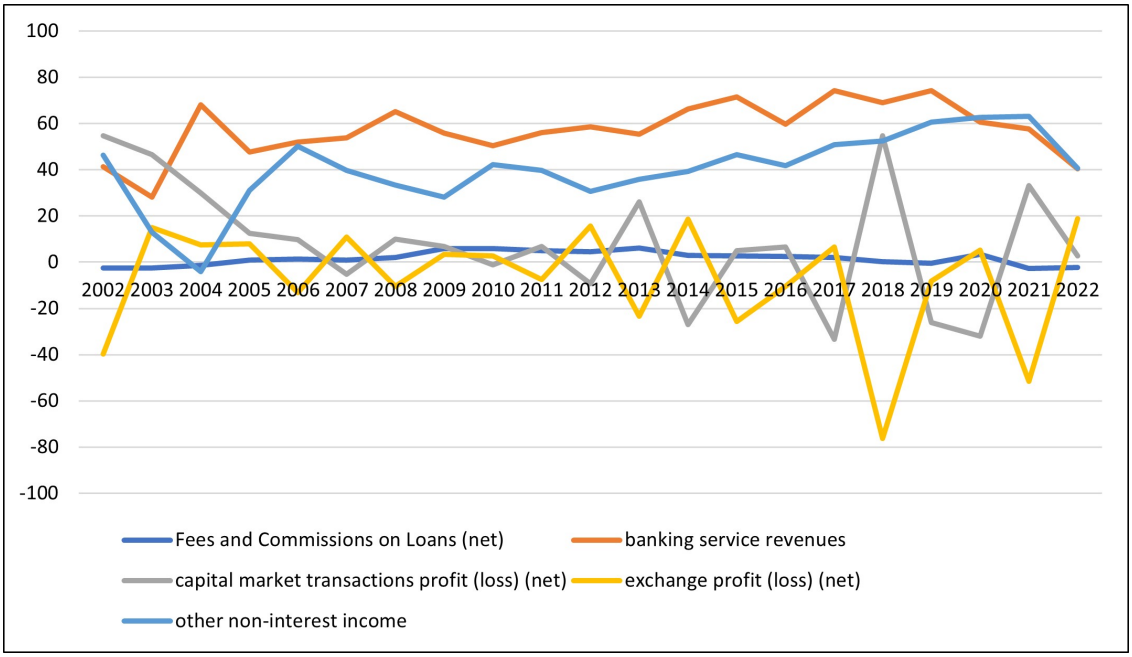
The test for the first two models (Models 1 and 2) was for bank profitability, while for the second two (Models 3 and 4), it was for bank risk. For bank profitability metrics, the computed NNII coefficients were positive and statistically significant. This shows that placing trust in NNII streams leads to an increase in bank profitability. The results of our study demonstrate that, following the decline in interest margins observed after 2002, deposit banks in Turkey sought to enhance their profitability by diversifying their activities and generating NNII. Furthermore, at the one-percent level, the computed coefficients for NNII for bank risk indicators were negative and statistically significant. This data proved the diversification impact associated with the use of NNII sources. Thus, the view that banks should diversify their income streams in order to remain competitive and profitable was corroborated in Turkey. The study's main findings were consistent with those of Sanya and

Wolfe (2011), Nisar et al. (2018), Dempsey et al. (2013), Meslier et al. (2014), and Brahmana et al. (2018).

Upon examining the NNII sources in Turkey (Figure 1), the asymmetric relationship between foreign exchange revenues and revenues from capital market transactions in the post-2002 period was made particularly apparent. In the aftermath of the 2001 banking crisis, banks were expected to manage sector-specific risks effectively, various regulatory rules and audits supporting this stance. The institutions utilized gains from capital market transactions by hedging exchange risks through derivative products (futures, options, swaps) to compensate for the foreign exchange losses incurred due to on-balance sheet FX position deficits. This indicates that banks diversified their risk management strategies and seized opportunities in capital markets.

Bank service revenues and other NNII activities made the most substantial contribution to total NNII. Following an increase in 2002, these two income elements positively contributed to profitability and exhibited a stable trajectory compared to other NNII elements. Despite the relatively modest contribution of loan fees and commission income to NNII, it could be asserted that it was the most stable income element.

Figure 1. Share of NNII sources in total NNII (%)



Source: Calculated by the authors using data from the Banks Association of Turkey https://www.tbb.org.tr/en/banks-and-banking-sector-information/statistics-and-data-query/statistical-reports/20

An examination of the sources of NNII expenses in Turkey (Figure 2) revealed a notable increase in the proportion of general provision (loan provisions based on expected credit losses) expenses within the total NNII expenses category in the post-2002 period. Conversely, the share of other NNII expense sources declined. The widespread use of mobile and internet banking in the sector resulted in a notable decline in personnel expenses, representing the highest NNII expense source. Conversely, the general provision increased significantly, particularly following the emergence of macroeconomic instability in the Turkish economy in 2017. This indicates that, in line with the government's policy of supporting economic growth through the provision of cheap credit and regulations that forced banks to lend money, banks

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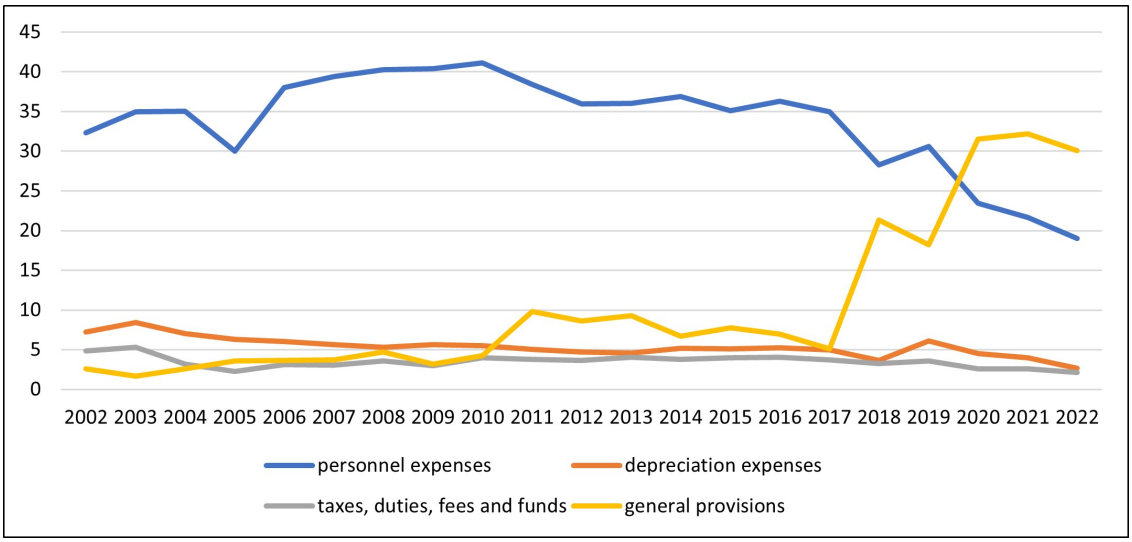
had to allocate more reserves against potential credit risk and adopt a prudent approach to future credit losses.

Figure 2. Share of NNII expense sources in total NNII expenses (%)



Source: Calculated by the authors using data from the Banks Association of Turkey https://www.tbb.org.tr/en/banks-and-banking-sector-information/statistics-and-data-query/statistical-reports/20

The dummy variable included in the model to analyze the financial effects of the COVID-19 pandemic was statistically significant in the first three models. It could be argued that the decline in bank profitability during the health crisis was closely related to the Turkish government's decision to postpone maturing loans. In addition to the postponement of maturities, there was a significant increase in bad loan rates during this period, although the legal deadline for loan collection was extended.

Lagged ROA and ROE were positive and significant in 1% of the control variables, which may imply that banks were successful in the past and could influence future performance expectations. We discovered that the profitability in the Turkish banking sector was sustainable due to successful management, which was also related to the BRSA's regulations on profitability. This agency has been regulating the profit distribution of banks since 2001, being able to make changes in these regulations by considering the economic conjuncture. It introduced stricter regulations on profit distribution during the GFC and the pandemic. Due to its decisions, the inability of banks to distribute a large portion of their profits led them to strengthen their capital structures. We observed that the relationship between equity capital, one of our control variables, and profitability was positive, supporting our finding that the lagged values of profitability in the sector positively affected profitability.

While the relationship between loans, one of our control variables, and profitability was positive, a negative relationship was found with risk. The results for the LOANS variable were dissimilar to those of Stiroh (2004) and (Sanya & Wolfe, 2011). We noted that loans increased profitability and reduced risk, indicating that the Turkish banking sector had learned the necessary lessons from the 2001 crisis and successfully managed loans. High capital adequacy standards forced banks to be cautious when building risk-weighted assets.

At the 1% significance level, DEPOSITS had the opposite impact of ROA. The average maturity of deposits in the Turkish banking sector was 2.3 months (BAT, 2023), which was relatively short. The high maturity mismatch significantly increased the funding costs

of banks, especially in periods of rising interest rates, and negatively affected profitability. Another reason for the negative relationship between deposits and ROA was the high share of foreign currency deposits in total deposits in the Turkish banking sector. In periods when the national currency depreciated against foreign currencies, the resource costs of banks increased as the value of foreign currency deposits increased in the national currency. Moreover, the exceptionally high reserve requirement ratios applied to foreign currency deposits were also essential reasons that increased the cost of resources. Therefore, extending the maturities of deposits in Turkey and increasing the share of deposits in the domestic currency was necessary. Undoubtedly, a stable macroeconomic climate would ensure this.

Although the relationship between equity and profitability, one of our control variables, was positive, the higher the ratio of equity to assets, the higher the risk. Although Turkey applies Basel II criteria, the regulator has set the minimum capital adequacy ratio of banks at 12 per cent. The average capital adequacy ratio for our analysis period was around 20 per cent, in line with Porter and Chiou (2013) and Abdelaziz et al. (2022). This suggests that high capital standards encouraged banks to achieve their profit targets by increasing the risk in their asset portfolios and off-balance sheet activities.

Meanwhile, the NPL variable reduced profitability and increased risk. The higher this ratio was, the lower the asset quality was, while the ROA was adversely affected. Hence, NPL, which we found to reduce interest income and negatively affect bank profitability due to provisioning, also increased risk, which was consistent with Vinh (2016), Athanasoglou et al. (2022), Menicucci and Paolucci (2016) and Ramadan et al. (2011). The increase in NPLs is an important indicator of uncertainty/deterioration in the country's economy and the financial structure of loan borrowers. In Turkey, whenever there has been a crisis. the ratio of NPLs in the banking sector has increased significantly. After the 2001 banking crisis, said ratio reached 20 per cent, while it totaled 5 per cent in the GFC. After 2013, increased geopolitical risks and political uncertainty led to significant fluctuations in exchange rates. Similarly, the exchange rate shock in 2018 caused companies with high foreign currency indebtedness to be unable to pay their debts to banks. The COVID-19 pandemic adversely affected the Turkish economy as it did the rest of the world. During these crisis periods, NPLs were restructured. In order to ensure macroeconomic stability, loan interest rates were reduced and/or payments were postponed during the loan restructuring process, adversely affecting the profitability of banks. Loan restructuring should limit bank losses by preventing NPLs from fully becoming NPLs. However, due to the frequent economic crises in Turkey, the NPL problem could be said not to have been solved by this type of process, apparent with the significant increase in the general provisions of banks (Figure 2), especially after 2010. Following that year, the increase in the share of state-owned banks in the sector (three state-owned banks accounting for about 42 per cent of total assets) made resolving NPLs more difficult. The fact that these kinds of banks are politically motivated to finance riskier projects and take the lead in providing loans with favorable interest rates to SMEs, which are more of a risk to them than large businesses, NPL ratios in the sector increase and profitability decreases.

While the relationship between the security variable and ROA was insignificant, the one between the latter and ROE was only 10 per cent significant and negative. The security variable reduced bank risk relative to both sdROA and sdROE. It was expected that bank risk would be reduced because a significant part of the security variable consisted of government-guaranteed bonds.

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6. CONCLUSION

This body of research has examined the impact of NNII on bank profitability and risk for 25 deposit banks operating uninterruptedly in Turkey in the period 2002-2021 with a dynamic panel data analysis method and a two-step system GMM estimator. In the post-2001 period, with the decline in the net interest margin in Turkey, banks attached more weight to NNII-generating activities than in previous periods. At the same time, after the breakout of the COVID-19 pandemic in Turkey in 2020, new regulations came into force to shape the banking sector's balance sheet. The regulations on the banking sector by the regulatory authority and the central bank reached dimensions that undermined the operability of the market mechanism and the ability of banks to use their resources most efficiently. Therefore, if these regulations continue in the coming years, NNII-generating activities are expected to carry more weight in the banking sector in Turkey. The BRSA's 2023 report stated that the operating costs of banks in Turkey increased due to regulations, and banks turned to NNII-generating activities to compensate for this situation, which affected their profitability and risks. Although the regulatory authority recognizes NNII as one of the crucial factors behind the profitability of Turkish banks, we need to find out whether the increase in yields leads to higher profit volatility. Knowing this information will guide the asset liability management of Turkish banks. Our findings show that NNII activities significantly increased profitability and reduced bank risk. Moreover, the COVID-19 pandemic decreased profitability and increased risk, as expected. Due to the results of our analysis pointing towards NNII increasing profitability and reducing risk in the banking sector in Turkey, it suggests that it acted as a significant shock absorber against an exogenous shock such as COVID-19 and/or regulations regulating bank balance sheets.

The discoveries from our analysis will be of great significance for regulators, bank managers, and investors in terms of income diversification in Turkish banks. NNII broadens the income base of banks, thereby reducing the risk of dependence on interest rates. In Turkey, interest rates have become increasingly volatile in recent years, mainly due to the government frequently changing central bank governors and using the policy rate as an experimental tool. This situation markedly elevates the interest rate risk faced by the sector. What is more, the recurrent macroeconomic instability in the Turkish economy renders it challenging for banks to collect loans. Our research has indicated that NPL, one of the control variables that we used, was associated with increased risk and decreased profitability. Therefore, an increase in loan losses will result in banks diversifying their activities to a greater extent. Macroeconomic instability also has the effect of increasing the general provision expense and decreasing net interest income. It would be reasonable to deduce that stabilizing economic policies positively impact the performance of banks, exerting a beneficial influence on traditional and non-traditional operating income.

This paper pointed out that banks increased their profitability and reduced their risks through non-traditional operating income, which may encourage banks operating in Turkey to further diversify their activities instead of focusing solely on traditional activities. To this end, they should analyze their sources of NNI and expenses and look for ways to increase their net interest income. Banks could reduce operational costs and enhance efficiency by investing more in digital transformation. Implementing digital banking services has the dual benefit of enhancing the customer experience and increasing profitability, achieved by optimizing the cost structure of banks. They could categorize their customer base and provide products and services tailored to each segment's specific requirements. The provision of personalized services may allow customer relationships with banks to be strengthened,

which could, in turn, lead to an increase in demand for additional paid services. However, overreliance on one single income source alone must be avoided and a balanced approach to income sources should be held. Banks should conduct their operations in compliance with the existing regulatory framework. Obeying regulations, especially related to commissions and fees, minimizes the legal risks of banks and supports sustainable profitability in the long term. The positive contribution of NNII to bank profitability and risk management indicates that banks should adopt strategies focused on income diversification, customer relationship management, digital transformation and operational efficiency. These strategies should help banks strengthen their competitive advantage, increase their resilience against interest rate risks and ensure long-term sustainable profitability.

As a limitation of our paper, it should be noted that we conducted sectoral analysis without considering the ownership structure of deposit banks. Therefore, the relationship between primary income sources and bank performance could be analyzed to see whether it differs according to the ownership structure by distinguishing between public, domestic and foreign private banks. Nonetheless, our study did analyze net NNII and bank performance. Determining the effect of NNII and expense sources on net NNII and, hence, on profitability and risk would be very useful in determining the composition of bank portfolios.

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Authors contribution

Conceptualization, N.A.B., T.K and A.E.B.; Methodology, N.A.B., T.K and A.E.B.; Software, N.A.B., T.K and A.E.B; Data acquisition, N.A.B., T.K and A.E.B.; Analysis and interpretation, N.A.B., T.K and A.E.B.; Writing- Preparation of the draft, N.A.B., T.K and A.E.B.; Writing-Revision & Editing, N.A.B., T.K and A.E.B. All authors read and agree with the published version of the manuscript.

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