INCOME DIVERSIFICATION AND PERFORMANCE OF COMMERCIAL BANKS IN TÜRKİYE

TARIK ALPEREN ER

Boğaziçi University

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DECLARATION OF ORIGINALITY

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ABSTRACT

Income Diversification and Performance of Commercial Banks in Türkiye

This thesis examines the impact of income diversification on bank performance by using the quarterly data of commercial banks from a large developing economy, Türkiye. The results show that diversification towards non-interest income generating activities improves bank profitability. Moreover, this improvement in bank profitability does not arise with the cost of higher risk. In other words, the higher degree of income diversification does not harm the risk-return trade-off (risk-adjusted profitability) because the gains in profitability offset the increase in earnings volatility. The results are also robust to the choice of the sample period, to the choice of explanatory variables, and to the examination of risk-return trade-off with a shorter-term risk perspective. Considering that Turkish commercial banks have a relatively lower share of non-interest income, this study underscores an implication for bank management and regulators that there can be still untapped potential for banks to be exploited through the diversification of income generating activities.

ÖZET

Gelir Çeşitliliği ve Türk Mevduat Bankalarının Performansı

Bu tez Türkiye'deki mevduat bankalarının çeyreklik frekanstaki verilerini kullanarak gelir çeşitliliğinin mevduat bankalarındaki karlılık performansına etkisini incelemektedir. Sonuçlar, faiz dışı gelir üreten faaliyetlere daha fazla yönelimin banka karlılığını artırdığını göstermektedir. Ayrıca, karlılıktaki bu ilerleme beraberinde daha yüksek risk maliyeti getirmemektedir. Daha yüksek seviyede gelir çeşitliliğinin banka karlılığında getirdiği iyileşme gelir oynaklığındaki artışı kompanse ettiğinden, daha yüksek gelir çeşitliliği risk-getiri ödünleşiminde olumsuz bir etki yaratmamaktadır. Ayrıca sonuçlarımız, alternatif örneklem dönemleri ve açıklayıcı değişkenler kullandığımız ve risk-getiri ödünleşimini daha kısa vadeli bir perspektif ile ele aldığımız analizlerimizde de tutarlılık göstermektedir. Türkiye'deki mevduat bankalarının görece düşük seviyede faiz dışı gelir oranına sahip olmasını dikkate alarak bu çalışma, bankaların gelir üretme faaliyetlerini çeşitlendirerek henüz yeterince istifade edilmemiş olabilecek bir potansiyelden faydalanılabileceği çıkarımında bulunmaktadır.

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CHAPTER 1

INTRODUCTION

Along with the deregulation process and increased market competition, innovations in communication and financial technologies have led to major changes in the implementation of banking activities over the last three decades (DeYoung & Torna, 2013; Lepetit, Nys, Rous, & Tarazi, 2008). As an outcome of these changes, banking systems have experienced a shift away from traditional income sources, which are generated through deposit holding and lending activities, towards non-interest income generating activities. Especially in the US, the trend of diversifying into new non-traditional banking activities started in the 1980s and was accelerated by the Gramm-Leach-Billey Act of 1999, which enabled banks to engage more freely in non-traditional banking activities (Saunders, Schmid, & Walter, 2020). In light of these developments, a stream of research has emerged to investigate whether banks' diversifying into new business lines and products enhances their profitability and affects their riskiness, with the prior studies that address the case of the US banking system (DeYoung & Rice, 2004; DeYoung & Roland, 2001; Stiroh, 2004a, 2004b; Stiroh & Rumble, 2006). These studies are followed by papers researching European countries in this context (Chiorazzo, Milani, & Salvini, 2008; Köhler, 2015; Lepetit et al., 2008; Mercieca, Schaeck, & Wolfe, 2007). Most of the studies that address developed countries (US and Europe) show that higher involvement in non-interest income generating activities is often associated with higher bank profitability; however, the findings on the risk-return trade-off are mixed[1].

[1] Potential channels that are expected to affect the risk-adjusted profitability of banks are discussed in Section 3.1.

On the other hand, the later studies that focus on emerging economies generally find that a higher share of non-interest income or higher income diversification improves both banks' profitability and risk-adjusted profitability (Buyuran & Ekşi, 2020; Gürbüz, Yanık, & Aytürk, 2013; Meslier, Tacneng, & Tarazi, 2014; Sanya & Wolfe, 2011).

This thesis examines the relationship between income diversification and the performance of commercial banks in Türkiye, using quarterly data of the largest 20 commercial banks from 2013Q1 to 2022Q3. We analyze the effects on both profitability and risk-adjusted profitability as components of banks' profitability performance. To our knowledge, there are two noteworthy studies that address the impact of income diversification on bank performance in the case of Türkiye (Buyuran & Ekşi, 2020; Gürbüz et al., 2013). Our study contributes to these studies in three aspects. First, we cover a more extended period with more frequent data compared to these studies; hence, we are able to exploit the information across quarters, unlike these studies. Second, differently than these studies, we fully control for the homogenous effects of time trends and macroeconomic conditions and better isolate the relationship between bank characteristics and bank performance thanks to our empirical setting with year x quarter fixed effects. Considering the dynamic change of both banks' non-interest income share and profitability across quarters and years (Figure 2), it is essential to control for these potential channels other than bank-specific characteristics. Third, we also utilize risk-adjusted profitability measures calculated with short-term rolling volatility unlike Gürbüz et al. (2013), and implement several other robustness checks to ensure the validity of our results. It is especially necessary to examine the risk-return trade-off with a shorter-term risk perspective, considering the varying income structure of banks over periods and the potential upward effect of non-interest activities on return volatility asserted by the prior studies in the literature (DeYoung & Rice, 2004; DeYoung & Roland, 2001; Stiroh, 2004a)

We provide new evidence on the positive relationship between income diversification and banks' profitability and risk-adjusted profitability with both statistically and economically significant results, in line with the previous studies that focus on emerging economies. We also implement several robustness tests to ensure the validity of our results. First, we calculate our risk-adjusted profitability measures by adjusting with shorter-term rolling volatility in addition to our baseline risk-adjusted profitability measures, which are adjusted by sample standard deviations as in Chiorazzo et al. (2008) and Gürbüz et al. (2013). Second, we repeat our analyses on the sample that excludes the post-COVID period (2013Q1-2019Q4) and the sample that covers the period after the Global Financial Crisis (2010Q1-2022Q3). Third, we use alternative variables to proxy income diversification and some control variables. In general, our results are robust to these tests in terms of both statistical and economic significance.

The remainder of the thesis is structured as follows. Section 2 briefly reviews the existing literature. Section 3.1 and 3.2 describe the dataset and variables we employed and discuss the potential channels of the impact of income diversification on bank performance, while Section 3.3 explains our empirical methodology. Section 4 reports the findings of our baseline analyses, and Section 5 presents the results of robustness checks. Lastly, Section 6 summarizes our findings and concludes the study.

CHAPTER 2

LITERATURE REVIEW

There is a large strand of literature that studies the relationship between income diversification and bank performance. Many of the prior studies in this strand of literature research the cases of developed economies (Chiorazzo et al., 2008; DeYoung & Rice, 2004; DeYoung & Roland, 2001; Lepetit et al., 2008; Stiroh, 2004a, 2004b). Among these studies, DeYoung and Roland (2001) examine the relationship between fee-based activities and revenue volatility using a sample of 472 US commercial banks from 1988 to 1995. Their results show that shifting towards more fee-based activities is associated with higher profitability but also with higher volatility in earnings. Stiroh (2004a) also finds that a greater share in non-interest income activities decreases risk-adjusted profitability by showing that non-interest income is more volatile than net interest income with the US banks for the period between 1984 and 2001. However, both DeYoung and Roland (2001) and Stiroh (2004a) estimate cross-sectional regressions with the bank-level means of each variable; hence, they cannot exploit time-series information in the relevant period. DeYoung and Rice (2004), however, examine US commercial banks between 1989 and 2001 with an empirical setting that enables them to account for the time series information in the data and control for time trends[2]. Their findings show that marginal increases in the share of non-interest income activities tend to be associated with higher profitability, higher volatility in profits, and, on net, worsened risk-return trade-off (risk-adjusted profitability) for the average US commercial bank in the relevant period. More recently, Saunders et al. (2020) analyze the effect of non-interest income share on the performance of US banks with a relatively more comprehensive sample, which includes more than 12,000 US banks and covers the period between 1984Q1 and 2013Q4. Their findings imply a positive relationship between the share of non-interest income and bank profitability. Saunders et al.

[2]DeYoung and Rice (2004) use six-year rolling averages of their dependent and explanatory variables in their panel regressions. They also include time dummies to control for intertemporal sources of variation.

(2020) also show that higher reliance on non-interest income is associated with higher volatility of profits and higher insolvency risk; however, the results regarding the risk-adjusted profitability are unclear.

On the other hand, the papers that study European countries document differing findings, especially for the risk-return trade-off. Using a sample of 755 small banks for the period between 1997 and 2003, Mercieca et al. (2007) suggest that small European banks do not benefit from income diversification. Their results imply that non-interest income activities are negatively associated with both profitability and risk-adjusted profitability. Moreover, Lepetit et al. (2008) show that the banks with a higher share of non-interest income activities present higher profitability risk and insolvency risk compared to the banks whose main source of income comes from traditional lending activities. In contrast to these findings, Chiorazzo et al. (2008) and Köhler (2015) display a positive effect of income diversification on bank performance. Köhler (2015) analyzes the effect of business models on bank stability by using a dataset that consists of banks from 15 European countries and covers the period of 2002-2011. The findings suggest that the banks with a higher share of non-interest income activities are more stable and profitable, indicating a significant potential to benefit through income diversification. In line with Köhler (2015), Chiorazzo et al. (2008) find a positive linkage between income diversification and risk-adjusted profitability for Italian banks. They also report that the gains arising from income diversification are stronger for larger banks; however, there are also limits to diversification gains as banks get larger.

There are also few studies that focus on the case of emerging economies in this topic. Contrasting with many of the papers that focus on developed economies, these studies on emerging economies generally highlight the positive impact of income diversification on bank performance. Sanya and Wolfe (2011) examine the effect of income diversification on bank performance and risk with a sample of 226 listed banks across 11 emerging economies. Their findings show that diversification across and within both interest and non-interest income generating activities reduces

banks' insolvency risk and improves their risk-adjusted profitability. Pennathur, Subrahmanyam, and Vishwasrao (2012) investigate the heterogeneous effect of diversification on profitability and insolvency risk measures for banks with different ownership structures in India. They find that diversifying into fee-based activities reduces the earning volatility for public sector banks; however, higher reliance on these activities increases profitability risk for private domestic and foreign banks. Furthermore, a higher share in fee-based income reduces the default risk for both public and private domestic banks, in line with Sanya and Wolfe (2011). Meslier et al. (2014) also find that a higher share of non-interest income brings both higher profits and risk-adjusted profits for Philippine banks.

Lastly, to our knowledge, two noteworthy studies address the impact of income diversification on bank performance in the case of Türkiye, a large developing economy with a bank-based financial system. Gürbüz et al. (2013) investigate the relationship between income diversification and risk-adjusted profitability by using annual data of 26 Turkish commercial banks for the period between 2005 and 2011, and they find that income diversification increases the risk-adjusted profitability performance of Turkish commercial banks in the relevant period. On the other hand, Buyuran and Ekşi (2020) examine the effect of income diversification on profitability with the annual data of 14 banks for the period of 2010-2017 and document that a higher degree of diversification is associated with higher profitability.

CHAPTER 3

DATA & RESEARCH DESIGN

3.1 Data

In this study, we exploit the dataset derived from quarterly balance sheets, income statements, and selected ratios provided by banks to the Banks Association of Türkiye (BAT)[3]. Our baseline analyses cover 39 quarters in the period between 2013Q1 and 2022Q3. Through the sample period, total of 57 banks actively operated in the Turkish banking sector, which consists of 35 commercial banks, 16 development and investment banks, and 6 participation banks in the relevant period. However, 3 of the commercial banks had been transferred to be operated by the Savings Deposit Insurance Fund of Türkiye (SDIF). Since our study focuses on income diversification and the performance of commercial banks, we exclude development and investment banks and participation banks from our scope. We also exclude the commercial banks transferred to SDIF because it is expected that the objective function of SDIF is likely to differ from the objectives of a self-managed commercial bank[4]. On the other hand, we also excluded the branches of banks that are founded in foreign countries and remarkably small banks due to their observable incongruities with the operations of a traditional commercial bank in Türkiye, which is expected to have deposit holding and lending as the main business operations. Consequently, our final sample contains the largest 20 commercial banks by asset size in the Turkish banking sector during the sample period. These 20 banks that consitute our regression sample represent 86.3% of the whole Turkish banking sector and 98.6% of all commercial banks in Türkiye in terms of the total asset size during the period between 2013Q1 and 2022Q3[5].

[3] More specifically, we use the database named "Quarterly Statistics by Banks (All Periods)", which is shared on the website of the Banks Association of Türkiye (BAT).

[4] SDIF is a public legal entity that is responsible for strengthening the financial source of, restructuring, transferring, merging, selling or liquidating the transferred banks, which cannot meet some particular conditions, such as not being able to fulfill its liabilities in its maturity, having liabilities that exceed the total of its assets, or in cases continuing to perform their businesses present a danger to the beneficiaries of commercial fund and stability of the financial system, etc.

[5] Table A1 in the Appendix section shows the list of banks included in our regression analyses.

3.2 Variables

3.2.1 Variables of interest: income diversification

This study analyzes whether commercial banks' deviations from their primary income source (interest-earning income) to non-interest income activities or more diversified income structure of commercial banks are associated with their profitability and profitability riskiness. Therefore, variables measuring the income diversification of banks are primarily in our focus. According to the theoretical point of view, banks may enhance their efficiency and profitability, benefiting economies of scope by extending their fixed costs and existing customer base/lending relationships over alternative products and business lines thanks to diversification in income structure (Lown, Osler, Sufi, & Strahan, 2000; Saunders & Walter, 1994). There is also conventional wisdom that postulates shifting towards non-interest income generating activities may lower the volatility of banks' profits and their riskiness. One potential channel of this argument is expected to be realized through diversification effects. Since non-interest income is believed to covary imperfectly with earnings from traditional interest income generating activities, income diversification gained by shifting towards non-interest income products may stabilize banks' stream of profits (Chiorazzo et al., 2008). Another potential channel is that non-interest income sources may be less sensitive to macroeconomic conditions and business cycles compared to interest-earning banking activities; hence, income diversification boosted by non-interest income generating activities may reduce the cyclical variation in bank earnings and support the stabilization of bank profitability (Albertazzi & Gambacorta, 2009; Stiroh, 2004a)[6]. On the other hand, various studies empirically exhibited that even if higher involvement in non-interest income activities is associated with higher profitability, it can also bring higher volatility in bank

[6]Some studies support the argument that interest income is more prone to overall economic conditions compared to non-interest income. For instance, Dang and Nguyen (2022), using bank level data from Vietnam during 2007- 2019, shows that banking uncertainty reduces the overall return of banks, and this decline in bank profitability arises from the adverse effect of uncertainty on net interest income, which is not compensated by improvements in non-interest income. Albertazzi and Gambacorta (2009), a cross-country study with ten countries from Europe, show that net interest income is positively correlated with business cycles, whereas non-interest income is not significantly affected by the changes in the GDP.

earnings (Demirgüç-Kunt & Huizinga, 2010; DeYoung & Roland, 2001; Stiroh, 2004a). DeYoung and Roland (2001) claim three possible channels that explain why non-interest income generating activities may lead to higher volatility in bank earnings. The first reason suggested under this argument is based on the switching cost of an existing lending relationship. Since switching and information costs make it costly for borrowers and lenders to walk away from a lending relationship, it is less likely to lose their customer base of interest income generating activities for banks (Chiorazzo et al., 2008; DeYoung & Roland, 2001). On the other hand, banks may be exposed to higher fluctuation in the demand for non-interest income generating activities due to the higher competitive rivalry, lower information costs, and less stable demand of customers for non-interest income services. Therefore, banks' earnings from traditional lending activities may be relatively more stable over time, even if it is more sensible to economic conditions and interest rate fluctuations (Chiorazzo et al., 2008; DeYoung & Roland, 2001). Second, shifting towards non-interest income activities may require high fixed costs in technological developments and human capital; hence, it may increase the operational cost and leverage of banks and earning volatility. Third, because some of the non-interest income generating activities are subject to little or no capital and regulatory requirements, volatility of bank earnings may rise due to a higher level of financial leverage.

To measure the degree of banks' income diversification, we use an adjusted Herfihndal-Hirschman index (HHI) as our primary variable of interest (*DIV_HHI*) in our baseline analyses, following Elsas, Hackethal, and Holzhäuser (2010):

$$DIV\_HHI = 1 - \left(\left(\frac{INT}{REV} \right)^2 + \left(\frac{FEE}{REV} \right)^2 + \left(\frac{TRAD}{REV} \right)^2 + \left(\frac{OTHER}{REV} \right)^2 \right) \quad (1)$$

In Equation (1), *INT* denotes gross interest income, *FEE* denotes fee & commission-based income, *TRAD* denotes trading income and *OTHER* denotes other operating income, and the denominator, *REV*, is the total gross operating income which is the total of *INT*, *FEE*, *TRAD* and *OTHER*. Differently from the studies that use the ratio of non-interest income to revenue/interest income (Gambacorta, Scatigna, & Yang, 2014; Lepetit et al., 2008; Li, Feng, Zhao, & Carter, 2021; Saunders et al., 2020) and the studies that compute HHI with interest income and aggregated non-interest income as proxies for income diversification (Chiorazzo et al., 2008; Gürbüz et al., 2013)[7], our measurement enables us to disaggregate non-interest income into its components and account for the dispersion in the non-interest income as well. Accounting for components of non-interest income to measure diversification might carry informational value because some non-interest income activities, especially fee & commission-based income activities, may be highly correlated with interest income. This potential positive correlation is expected to be generated through cross-selling of different products to the same customer on lending activities, as mentioned by Stiroh (2004a). Moreover, following the aforementioned studies in the literature, we also use the ratio of aggregated non-interest income to total income (*DIV_NII*) as an additional measurement for diversification in our robustness checks.

[7] Chiorazzo et al. (2008) also use the HHI index computed using components of non-interest income in their robustness checks. However, they use the HHI index computed by interest income and aggregated non-interest income as the measure of income diversification in their main specification.

3.2.2 Dependent variables: profitability & risk-adjusted profitability

We employ several alternatives of dependent variables to assess bank performance. Banks' profitability is proxied by return on assets (*ROA*) and return on equity (*ROE*), which are calculated as profit before tax divided by total assets and equity, respectively (Apergis, 2014; Athanasoglou, Brissimis, & Delis, 2008; Dang & Nguyen, 2022; Demirgüç-Kunt & Huizinga, 2010). We chose to use profits before taxes as the measurement for bank returns because it better reflects the efficiency of banks in income generation and is not exposed to potential heterogeneity in the effective tax rate across banks and periods (Dang & Nguyen, 2022). However, examining only the relationship between income diversification and bank profitability might be misleading because the activities that generate non-interest income, which is expected to be the driver of the income diversification for commercial banks, may bring higher volatility in banks' profits and create a potential risk on the stable earning generation for banks (DeYoung & Roland, 2001). Therefore, we also use risk-adjusted profitability measures as dependent variables in our analyses to assess the effect of income diversification on bank performance. Following Stiroh (2004a) and Chiorazzo et al. (2008), first, we adjust our profitability measures for volatility by dividing them with their standard deviation over the sample period and obtain risk-adjusted profitability measures (*SHROA* and *SHROE*), which are also known as Sharpe ratios in the literature:

$$SHROA_{b,t} = \frac{ROA_{b,t}}{\sigma_{ROA_b}} \tag{2}$$

$$SHROE_{b,t} = \frac{ROE_{b,t}}{\sigma_{ROE_b}} \tag{3}$$

However, if the level of income diversification of banks changes dynamically across periods, as observed in Figure 2, and if we assume the argument that asserts the activities which generate non-interest income may increase the volatility of profits is expected to be correct, then adjusting profitability by its sample standard deviation

might underestimate (overestimate) Sharpe ratios in short term perspective when there is a higher (lower) level of income diversification. In order to mitigate this concern, we also use Sharpe ratios adjusted with shorter-term rolling standard deviations in our analyses under robustness checks (Section 5.1). Following Saunders et al. (2020), we adjust our profitability measures with standard deviations computed over a rolling window of the last 8 quarters (*SHROA_p8* and *SHROE_p8*) and the last 12 quarters (*SHROA_p12* and *SHROE_p12*). Moreover, as an alternative to Sharpe ratios used by Saunders et al. (2020), we also measure Sharpe ratios that are adjusted with 8 quarters rolling standard deviations computed over the last 5 quarters and next 3 quarters (*SHROA_p5f3* and *SHROE_p5f3*).

3.2.3 Control variables

To mitigate concerns regarding the omitted variable bias, we also use several bank-specific control variables, which are expected to be related with profitability, riskiness, and income diversification. First, we use *SIZE*, which is measured as the natural logarithm of banks' inflation-adjusted total assets, to control for the effect of bank size on profitability and risk-adjusted profitability (Chiorazzo et al., 2008; DeYoung & Rice, 2004; Stiroh, 2004a; Stiroh & Rumble, 2006). Considering larger banks are able to allocate more resources to technological investments, R&D, and human capital; they can build more developed risk management compared to small-sized banks. Moreover, large banks may be better able to expand their operations across customers, business lines, and regions. On the other hand, small banks may benefit from their operational flexibility by dynamically adjusting their strategy in accordance with macroeconomic fluctuations. Second, we control for the capital structure of banks by *EQUITY*, which is measured as total equity divided by total assets, in our baseline analyses. Alternatively, we use *CAR*, the regulatory capital adequacy ratio calculated as total equity divided by risk-weighted assets, to proxy the capitalization of banks in our robustness checks. Stiroh (2004b) and Chiorazzo et al. (2008) use capital structure as a proxy for banks' risk aversion,

where a higher level of capitalization is a sign of higher risk aversion, and vice versa. Considering the conventional risk-return hypothesis, it can be expected that banks with higher shares of equity may have lower returns compared to risk-seeking banks with lower capitalization ratios. However, a higher share of capital may also support banks' profitability through different channels. Banks with higher equity ratio can utilize their capital buffer to maintain their profitability against economic downturns and to be less exposed to exogenous shocks. Moreover, the stronger capital structure can reduce banks' need for external financing and reduces their funding cost by increasing their creditworthiness (Dietrich & Wanzenried, 2011). Our third control is the credit risk of banks. We utilize two alternatives to proxy credit risk: the ratio of non-performing loans to total loans (*NPL*) in our baseline analyses (Apergis, 2014; Chiorazzo et al., 2008; Saunders et al., 2020) and the ratio of loan-loss provision to total loans (*LOSS_PROVISION*) in our robustness checks (Athanasoglou et al., 2008; Dietrich & Wanzenried, 2011). A deterioration in the credit quality of banks reduces the expected returns of already granted loans; hence, it is expected to be negatively linked with bank profitability. Fourthly, we control for the liquidity of banks' assets. We utilize two alternatives to measure liquidity as well. In our baseline analyses, we utilize the ratio of the sum of cash & reserves, payables from banks, and payables from the money market to total assets ratio (*LIQUIDITY1*), taking as reference the definition of liquid assets used by BAT for the period after 2018. Our second proxy for liquidity (*LIQUIDITY2*) is calculated as the sum of cash & reserves, payables from banks, payables from the money market, and marketable securities[8]. Fifth, we control for the asset growth of banks (*GROWTH*), which is measured as the annual growth rate of inflation-adjusted total assets. *GROWTH* is assumed to capture banks' preference for risk-taking, with the expectation that risk-loving bank managements would prefer more aggressive growth strategies and prioritize faster growth over the more stable stream of profits (Chiorazzo et al., 2008; Stiroh, 2004a). Lastly, we control for the foreign exchange exposure of banks (*FX_POSITION*). Türkiye

[8] *LIQUDITY2* is constructed based on the liquid asset definition used by BAT for the period between 2009 and 2018.

experienced multiple exchange rate shocks during our sample period, and the volatility of exchange rate movements also increased in these shock periods (Figure 1)[9][10]. Even if higher exchange rate volatility can create a return opportunity for banks through foreign exchange (FX) transactions, it is also linked with higher volatility in these returns. Also, a balance sheet with a higher mismatch between FX-denominated liabilities and FX-denominated assets increases the sensitivity of banks to exchange rate movements, and banks' higher exposure to FX rate risk can impact their returns, especially during the shock periods. We measure *FX_POSITION* as the difference between on- and off-balance sheet FX-denominated assets minus on- and off-balance sheet FX-denominated liabilities divided by total assets. The higher *FX_POSITION* implies lower exposure to FX rate risk.

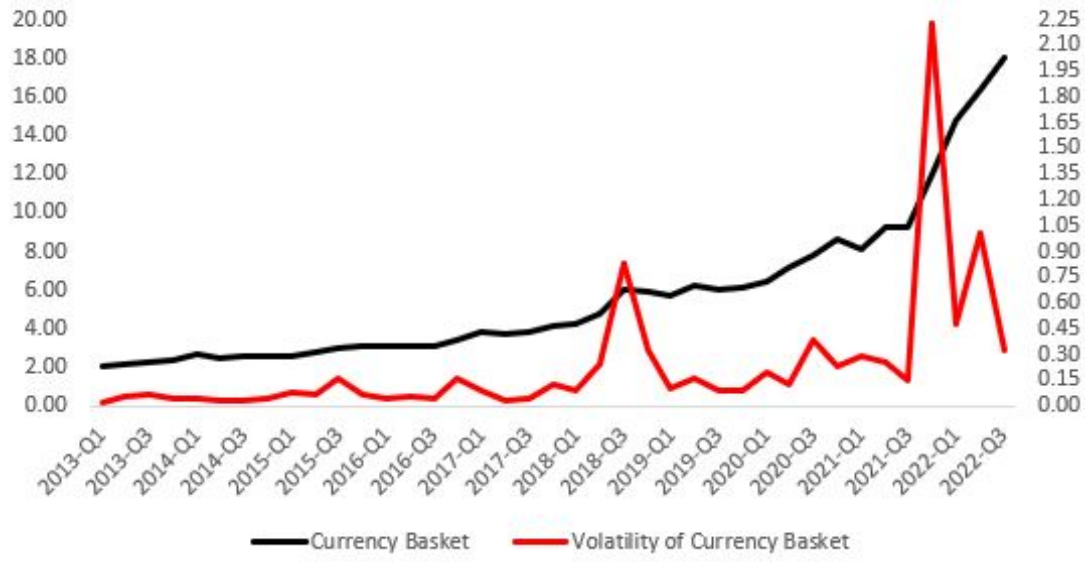

Figure 1. Currency basket movements in Türkiye (2013Q1-2022Q3)

Table 1 lists all variables we employed in our baseline analyses and robustness checks.

[9] In Figure 1, the black line (left axis) displays the rate of currency basket, and the red line (right axis) displays the standard deviation of the currency basket. Calculations are based on the quarterly mean and standard deviation of daily Turkish lira (TL)/Currency Basket parity. USD and EUR have equal weight in our currency basket. Source: Author's calculations from the data of the Central Bank of Türkiye (CBRT)

[10] It is also noteworthy that even in periods when there were no sudden exchange rate shocks after 2018, exchange rate volatility remained higher compared to the period before 2018.

Table 1. Variable List

Variables	Definitions
A. Baseline	
ROA	Operating Profit/Total Assets
ROE	Operating Profit/Equity
SHROA	ROA divided by standard deviation of ROA
SHROE	ROE divided by standard deviation of ROE
DIV_HHI	Defined in Equation (1)
EQUITY	Equity/Total Assets
SIZE	Logarithm of inflation-adjusted total assets
NPL	Non-performing Loans/Total Loans
GROWTH	Annual growth of inflation-adjusted total assets
FX_POSITION	(On- and Off-balance sheet FX denominated assets - On- and Off-balance sheet FX denominated liabilities)/Total Assets
LIQUIDITY1	(Cash Reserves + Payables from Banks + Payables from Money Market)/Total Assets
B. Robustness Checks	
SHROA_p8	ROA divided by standard deviation of ROA in last 8 quarters (from t-7 to t)
SHROE_p8	ROE divided by standard deviation of ROE in last 8 quarters (from t-7 to t)
SHROA_p12	ROA divided by standard deviation of ROA in last 12 quarters (from t-11 to t)
SHROE_p12	ROE divided by standard deviation of ROE in last 12 quarters (from t-11 to t)
SHROA_p5f3	ROA divided by standard deviation of ROA in last 5 quarters and next 3 quarters (from t-4 to t+3)
SHROE_p5f3	ROE divided by standard deviation of ROE in last 5 quarters and next 3 quarters (from t-4 to t+3)
DIV_NII	Non-Interest Income/Total Income
CAR	Equity/Risk-Weighted Assets
LOSS_PROVISION	Loan Loss Provision/Total Loans
LIQUIDITY2	(CashReserves + Payables from Banks + Payables from Money Market + Marketable securities)/Total Assets

3.3 Methodology

To explore the relation between banks' income diversification and their profitability performance, we estimate fixed effect regressions at bank-quarter level under our baseline analyses and robustness checks. Our specification is expressed in Equation (4):

$$PROFITABILITY_{b,t} = \alpha + \beta DIVERSIFICATION_{b,t-1} + \vartheta CONTROLS_{b,t-1} + \psi_b + \gamma_t + \varepsilon_{b,t} \quad (4)$$

In Equation (4), $PROFITABILITY_{b,t}$ represents the set of variables we employed to measure banks' returns (*ROA* and *ROE*) and risk-adjusted returns (*SHROA*, *SHROE*, *SHROA_p8*, *SHROE_p8*, *SHROA_p12*, *SHROE_p12*, *SHROA_p5f3*, *SHROE_p5f3*). $DIVERSIFICATION_{b,t-1}$ represents our variables of interest, which are *DIV_HHI* and *DIV_NII* in our baseline analyses and robustness checks, respectively. As we mentioned in Section 3.2, we also control for a set of bank characteristics ($CONTROLS_{b,t-1}$) that are expected to be associated with bank profitability and/or banks' income structure. $CONTROLS_{b,t-1}$ includes the variables of *SIZE*, *EQUITY*, *NPL*, *LIQUIDITY1*, *GROWTH*, and *FX_POSITION*, which are described in detail under Section 3.2. Alternatively, we replace *EQUITY* with *CAR*, *NPL* with *LOSS_PROVISION*, and *LIQUIDITY1* with *LIQUIDITY2* as a robustness check in Section 5.3. To alleviate potential omitted variable bias that may stem from unobserved and time-invariant characteristics of banks, we include bank fixed effects in all our regressions (ψ_b). Moreover, considering the dynamic change of non-interest income activities of banks over periods (Figure 2), it is also essential to control for time trends that are expected to be related with bank profitability and income structure. Therefore, we include time fixed effects (γ_t) in all our regressions[11]. Since we study a single country setup, utilizing time fixed effects (year x quarter) enables us to control for the homogenous effect of all possible macro factors, which are

[11] We tested the joint significance of time dummies in our baseline regressions. Test statistics fail to accept the null hypothesis that the coefficients of period dummies are jointly equal to 0; hence, we conclude time fixed effects are needed in our analyses.

shown to have an impact on banks' performance and their components of income sources by the previous studies in the literature (Albertazzi & Gambacorta, 2009; Athanasoglou et al., 2008; Borio, Gambacorta, & Hofmann, 2017; Dang & Nguyen, 2022; Demirgüç-Kunt & Huizinga, 1999; Dietrich & Wanzenried, 2011; Molyneux & Thornton, 1992). In addition, to mitigate endogeneity concerns arising from the reverse causality between the dependent variable and explanatory bank characteristics, we lag all explanatory variables by one period (quarter).

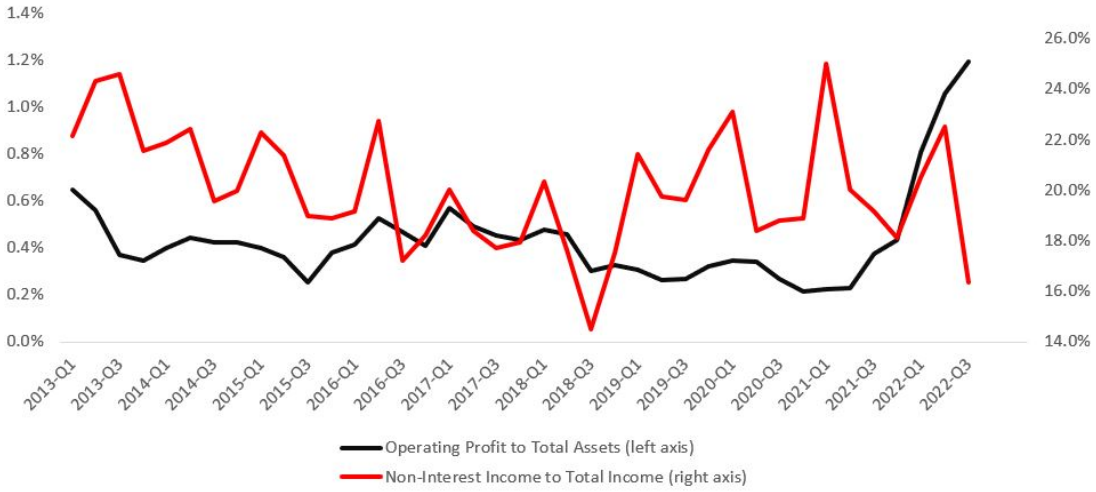

Figure 2. Evolution of Turkish commercial banks' profitability and non-interest income shares

For efficiency concerns of our estimation, we employ modified Wald test for heteroskedasticity[12] (Greene, 2003), Wooldridge test for autocorrelation[13] (Wooldridge, 2010), and Breusch-Pagan LM test (Breusch & Pagan, 1980) and Pesaran's test (Pesaran, 2004) for cross-sectional dependence[14] in the residuals. The test statistics are reported in Table 2.

Table 2. Efficiency Tests

Model	(1)		(2)		(3)		(4)	
Dependent Variable	ROA		ROE		SHROA		SHROE	
	Test Stats	p-value	Test Stats	p-value	Test Stats	p-value	Test Stats	p-value
Modified Wald Test	417.37	0.00	2853.18	0.00	70.96	0.00	139.96	0.00
Wooldridge Test	7.35	0.01	4.48	0.05	15.97	0.00	17.23	0.00
Breusch-Pagan LM Test	652.62	0.00	809.71	0.00	560.07	0.00	540.32	0.00
Pesaran's Test	-3.74	0.00	-2.56	0.01	-3.62	0.00	-3.34	0.00

The test statistics reported in Table 2 imply that the residuals of regressions estimated with robust standard errors have heteroskedasticity, first-order autocorrelation, and cross-sectional dependence. To handle these drawbacks in our estimations, we employ Driscoll and Kraay (1998) correction for the covariance matrix estimator that produces heteroskedasticity- and autocorrelation-consistent standard errors that are robust to cross-sectional and temporal dependence (Hoechle, 2007)[15].

[12] The null hypothesis of modified Wald test is that there is no heteroskedasticity in residuals.

[13] The null hypothesis of Wooldridge autocorrelation test is that there is no first-order autocorrelation in residuals.

[14] The null hypotheses of both Breusch-Pagan LM test and Pesaran's test state that there is no cross-sectional correlation in residuals.

[15] All regression results reported in this study are estimated with Driscoll-Kraay standard errors, applying the Stata module "xtscc" suggested by Hoechle (2007).

CHAPTER 4

RESULTS

4.1 Descriptive statistics

Panel A of Table 3 presents the summary statistics of the variables employed in our baseline models for the period between 2013Q1 and 2022Q3, while Panel B reports the summary statistics of additional variables included in robustness checks. The mean (median) value of *ROA* and *ROA* are 0.4% (0.4%) and 3.9% (3.5%) during the sample period, respectively. The descriptive statistics of our variables of interests (*DIV_HHI* and *DIV_NII*) indicate that commercial banks in our sample have relatively lower level of diversification in their income structure and they are more engaged in interest earning activities. The mean (median) *DIV_HHI* is 0.233 (0.25), whereas the mean (median) *DIV_NII* is only 14.5% (14.4%). Besides the low level of diversification on average, we observe remarkable variation in diversification measures over the sample period[16], which is expected to enable us to test our main hypothesis of whether banks with higher income diversification result in better profitability performance. However, considering the dynamic change of share of non-interest income share over periods for the whole sample (Figure 2), the variation in diversification measures may potentially be driven by the variation across periods rather than the cross-sectional variation among panel units. To eliminate this concern, we also check the variation of diversification measures for all periods separately[17]. The standard deviation of *DIV_HHI* (*DIV_NII*) ranges between 0.09 and 0.276 (between 0.049 and 0.155), from the period with the lowest variation to the highest, implying there is a considerable cross-sectional variation in income diversification measures to be exploited. On the other hand, an average (median) commercial bank has 10.2% (10.1%) share of equity to total assets (*EQUITY*), 4% (3.8%) of non-performing loans to total loans (*NPL*), 18.1% (15.4%) of highly liquid assets to total assets ratio (*LIQUIDITY1*) over the sample period. It is also notable that an

[16] The standard deviations of *DIV_HHI* and *DIV_NII* are 0.161 and 0.094 respectively.

[17] We did not report the results of cross-sectional variation in income diversification measures for all periods for the sake of brevity. It is available upon request.

average commercial bank experienced relatively high annual growth performance in real terms (the mean *GROWTH* is 7.7%) and does not have significant level of exposure to FX rate risk compared to its total assets (the mean *FX_POSITION* is 0.2%).

Table 3. Descriptive Statistics

	Obs	Mean	Sd	p10	p25	Median	p75	p90
A. Baseline								
ROA (in percent)	776	0.398	0.409	0.036	0.171	0.351	0.515	0.759
ROE (in percent)	776	3.862	4.057	0.396	1.914	3.546	5.030	7.123
SHROA	776	1.331	1.187	0.108	0.566	1.147	1.965	2.771
SHROE	776	1.285	1.179	0.098	0.550	1.090	1.840	2.740
DIV_HHI	776	0.233	0.161	0.037	0.147	0.250	0.335	0.419
EQUITY	776	0.102	0.027	0.068	0.083	0.101	0.117	0.138
SIZE	776	9.909	1.357	8.196	8.623	9.957	11.352	11.561
NPL	776	0.040	0.021	0.018	0.024	0.038	0.053	0.066
GROWTH	776	0.077	0.188	-0.111	-0.012	0.069	0.144	0.240
LIQUIDITY1	776	0.181	0.090	0.114	0.133	0.154	0.191	0.289
FX_POSITION	776	0.002	0.009	-0.008	-0.002	0.001	0.006	0.013
B. Robustness Checks								
SHROA_p8	776	3.056	2.755	0.169	1.086	2.798	4.060	6.520
SHROE_p8	776	3.187	2.800	0.203	1.247	2.886	4.344	6.546
SHROA_p12	776	2.662	2.251	0.175	0.900	2.531	3.934	5.242
SHROE_p12	776	2.774	2.252	0.197	1.031	2.759	4.072	5.537
SHROA_p5f3	776	2.872	2.684	0.171	1.083	2.366	4.025	6.038
SHROE_p5f3	776	2.968	2.697	0.168	1.152	2.444	4.189	6.152
DIV_NII	776	0.145	0.094	0.029	0.089	0.144	0.202	0.261
CAR	776	0.171	0.033	0.137	0.145	0.164	0.187	0.211
LOSS_PROVISION	776	0.036	0.021	0.013	0.020	0.033	0.049	0.065
LIQUIDITY2	776	0.274	0.102	0.181	0.210	0.248	0.304	0.396

Table 4 exhibits the pairwise correlation coefficients of the variables used in our baseline regressions to conduct the preliminary analyses of the relationships between the dependent variables and explanatory variables, and examine whether there is a potential multicollinearity problem among explanatory variables[18]. In general, correlation coefficients between the profitability measures and explanatory variables are statistically significant and consistent with the expectations. The correlation coefficients of the variable of interest (*DIV_HHI*) imply that income diversification is positively correlated with profitability and risk-adjusted profitability. The correlation coefficients of *SIZE*, *EQUITY*, and *NPL* are also consistent with the

[18]For the sake of brevity, we did not include *ROE* and *SHROE* in the correlation matrix. *ROA* and *SHROA* represent the profitability and risk-adjusted profitability measures in the correlation matrix.

expectations. *SIZE* and *EQUITY* are positively correlated with profitability and risk-adjusted profitability, whereas *NPL* is negatively correlated with both dependent variables (*ROA* and *SHROA*). On the other hand, the strongest correlation coefficient among explanatory variables is -0.40, which is the coefficient between *SIZE* and *LIQUIDITY1*. Also, the correlation coefficients between *DIV_HHI* and other control variables vary between -0.07 and 0.17. Briefly, Table 4 supports the primary positive linkage between income diversification and profitability performance and also demonstrates that independent variables are not highly correlated with each other to raise concerns about a potential multicollinearity problem.

Table 4. Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) ROA	1								
(2) SHROA	0.81*	1							
(3) DIV_HHI	0.27*	0.21*	1						
(4) SIZE	0.08*	0.37*	0.06	1					
(5) EQUITY	0.34*	0.13*	0.16*	-0.03	1				
(6) NPL	-0.26*	-0.25*	0.02	-0.12*	0.09*	1			
(7) GROWTH	-0.06	-0.04	-0.07*	-0.01	-0.26*	-0.32*	1		
(8) LIQUIDITY1	0.41*	0.04	0.08*	-0.40*	0.20*	-0.05	-0.07	1	
(9) FX_POSITION	0.11*	0.00	0.17*	-0.09*	-0.02	0.14*	-0.13*	0.22*	1

This table presents Pearson correlation coefficients. * denotes the statistical significance at 5% level.

4.2 Empirical findings

Table 5 reports the regression results for the model of Equation (4) with *ROA*, *ROE*, *SHROA*, and *SHROE* as dependent variables, *DIV_HHI* as the variable of interest, and the baseline bank-specific control variables. Column 1 and 2 of Table 5 shows that the higher degree of diversification in banks' income structure is associated with higher profitability (*ROA*, *ROE*) without considering the risk/volatility aspect of higher returns. This finding is in line with the results obtained by some of recent studies (Gambacorta et al., 2014; Li et al., 2021; Meslier et al., 2014; Saunders et al., 2020). Besides the statistical significance of the result displayed in Column 1 and 2 of Table 5, the relationship between income diversification and bank profitability is economically significant as well. One standard deviation increase in the diversification measure (*DIV_HHI*) is associated with a 0.048 percentage points increase in *ROA* and 0.29 percentage points increase in *ROE*, which accounts for the 12.1% of the mean *ROA* and 7.5% of the mean *ROE* respectively.

Taking the volatility of returns into account, there are contrasting results in the literature regarding the relationship between income diversification and risk-adjusted profitability. Some of the earlier studies that examine US banks show that shifting towards non-interest income generating activities results in lower risk-adjusted profitability (Stiroh, 2004a, 2004b; Stiroh & Rumble, 2006), whereas other studies that focus on European countries and emerging economies imply non-interest income generating activities of banks can contribute to a reduction in profitability risk (Brahmana, Kontesa, & Gilbert, 2018; Chiorazzo et al., 2008; Gürbüz et al., 2013; Meslier et al., 2014; Sanya & Wolfe, 2011). As displayed in Column 3 and 4 of Table 5, our results regarding the relationship between income diversification and risk-adjusted profitability are in line with the second strand of the literature that mostly focus on emerging economies, implying a higher degree of income diversification is associated with a statistically and economically significant increase in risk-adjusted profitability (*SHROA* and *SHROE*)[19]. Column 3 and 4 show that one

[19] We also check the impact of income diversification on income volatility in our unreported results. The results show that income diversification is generally positively associated with income volatility;

standard deviation increase in income diversification (*DIV_HHI*) is associated with an increase in risk-adjusted profitability measures by 8% of mean *SHROA* and 6.5% of mean *SHROE*, respectively.

For our control variables, the higher degree of capitalization has a positive impact on *ROA* and *SHROA*. These results support the channels that suggest stronger capital structure enables banks to pursue their activities more effectively, mitigate their vulnerability against economic downturns and exogenous income/liquidity shocks, and benefit from lower funding costs arising from higher creditworthiness, rather than the channel of conventional risk-return hypothesis associating higher degree of capitalization with higher risk aversion. However, we do not find a statistically significant relationship between the equity ratio and *ROE*, and *SHROE*, probably for the reason that *ROE* and *SHROE* are normalized by total equity by their definition. For the credit risk, which is proxied by *NPL*, our results show that the higher credit risk has a negative impact on both profitability and risk-adjusted profitability, in line with the earlier studies in the literature (Apergis, 2014; Chiorazzo et al., 2008; DeYoung & Rice, 2004; Saunders et al., 2020). On the other hand, our results regarding the negative relationship between bank size and bank profitability measures contradict the findings of many studies in the literature (Chiorazzo et al., 2008; DeYoung & Rice, 2004; Meslier et al., 2014; Stiroh & Rumble, 2006). Chiorazzo et al. (2008) argue that banks are able to exploit scale and scope economies and more efficient risk management capabilities up to a certain size level; however, after a threshold level, larger size can lead to a decline in risk-adjusted returns due to the difficulties arising from the complexity of a larger organization and the rigidity of the cost structure. We propose two potential channels that lead to a negative relation between bank size and profitability performance in our results. First, since our sample consists of the largest twenty commercial banks in the Turkish banking sector, variation in bank size is relatively lower compared to the samples of aforementioned studies; therefore, the marginal effect of a larger bank size is limited

however, the gains in profitability offset the increase in earnings volatility. Therefore, income diversification improves the risk-return trade-off (risk-adjusted profitability) on net.

within a group of banks that are already chosen by a size criterion. Additionally, the opportunities of scope economies that are expected to be realized through the expansion of operations across customers and business lines are also captured to some extent by our variable of interest (*DIV_HHI*). Second, the negative relation between *SIZE* and profitability measures may be driven by the state-owned banks, considering the fact that three of the largest four banks are state-owned banks in the sample period. As also stated in Sapienza (2004), the objective function of state-owned enterprises differs from that of private enterprises. State-owned enterprises emphasize more on social benefits, while private enterprises primarily aim to maximize their profits. In light of this expectation, we repeat our analyses excluding the three state-owned banks from our sample and only focusing on privately owned banks. For the sample of privately-owned banks, the relationships between firm size (*SIZE*) and all profitability and risk-adjusted profitability measures become statistically insignificant[20]. In addition, the lower exposure to FX rate risk (the higher *FX_POSITION*[21]) results in both higher profitability and risk-adjusted profitability. Lastly, Column 1, 3, and 4 show that more liquid bank assets are related with higher *ROA*, *SHROA*, and *SHROE*.

[20] The baseline regression results for the sample of privately-owned banks are reported in Table A2 under the Appendix section.

[21] To mitigate the effect of outliers detected for *FX_POSITION*, *FX_POSITION* is winsorized at its 1st and 99th percentiles in all regressions reported in this study. When we repeat our analyses without winsorizing *FX_POSITION*, all other variables maintain their statistical significance and coefficient sign, while *FX_POSITION* loses its statistical significance. Alternatively, when we repeat our analyses with all variables winsorized at their 1st and 99th percentiles, we obtain similar results as reported in Table 5.

Table 5. Regression Results

	(1) ROA	(2) ROE	(3) SHROA	(4) SHROE
DIV_HHI	0.298***	1.799**	0.657***	0.519***
	(0.091)	(0.837)	(0.161)	(0.134)
EQUITY	3.192***	-7.287	4.793**	0.069
	(0.975)	(13.181)	(1.986)	(2.155)
SIZE	-0.206***	-1.937**	-0.537**	-0.471
	(0.063)	(0.852)	(0.259)	(0.301)
NPL	-4.244***	-40.483***	-5.937**	-6.199**
	(1.110)	(9.892)	(2.819)	(2.555)
GROWTH	0.125	-0.030	0.082	-0.058
	(0.146)	(1.168)	(0.306)	(0.253)
LIQUIDITY1	1.171**	9.080	3.664***	2.569**
	(0.482)	(5.407)	(1.192)	(1.202)
FX_POSITION	3.313***	34.710***	11.445***	9.458***
	(1.221)	(12.304)	(2.935)	(3.314)
Constant	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Period	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3
Observations	776	776	776	776

***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively. Driscoll-Kraay standard errors are reported in parentheses. All regressions include bank and year x quarter fixed effects. Definitions of all variables are given in Table 1. All explanatory variables are lagged by one quarter. *FX_POSITION* is winsorized at 1st and 99th percentiles.

Since *ROA* and *SHROA* are inversely related with the total assets of banks, and *ROE* and *SHROE* are inversely related with total equity by their definition, Chiorazzo et al. (2008) suggest that the control variable of *SIZE* should be excluded from the regressions with the dependent variables of *ROA* and *SHROA*, and the control variable of *EQUITY* should be excluded from the regressions with the dependent variables of *ROE* and *SHROE*. Table 6 reports the regression results repeated in this regard. The results show that the effect of income diversification on all profitability and risk-adjusted profitability measures remains statistically and economically significant. We also do not observe major changes in the significance and signs of the coefficients of control variables.

Table 6. Regression Results Following Chiorazzo et al. (2008)

	(1) ROA	(2) ROE	(3) SHROA	(4) SHROE
DIV_HHI	0.301***	1.717**	0.687***	0.520***
	(0.095)	(0.762)	(0.168)	(0.143)
EQUITY	4.290***		7.663***	
	(0.860)		(1.487)	
SIZE		-1.660*		-0.474*
		(0.885)		(0.262)
NPL	-3.968***	-42.058***	-5.215**	-6.185**
	(1.095)	(10.067)	(2.490)	(2.653)
GROWTH	0.126	0.065	0.085	-0.059
	(0.142)	(1.215)	(0.296)	(0.248)
LIQUIDITY1	1.207**	9.351*	3.758***	2.566**
	(0.498)	(5.405)	(1.231)	(1.158)
FX_POSITION	3.126**	33.849***	10.958***	9.466***
	(1.161)	(11.785)	(2.912)	(3.266)
Constant	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Period	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3
Observations	776	776	776	776

***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively. Driscoll-Kraay standard errors are reported in parentheses. All regressions include bank and year x quarter fixed effects. All explanatory variables are lagged by one quarter. *FX_POSITION* is winsorized at 1st and 99th percentiles.

CHAPTER 5

ROBUSTNESS CHECKS

5.1 Alternative risk-adjusted profitability measures

Considering the varying state of sample banks' non-interest income shares over periods and potential upward effect of non-interest income activities on return volatility together, utilizing Sharpe ratios with the standard deviations calculated in shorter time spans might lead to different results for the relationship between income diversification and risk-adjusted profitability than what we found in our baseline regressions. Therefore, we also repeat our analyses with the Sharpe ratios adjusted by rolling standard deviations computed over the last 8 quarters (*SHROA_p8* and *SHROE_p8*), the last 12 quarters (*SHROA_p12* and *SHROE_p12*), and the last 5 and next 3 quarters (*SHROA_p5f3* and *SHROE_p5f3*). Table 7 reports the regression results with these shorter-term looking risk-adjusted profitability measures.

Table 7 exhibits that the positive relation between income diversification and risk-adjusted profitability suggested by our main results is robust to alternative use of Sharpe ratios with shorter-term risk perspective. The coefficients of income diversification are statistically significant at 1% level for the regressions with the dependent variables of *SHROA_p8*, *SHROE_p8* and *SHROA_p5f3*, and at 5% level for the regressions with the dependent variables of *SHROA_p12*, *SHROE_p12* and *SHROE_p5f3*. Economic significance implied by the results with alternative Sharpe ratios is also in line with the main results. One standard deviation increase in *DIV_HHI* is associated with a rise of risk-adjusted profitability measures equivalent to 8.1% of mean *SHROA_p8*, 5.7% of mean *SHROA_p12*, and 8.8% of mean *SHROA_p5f3*, respectively. For control variables, the only major change compared to the main results is that the negative coefficients of *GROWTH* in Column 1, 2, 3, and 4 of Table 7 become statistically significant, which implies higher asset growth is associated with lower Sharpe ratios adjusted with rolling standard deviations computed over the last 8 and 12 quarters.

Table 7. Regression Results with Alternative Sharpe Ratios

	(1) SHROA_p8	(2) SHROE_p8	(3) SHROA_p12	(4) SHROE_p12	(5) SHROA_p5f3	(6) SHROE_p5f3
DIV_HHI	1.524***	1.677***	0.934**	0.939**	1.589***	1.537**
	(0.488)	(0.553)	(0.366)	(0.389)	(0.569)	(0.604)
EQUITY	8.903**	1.465	11.030**	3.210	4.569	-1.561
	(3.991)	(3.245)	(4.589)	(4.382)	(5.244)	(5.331)
SIZE	-1.283*	-1.591***	-0.647	-0.992*	-1.438**	-1.657***
	(0.669)	(0.586)	(0.539)	(0.557)	(0.570)	(0.473)
NPL	-21.278***	-22.173***	-18.392***	-19.629***	-16.514**	-19.315**
	(6.494)	(7.348)	(3.979)	(4.291)	(7.133)	(7.516)
GROWTH	-0.913**	-1.033**	-0.702***	-0.817***	-0.248	-0.405
	(0.391)	(0.383)	(0.257)	(0.253)	(0.550)	(0.592)
LIQUIDITY1	6.001**	6.224**	5.387***	4.990**	6.854**	6.872**
	(2.430)	(2.552)	(1.865)	(2.061)	(2.667)	(2.662)
FX_POSITION	33.214***	33.397***	30.824***	29.723***	31.123***	37.976***
	(10.718)	(10.619)	(10.364)	(10.177)	(10.473)	(10.268)
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Period	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2021Q4	2013Q1-2021Q4
Observations	776	776	776	776	716	716

***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively. Driscoll-Kraay standard errors are reported in parentheses. All regressions include bank and year x quarter fixed effects. All explanatory variables are lagged by one quarter. *FX_POSITION* is winsorized at 1st and 99th percentiles.

5.2 Alternative sample periods

To check whether the positive relationship between income diversification and bank performance is specific to a certain period only, we reestimate our baseline regressions with alternative sample periods as well. First, we extend the beginning of our sample period to the first quarter of 2010, just after the Global Financial Crisis. Table 8 displays the regression results for the period between 2010Q1 and 2022Q3. Column 1, 3, 5, and 7 include the complete set of bank-level control variables, while we exclude SIZE in Column 2 and Column 6, and *EQUITY* in Column 4 and Column 8 following Chiorazzo et al. (2008).

As reported in Table 8, we find a positive and statistically significant impact of income diversification on profitability and risk-adjusted profitability for the sample period between 2010Q1 and 2022Q3 as well. Our findings remain robust to the choice of dependent variables that proxy profitability and risk-adjusted profitability, and also to the exclusion of the control variables of *SIZE* for the analyses with *ROA* and *SHROA*; and *EQUITY* for the analyses with *ROE* and *SHROE*. In addition to robustness in terms of statistical significance, the economic significance of the effect of income diversification on profitability becomes stronger when we extend the sample period to start from the first quarter of 2010. For the period between 2010Q1 and 2022Q3, one standard deviation increase in *DIV_HHI* is associated with an increase in profitability corresponding to 15% of mean *ROA* and 12.2% of mean *ROE*, and an increase in risk-adjusted profitability corresponding to 11.3% of mean *SHROA* and 10% of mean *SHROE*[22].

Secondly, we limit the end of the sample period to the last quarter of 2019, which is also the last quarter before the COVID-19 pandemic began in Türkiye, and repeat our analyses for the period between 2013Q1 and 2019Q4. During the period since 2020, Türkiye experienced COVID-19 pandemic lockdowns that led to a significant deterioration in revenues of real sector firms and economic activity; then, a stimulus-driven credit expansion was experienced with the aim of mitigating the

[22]Descriptive statistics for the alternative sample periods are reported in Table A3.

Table 8. Regression Results for the Period of 2010Q1-2022Q3

	(1) ROA	(2) ROA	(3) ROE	(4) ROE	(5) SHROA	(6) SHROA	(7) SHROE	(8) SHROE
DIV_HHI	0.390***	0.392***	2.988***	2.934***	0.987***	0.991***	0.840***	0.824***
	(0.092)	(0.096)	(0.915)	(0.848)	(0.245)	(0.260)	(0.226)	(0.221)
EQUITY	3.452***	3.271***	-3.754		4.640***	4.222**	-1.115	
	(0.628)	(0.712)	(10.631)		(1.497)	(1.663)	(1.724)	
SIZE	0.032		0.455	0.583	0.074		0.017	0.055
	(0.095)		(1.005)	(0.971)	(0.275)		(0.246)	(0.236)
NPL	-4.481***	-4.439***	-34.408**	-35.188***	-5.826***	-5.730***	-6.364***	-6.596***
	(0.584)	(0.584)	(4.982)	(5.570)	(1.827)	(1.776)	(1.466)	(1.508)
GROWTH	0.118	0.122	0.146	0.184	0.151	0.159	-0.008	0.003
	(0.109)	(0.114)	(0.857)	(0.864)	(0.257)	(0.275)	(0.215)	(0.218)
LIQUIDITY1	1.167**	1.137**	8.299*	8.594*	3.154***	3.084**	2.377**	2.465**
	(0.478)	(0.491)	(4.604)	(4.634)	(1.174)	(1.208)	(1.110)	(1.040)
FX_POSITION	3.085**	3.091**	26.354**	25.906**	10.162***	10.176***	7.800**	7.667**
	(1.278)	(1.288)	(11.993)	(11.826)	(3.322)	(3.316)	(3.083)	(3.084)
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period	2010Q1-2022Q3	2010Q1-2022Q3	2010Q1-2022Q3	2010Q1-2022Q3	2010Q1-2022Q3	2010Q1-2022Q3	2010Q1-2022Q3	2010Q1-2022Q3
Observations	1,004	1,004	1,004	1,004	1,004	1,004	1,004	1,004

***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively. Driscoll-Kraay standard errors are reported in parentheses. All regressions include bank and year x quarter fixed effects. All explanatory variables are lagged by one quarter. *FX_POSITION* is winsorized at 1st and 99th percentiles.

effects of the economic downturn that arose from COVID-19 pandemic. There is also another rapid credit expansion driven by TL-denominated corporate loans had been experienced from the beginning of 2022. Annualized 13-week growth in TL-denominated corporate loans reached 140% as of May 2022. From that month on, macroprudential measures implemented for commercial loans curbed the acceleration in credit growth. In the relevant period, there is also a remarkable depreciation in TL against the currency basket and an increase in exchange rate volatility in the relevant period, especially from the third quarter of 2021 (Figure 1). Furthermore, the inflation rate had risen up to the level of 83.4% at the end of 2022Q3, where the inflation rates were 19.6% and 11.7% for the third quarter of 2021 and 2020, respectively. Figure 1 also shows that the profitability of the sample banks soared up enormously in the first three quarters of 2022. In light of these developments regarding the banking sector and macroeconomic conditions, excluding the period between 2020-Q1 and 2022-Q3 may allow us to focus on a relatively more stable and usual period in Türkiye. Table 9 shows that the results we found in our baseline analyses are generally robust with the sample period between 2013Q1 and 2019Q4 as well. The coefficients of income diversification (*DIV_HHI*) remain statistically significant for the regressions with the dependent variables of *ROA* and *SHROA*, regardless of including the control variable that proxies bank size, *SIZE*, or not (Column 1, 2, 5, and 6). In line with the baseline results, the positive relationship between income diversification and *SHROE* maintain its statistical significance (Column 7 and 8). On the other hand, when we do not include the control variable of *EQUITY*, the coefficient of *DIV_HHI* is statistically significant at 10% level for the regression with the dependent variable of *ROE* (Column 4); however, the positive relationship between *DIV_HHI* and *ROE* loses its statistical significance if the control variable of *EQUITY* is also included in the regression (Column 3).

Table 9. Regression Results for the Period of 2013Q1-2019Q4

	(1) ROA	(2) ROA	(3) ROE	(4) ROE	(5) SHROA	(6) SHROA	(7) SHROE	(8) SHROE
DIV_HHI	0.259**	0.252**	1.122	1.222*	0.610***	0.591**	0.656***	0.635***
	(0.100)	(0.109)	(0.730)	(0.690)	(0.210)	(0.237)	(0.208)	(0.210)
EQUITY	3.219*	4.417***	15.281		5.971*	9.377***	-3.279	
	(1.804)	(1.497)	(19.606)		(3.065)	(2.846)	(3.345)	
SIZE	-0.227*		-1.355	-1.926**	-0.644**		-0.662**	-0.540*
	(0.115)		(1.355)	(0.888)	(0.308)		(0.299)	(0.277)
NPL	-6.521***	-6.368***	-53.180***	-47.112***	-15.021***	-14.585***	-13.684***	-14.986***
	(0.930)	(1.123)	(7.231)	(11.432)	(3.609)	(3.704)	(2.996)	(3.263)
GROWTH	-0.044	-0.033	-0.902	-1.097	-0.306**	-0.276*	-0.534***	-0.492***
	(0.088)	(0.087)	(0.822)	(0.648)	(0.137)	(0.140)	(0.142)	(0.119)
LIQUIDITY1	1.774***	1.708**	13.685***	13.310***	5.996***	5.807***	5.607***	5.687***
	(0.576)	(0.647)	(4.706)	(4.700)	(1.699)	(1.882)	(1.702)	(1.636)
FX_POSITION	4.445**	4.161**	33.014**	36.710**	16.446***	15.638***	14.248**	13.455**
	(1.628)	(1.732)	(13.734)	(13.852837)	(4.616)	(5.003)	(5.219)	(5.745)
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period	2013Q1-2019Q4	2013Q1-2019Q4	2013Q1-2019Q4	2013Q1-2019Q4	2013Q1-2019Q4	2013Q1-2019Q4	2013Q1-2019Q4	2013Q1-2019Q4
Observations	556	556	556	556	556	556	556	556

***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively. Driscoll-Kraay standard errors are reported in parentheses. All regressions include bank and year x quarter fixed effects. All explanatory variables are lagged by one quarter. *FX_POSITION* is winsorized at 1st and 99th percentiles.

5.3 Alternative control variables

Lastly, we employ alternative measures to proxy banks' capitalization, credit risk, liquidity, and income structure and repeat our analyses with this new set of explanatory variables. Table 10 and 11 shows the results of the regressions in which the dependent variables of *ROA* and *SHROA* regressed on the new set of explanatory variables, respectively[23]. We replace *EQUITY* with *CAR* for capitalization in Column 2, then we additionally replace *NPL* with *LOSS_PROVISION* for credit risk in Column 3, and lastly, we replace *LIQUIDITY1* with *LIQUIDITY2* for asset liquidity in Column 4[24].

Through Column 5-8 in both Table 10 and Table 11, we employ *DIV_NII* as the measurement of income diversification instead of *DIV_HHI*. Briefly, Table 10 (11) shows that the positive relationship between income diversification and profitability (risk-adjusted profitability) is both statistically and economically significant, regardless of the choice of income diversification proxies and control variables. Also, using alternative control variables does not yield to changes in the sign of any coefficient; however, the statistical significance of the variables that proxy bank capitalization and liquidity weaken with the use of *CAR* and *LIQUIDITY2*[25].

[23] Results for the dependent variables of *ROE* and *SHROE* are reported in Table A4 and A5 under the Appendix section.

[24] Definitions of each variable are described in Section 3.2 and reported by Table 1.

[25] Additionally, we also include the control variable that accounts for the ratio of non-deposit funding to total funding in our unreported analyses, and the results we obtained are similar to our main results. It is available upon request.

Table 10. Regression Results with Alternative Explanatory Variables (ROA)

	(1) ROA	(2) ROA	(3) ROA	(4) ROA	(5) ROA	(6) ROA	(7) ROA	(8) ROA
DIV_HHI	0.298***	0.297***	0.279***	0.257***				
	(0.091)	(0.097)	(0.084)	(0.088)				
DIV_NII					0.506***	0.499***	0.489***	0.453***
					(0.154)	(0.163)	(0.150)	(0.163)
EQUITY	3.192***				3.221***			
	(0.975)				(0.984)			
CAR		1.330*	1.012	1.246*		1.343	1.001	1.239*
		(0.787)	(0.685)	(0.714)		(0.802)	(0.696)	(0.721)
SIZE	-0.206***	-0.323***	-0.347***	-0.352***	-0.209***	-0.328***	-0.351***	-0.356***
	(0.063)	(0.053)	(0.055)	(0.060)	(0.063)	(0.053)	(0.056)	(0.061)
NPL	-4.244***	-3.776***			-4.342***	-3.871***		
	(1.110)	(1.121)			(1.115)	(1.113)		
LOSS_PROVISION			-6.081***	-6.032***			-6.214***	-6.156***
			(1.288)	(1.241)			(1.289)	(1.240)
GROWTH	0.125	0.119	0.095	0.126	0.129	0.123	0.098	0.129
	(0.146)	(0.153)	(0.154)	(0.163)	(0.145)	(0.151)	(0.152)	(0.162)
LIQUIDITY1	1.171**	0.850	0.938*		1.151**	0.827	0.921*	
	(0.482)	(0.539)	(0.484)		(0.486)	(0.544)	(0.487)	
LIQUIDITY2				0.393				0.373
				(0.468)				(0.473)
FX_POSITION	3.313***	3.655***	4.612***	5.500***	3.507***	3.858***	4.790***	5.644***
	(1.221)	(1.199)	(1.200)	(1.488)	(1.210)	(1.192)	(1.202)	(1.476)
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3
Observations	776	776	776	776	776	776	776	776

***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively. Driscoll-Kraay standard errors are reported in parentheses. All regressions include bank and year x quarter fixed effects. All explanatory variables are lagged by one quarter. *FX_POSITION* is winsorized at 1st and 99th percentiles.

Table 11. Regression Results with Alternative Explanatory Variables (SHROA)

	(1) SHROA	(2) SHROA	(3) SHROA	(4) SHROA	(5) SHROA	(6) SHROA	(7) SHROA	(8) SHROA
DIV_HHI	0.657***	0.650***	0.650***	0.572***				
	(0.161)	(0.161)	(0.157)	(0.156)				
DIV_NII					1.125***	1.108***	1.118***	0.993***
					(0.263)	(0.259)	(0.260)	(0.278)
EQUITY	4.793**				4.849**			
	(1.986)				(2.010)			
CAR		2.135	1.688	2.445*		2.153	1.678	2.441
		(1.384)	(1.315)	(1.447)		(1.419)	(1.350)	(1.470)
SIZE	-0.537**	-0.714***	-0.708***	-0.731***	-0.545**	-0.724***	-0.719***	-0.739***
	(0.259)	(0.214)	(0.207)	(0.214)	(0.258)	(0.214)	(0.208)	(0.217)
NPL	-5.937**	-5.258*			-6.148**	-5.460*		
	(2.819)	(3.064)			(2.816)	(3.039)		
LOSS_PROVISION			-5.988**	-5.804**			-6.307**	-6.088**
			(2.925)	(2.803)			(2.906)	(2.780)
GROWTH	0.082	0.077	0.092	0.197	0.091	0.085	0.099	0.202
	(0.306)	(0.310)	(0.314)	(0.345)	(0.303)	(0.307)	(0.311)	(0.342)
LIQUIDITY1	3.664***	3.161**	3.283***		3.619***	3.112**	3.240***	
	(1.192)	(1.181)	(1.125)		(1.195)	(1.184)	(1.129)	
LIQUIDITY2				1.469				1.427
				(1.146)				(1.161)
FX_POSITION	11.445***	11.955***	12.707***	15.821***	11.853***	12.377***	13.155***	16.169***
	(2.935)	(2.946)	(2.944)	(3.504)	(2.840)	(2.855)	(2.871)	(3.433)
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3
Observations	776	776	776	776	776	776	776	776

***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively. Driscoll-Kraay standard errors are reported in parentheses. All regressions include bank and year x quarter fixed effects. All explanatory variables are lagged by one quarter. *FX_POSITION* is winsorized at 1st and 99th percentiles.

CHAPTER 6

CONCLUSION

The shift of banks' income composition away from traditional banking to non-interest income generating activities over the last three decades has brought up the question of whether higher involvement in non-interest income generating activities is beneficial for banks or not. While the studies that focus on emerging economies highlight the positive effect of income diversification on bank performance (Buyuran & Ekşi, 2020; Gürbüz et al., 2013; Meslier et al., 2014; Sanya & Wolfe, 2011), the papers that address developed economies conclude mixed results, especially for the risk-return trade-off of banks (DeYoung & Roland, 2001; Köhler, 2015; Lepetit et al., 2008; Saunders et al., 2020; Stiroh, 2004a). In this regard, we examine whether a higher degree of income diversification improves Turkish commercial banks' profitability and risk-adjusted profitability. Our empirical analyses are applied to a sample of 20 commercial banks during the period between 2013Q1 and 2022Q3, using panel data estimations with bank and year x quarter fixed effects. Utilizing bank and year x quarter fixed effects enables us to account for unobservable time invariant bank characteristics, but more importantly, time trends and macroeconomic conditions that are expected to affect banks' income structure and performance. We also test the sensitivity of our findings to the choice of the sample period, to the choice of explanatory variables, and to the examination of risk-return trade-off with a shorter-term risk perspective. Our main findings indicate that higher income diversification is associated with an improvement in both bank profitability and risk-return trade-off, in line with the studies that address emerging economies (Gürbüz et al., 2013; Meslier et al., 2014; Sanya & Wolfe, 2011). The results remain robust when we repeat our analyses for the periods of 2010Q1-2022Q3 and 2013Q1-2019Q4. Moreover, the positive impact of income diversification on risk-return trade-off is valid even when we investigate this relationship in shorter time spans. In a word, even though income diversification is related with higher volatility

in earnings, it still increases profits per unit of volatility. Lastly, our results do not change with the use of alternative variables to proxy income diversification, capitalization, credit risk, and liquidity and the use of additional control variables. Considering that Turkish commercial banks have relatively lower share of non-interest income activities, our findings suggest the implication for bank managements and regulators that there can still be an opportunity to be exploited through diversification of income generating activities.

APPENDIX A

ADDITIONAL TABLES

Table A1. Bank List

Bank	Type
Akbank T.A.Ş.	Privately-owned Commercial Bank
Alternatifbank A.Ş.	Foreign Bank Founded in Türkiye
Anadolubank A.Ş.	Privately-owned Commercial Bank
Burgan Bank A.Ş.	Foreign Bank Founded in Türkiye
Citibank A.Ş.	Foreign Bank Founded in Türkiye
Denizbank A.Ş.	Foreign Bank Founded in Türkiye
Fibabanka A.Ş.	Privately-owned Commercial Bank
HSBC Bank A.Ş.	Foreign Bank Founded in Türkiye
ICBC Turkey Bank A.Ş.	Foreign Bank Founded in Türkiye
ING Bank A.Ş.	Foreign Bank Founded in Türkiye
Odea Bank A.Ş.	Foreign Bank Founded in Türkiye
QNB Finansbank A.Ş.	Foreign Bank Founded in Türkiye
Türk Ekonomi Bankası A.Ş.	Privately-owned Commercial Bank
Türkiye Cumhuriyeti Ziraat Bankası A.Ş.	State-owned Commercial Bank
Türkiye Garanti Bankası A.Ş.	Foreign Bank Founded in Türkiye
Türkiye Halk Bankası A.Ş.	State-owned Commercial Bank
Türkiye Vakıflar Bankası T.A.O.	State-owned Commercial Bank
Türkiye İş Bankası A.Ş.	Privately-owned Commercial Bank
Yapı ve Kredi Bankası A.Ş.	Privately-owned Commercial Bank
Şekerbank T.A.Ş.	Privately-owned Commercial Bank

Table A2. Regression Results Excluding State-owned Banks

	(1) ROA	(2) ROE	(3) SHROA	(4) SHROE
DIV_HHI	0.282***	1.214*	0.496***	0.397***
	(0.086)	(0.615)	(0.156)	(0.146)
EQUITY	3.551***	-4.512	5.838**	0.960
	(1.166)	(13.956)	(2.227)	(2.418)
SIZE	-0.075	-0.449	0.034	-0.030
	(0.104)	(1.167)	(0.272)	(0.290)
NPL	-4.238***	-40.677***	-6.383**	-6.700**
	(1.198)	(10.614)	(2.738)	(2.556)
GROWTH	0.130	-0.074	0.154	0.016
	(0.142)	(1.111)	(0.335)	(0.286)
LIQUIDITY1	0.800	4.536	1.759	1.051
	(0.611)	(6.279)	(1.393)	(1.446)
FX_POSITION	2.177	20.780	2.771	3.117
	(1.850)	(16.896)	(3.518)	(4.019)
Constant	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Period	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3
Observations	659	659	659	659

***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively. Driscoll-Kraay standard errors are reported in parentheses. All regressions include bank and year x quarter fixed effects. All explanatory variables are lagged by one quarter. *FX_POSITION* is winsorized at 1st and 99th percentiles.

Table A3. Descriptive Statistics for Alternative Sample Periods

	Obs	Mean	Sd	p10	p25	Median	p75	p90
A. 2010Q1-2022Q3								
ROA (in percent)	1004	0.415	0.393	0.045	0.195	0.380	0.558	0.823
ROE (in percent)	1004	3.883	3.800	0.459	2.020	3.660	5.152	7.165
SHROA	1004	1.394	1.204	0.130	0.614	1.251	2.030	2.900
SHROE	1004	1.333	1.188	0.112	0.561	1.164	1.933	2.786
DIV_HHI	1004	0.243	0.159	0.049	0.165	0.257	0.342	0.423
EQUITY	1004	0.107	0.029	0.071	0.087	0.106	0.123	0.143
SIZE	1004	9.799	1.391	8.031	8.550	9.749	11.207	11.510
NPL	1004	0.041	0.023	0.018	0.024	0.038	0.053	0.068
GROWTH	1004	0.089	0.200	-0.099	-0.003	0.074	0.151	0.256
LIQUIDITY1	1004	0.170	0.088	0.099	0.122	0.147	0.183	0.262
FX_POSITION	1004	0.001	0.008	-0.008	-0.003	0.001	0.005	0.011
B. 2013Q1-2019Q4								
ROA (in percent)	556	0.339	0.319	0.036	0.161	0.341	0.479	0.646
ROE (in percent)	556	3.095	2.835	0.316	1.753	3.364	4.596	5.636
SHROA	556	2.086	1.712	0.122	0.672	1.927	3.464	4.337
SHROE	556	2.180	1.751	0.122	0.696	2.108	3.545	4.499
DIV_HHI	556	0.221	0.149	0.042	0.149	0.239	0.310	0.385
EQUITY	556	0.105	0.024	0.076	0.089	0.104	0.117	0.136
SIZE	556	9.853	1.344	8.083	8.519	9.957	11.295	11.492
NPL	556	0.037	0.017	0.018	0.023	0.035	0.049	0.061
GROWTH	556	0.080	0.208	-0.118	-0.014	0.070	0.149	0.226
LIQUIDITY1	556	0.174	0.088	0.114	0.130	0.149	0.177	0.262
FX_POSITION	556	0.001	0.008	-0.009	-0.003	0.000	0.004	0.009

Table A4. Regression Results with Alternative Explanatory Variables (ROE)

	(1) ROE	(2) ROE	(3) ROE	(4) ROE	(5) ROE	(6) ROE	(7) ROE	(8) ROE
DIV_HHI	1.799**	1.541**	1.670**	1.437*				
	(0.837)	(0.697)	(0.747)	(0.727)				
DIV_NII					3.338**	2.894**	3.129**	2.741*
					(1.640)	(1.350)	(1.458)	(1.500)
EQUITY	-7.287				-7.302			
	(13.181)				(13.386)			
CAR		6.239	2.549	4.186		6.059	2.324	4.017
		(6.905)	(6.822)	(7.838)		(6.825)	(6.796)	(7.753)
SIZE	-1.937**	-1.644*	-1.379	-1.468	-1.955**	-1.658*	-1.398	-1.479
	(0.852)	(0.884)	(1.009)	(1.019)	(0.850)	(0.892)	(1.017)	(1.031)
NPL	-40.483***	-43.010***			-40.940***	-43.457***		
	(9.892)	(10.017)			(9.920)	(10.042)		
LOSS_PROVISION			-35.483***	-34.859***			-36.188***	-35.465***
			(12.785)	(12.264)			(12.788)	(12.250)
GROWTH	-0.030	0.233	0.621	0.885	-0.003	0.251	0.637	0.901
	(1.168)	(1.350)	(1.460)	(1.552)	(1.159)	(1.338)	(1.448)	(1.545)
LIQUIDITY1	9.080	8.405	9.403*		8.948	8.320	9.319*	
	(5.407)	(5.258)	(5.126)		(5.358)	(5.211)	(5.074)	
LIQUIDITY2				5.002				4.860
				(3.713)				(3.762)
FX_POSITION	34.709***	33.686***	36.661***	45.629***	35.367***	34.207***	37.347***	46.070***
	(12.304)	(12.002)	(12.962)	(15.904)	(12.249)	(11.878)	(12.928)	(15.846)
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3
Observations	776	776	776	776	776	776	776	776

***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively. Driscoll-Kraay standard errors are reported in parentheses. All regressions include bank and year x quarter fixed effects. All explanatory variables are lagged by one quarter. *FX_POSITION* is winsorized at 1st and 99th percentiles.

Table A5. Regression Results with Alternative Explanatory Variables (SHROE)

	(1) SHROE	(2) SHROE	(3) SHROE	(4) SHROE	(5) SHROE	(6) SHROE	(7) SHROE	(8) SHROE
DIV_HHI	0.519***	0.509***	0.522***	0.457***				
	(0.134)	(0.139)	(0.127)	(0.129)				
DIV_NII					0.884***	0.865***	0.893***	0.786***
					(0.226)	(0.230)	(0.220)	(0.233)
EQUITY	0.069				0.117			
	(2.155)				(2.183)			
CAR		0.400	-0.135	0.377		0.414	-0.139	0.378
		(1.263)	(1.228)	(1.357)		(1.290)	(1.261)	(1.376)
SIZE	-0.471	-0.473*	-0.443*	-0.466*	-0.478	-0.481*	-0.452*	-0.473*
	(0.301)	(0.261)	(0.257)	(0.262)	(0.300)	(0.261)	(0.258)	(0.264)
NPL	-6.199**	-6.251**			-6.369**	-6.410**		
	(2.555)	(2.653)			(2.559)	(2.645)		
LOSS_PROVISION			-5.717**	-5.550**			-5.975**	-5.780**
			(2.810)	(2.655)			(2.833)	(2.672)
GROWTH	-0.058	-0.048	-0.003	0.075	-0.051	-0.042	0.003	0.080
	(0.253)	(0.258)	(0.267)	(0.287)	(0.249)	(0.255)	(0.263)	(0.285)
LIQUIDITY1	2.569**	2.506**	2.651*		2.534**	2.468**	2.616**	
	(1.202)	(1.149)	(1.106)		(1.208)	(1.153)	(1.112)	
LIQUIDITY2				1.334				1.302
				(0.958)				(0.974)
FX_POSITION	9.458***	9.456***	10.021***	12.544***	9.790***	9.788***	10.390***	12.834***
	(3.314)	(3.293)	(3.296)	(3.812)	(3.217)	(3.193)	(3.216)	(3.747)
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3	2013Q1-2022Q3
Observations	776	776	776	776	776	776	776	776

***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively. Driscoll-Kraay standard errors are reported in parentheses. All regressions include bank and year x quarter fixed effects. All explanatory variables are lagged by one quarter. *FX_POSITION* is winsorized at 1st and 99th percentiles.

REFERENCES

Albertazzi, U., & Gambacorta, L. (2009). Bank profitability and the business cycle. *Journal of Financial Stability*, *5*(4), 393–409.

Apergis, N. (2014). The long-term role of non-traditional banking in profitability and risk profiles: Evidence from a panel of U.S. banking institutions. *Journal of International Money and Finance*, *45*(C), 61–73.

Athanasoglou, P. P., Brissimis, S. N., & Delis, M. D. (2008). Bank-specific, industry-specific and macroeconomic determinants of bank profitability. *Journal of International Financial Markets, Institutions and Money*, *18*(2), 121–136.

Borio, C., Gambacorta, L., & Hofmann, B. (2017). The influence of monetary policy on bank profitability. *International Finance*, *20*(1), 48–63.

Brahmana, R., Kontesa, M., & Gilbert, R. E. (2018). Income diversification and bank performance: Evidence from Malaysian banks. *Economics Bulletin*, *38*(2), 799–809.

Breusch, T. S., & Pagan, A. R. (1980). The Lagrange multiplier test and its applications to model specification in econometrics. *The Review of Economic Studies*, *47*(1), 239–253.

Buyuran, B., & Ekşi, İ. H. (2020). Revenue diversification and bank performance: Evidence from Turkey. *South-Eastern Europe Journal of Economics*, *18*(1), 7–18.

Chiorazzo, V., Milani, C., & Salvini, F. (2008). Income diversification and bank performance: Evidence from Italian banks. *Journal of Financial Services Research*, *33*(3), 181–203.

Dang, V. D., & Nguyen, H. C. (2022). Bank profitability under uncertainty. *The Quarterly Review of Economics and Finance*, *83*(C), 119–134.

Demirgüç-Kunt, A., & Huizinga, H. (1999). Determinants of commercial bank interest margins and profitability: Some international evidence. *The World Bank Economic Review*, *13*(2), 379–408.

Demirgüç-Kunt, A., & Huizinga, H. (2010). Bank activity and funding strategies: The impact on risk and returns. *Journal of Financial Economics*, *98*(3), 626–650.

DeYoung, R., & Rice, T. (2004). Noninterest income and financial performance at U.S. commercial banks. *The Financial Review*, *39*(1), 101–127.

DeYoung, R., & Roland, K. P. (2001). Product mix and earnings volatility at commercial banks: Evidence from a degree of total leverage model. *Journal of Financial Intermediation*, *10*(1), 54–84.

DeYoung, R., & Torna, G. (2013). Nontraditional banking activities and bank failures during the financial crisis. *Journal of Financial Intermediation*, *22*(3), 397–421.

Dietrich, A., & Wanzenried, G. (2011). Determinants of bank profitability before and during the crisis: Evidence from Switzerland. *Journal of International Financial Markets, Institutions and Money*, *21*(3), 307–327.

Driscoll, J. C., & Kraay, A. C. (1998). Consistent covariance matrix estimation with spatially dependent panel data. *Review of Economics and Statistics*, *80*(4), 549–560.

Elsas, R., Hackethal, A., & Holzhäuser, M. (2010). The anatomy of bank diversification. *Journal of Banking & Finance*, *34*(6), 1274–1287.

Gambacorta, L., Scatigna, M., & Yang, J. (2014). Diversification and bank profitability: A nonlinear approach. *Applied Economics Letters*, *21*(6), 438–441.

Greene, W. H. (2003). *Econometric analysis*. Pearson Education India.

Gürbüz, A. O., Yanık, S., & Aytürk, Y. (2013). Income diversification and bank performance: Evidence from Turkish banking sector. *BDDK Bankacılık ve Finansal Piyasalar Dergisi*, *7*(1), 9–29.

Hoechle, D. (2007). Robust standard errors for panel regressions with cross-sectional dependence. *The Stata Journal*, *7*(3), 281–312.

Köhler, M. (2015). Which banks are more risky? the impact of business models on bank stability. *Journal of Financial Stability*, *16*(C), 195–212.

Lepetit, L., Nys, E., Rous, P., & Tarazi, A. (2008). Bank income structure and risk: An empirical analysis of European banks. *Journal of Banking & Finance*, *32*(8), 1452–1467.

Li, X., Feng, H., Zhao, S., & Carter, D. A. (2021). The effect of revenue diversification on bank profitability and risk during the COVID-19 pandemic. *Finance Research Letters*, *43*(C), 101957.

Lown, C. S., Osler, C. L., Sufi, A., & Strahan, P. E. (2000). The changing landscape of the financial services industry: What lies ahead? *FRB of New York Economic Policy Review*, *6*(4), 39–55.

Mercieca, S., Schaeck, K., & Wolfe, S. (2007). Small European banks: Benefits from diversification? *Journal of Banking & Finance*, *31*(7), 1975–1998.

Meslier, C., Tacneng, R., & Tarazi, A. (2014). Is bank income diversification beneficial? Evidence from an emerging economy. *Journal of International Financial Markets, Institutions and Money*, *31*(C), 97–126.

Molyneux, P., & Thornton, J. (1992). Determinants of European bank profitability: A note. *Journal of Banking & Finance*, *16*(6), 1173–1178.

Pennathur, A. K., Subrahmanyam, V., & Vishwasrao, S. (2012). Income diversification and risk: Does ownership matter? An empirical examination of Indian banks. *Journal of Banking & Finance*, *36*(8), 2203–2215.

Pesaran, M. H. (2004). General diagnostic tests for cross section dependence in panels. *Available at SSRN 572504*.

Sanya, S., & Wolfe, S. (2011). Can banks in emerging economies benefit from revenue diversification? *Journal of Financial Services Research*, *40*(1), 79–101.

Sapienza, P. (2004). The effects of government ownership on bank lending. *Journal of Financial Economics*, *72*(2), 357–384.

Saunders, A., Schmid, M., & Walter, I. (2020). Strategic scope and bank performance. *Journal of Financial Stability*, *46*(C), 100715.

Saunders, A., & Walter, I. (1994). *Universal banking in the United States: What could we gain? what could we lose?* Oxford University Press.

Stiroh, K. J. (2004a). Diversification in banking: Is noninterest income the answer? *Journal of Money, Credit and Banking*, *36*(5), 853–882.

Stiroh, K. J. (2004b). Do community banks benefit from diversification? *Journal of Financial Services Research*, *25*(2), 135–160.

Stiroh, K. J., & Rumble, A. (2006). The dark side of diversification: The case of U.S. financial holding companies. *Journal of Banking & Finance*, *30*(8), 2131–2161.

Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data*. MIT press.