1. NON-INTEREST INCOME – WHAT IS AT STAKE?

Abstract

Non-interest income plays a major role in the bank industry. However, as the rise of *Fintechs* and financial innovation decreases entry barriers to new players, banks are on the brink of losing non-interest income. In this paper, using data from the Brazilian banking system, we investigate what is at stake by showing the relevance of non-interest income for banking profitability and if there is a compensatory effect to financial intermediation earnings in relation to bank profitability, which smooths earnings in economic downside, helping, thus, financial stability.

Our findings suggest that non-interest income positively impacts bank profitability, decreases bank riskiness, and presents a compensatory effect to financial intermediation earnings in relation to bank profitability. Lastly, we find that non-interest income is more relevant to profitability than financial intermediation earnings for large banks. For the small banks, financial intermediation earnings are more relevant, which shows that larger banks shall be, at first, the most affected by the potential loss of non-interest income.

Keywords: Banks, non-interest income, profitability

JEL Classification: G01, G18, G21, G32, G33

1.1. Introduction

Non-interest income (NII) plays a major role in banking. The business model of universal banks spread around the world during the late 90s and gave rise to a source of income diversification for banks that helped them increase profitability. This new business model, associated with financial deepening and technological advances, made it possible for banks to increase the share of NII over time (DeYoung & Rice, 2004; Geyfman & Yeager, 2009).

However, the rise of *Fintechs* and the further development of technology decreased the barrier of entry for many markets in the financial services industry. From the consumer's standpoint, as Bos, Kolari & Van Lamoen (2013) point out, it is good news that an increase in innovation enhances product offering and competition. However, this shift in competitive forces can cause frictions in the intermediation process and elevate the systemic risk of the financial system, as NII is a source of diversification (Feng & Serletis, 2010; Elsas Hackethal, A., & Holzhäuser, 2010; Abedifar *et al*. 2018) and can be used as a buffer against a downturn in the credit cycle (Shim, 2013). Therefore, the loss of this source of income may represent a significant source of instability, as it helps soften business cycle impacts on banks' profitability, which raises a major research problem.

In this regard, this paper delves into the relationship between NII and financial intermediation to investigate whether the role performed by NII contributes to (1) positive impact on overall profitability, (2) reduction of bank riskiness; (3) compensate changes in financial intermediation earnings; thus, smoothing bank's profitability; and (4) compete with financial intermediation earnings, reducing its relevance in banks' profitability for large banks; thus curbing financial intermediation appetite.

This study uses the Brazilian market to unveil these dynamics, as it is a large developing economy with a complex and developed financial system, which is in the middle of the process of financial innovation that may alter the business structure of the banking system (Inter-American Development Bank, 2018). In addition, it is a market in which financial intermediation is done mainly through the banking system (Central Bank of Brazil, 2021), so the dynamics of NII and financial intermediation earnings in relation to profitability can be well analyzed with a diverse bank segmentation that offers opportunities for a

longitudinal study. According to the Central Bank of Brazil [1] , Brazil's credit to GDP ratio grew from 25% in March 2003 to 50% in December 2019; and its total assets increased from 60% to 93% in the same period. Considering that Brazil had the 9th largest GDP in the world in 2019, it is an important emerging market to be studied, according to the World Bank.

With increasing competition and potential reduction in NII, understanding this relationship is of utmost relevance for policymakers and academics. First, the role played by NII is not consensus since previous literature shows that NII is an additional source of risk (Stiroh, 2004; Stiroh, 2006; Murphy, 2009; Williams, 2016; Chen *et al.*, 2017) and has no impact in bank profitability (Stiroh & Rumble, 2006; Lee *et al.*, 2014); however, it offers a greater income stabilization benefit over the business cycle (Albertazzi & Gambacorta; 2009; Shim, 2013). On the other hand, Köhler (2014) and Abedifar *et al*. (2018) document that NII has no impact on risk and actually reduces it (Köhler, 2014). Second, non-interest revenue may have a compensatory role for a bank's profitability in relation to changes in financial intermediation earnings, acting, thus, as a "friend" of financial intermediation. Lastly, this compensatory effect can lead to the unintended consequence of increasing banks' proclivity to reduce financial intermediation, as NII may become more attractive for bank profitability, acting, thus, as an "enemy" of financial intermediation.

With a sample of quarterly data, from 2003 to 2019, from 95 Brazilian banks, using an S-GMM dynamic panel approach, this paper shows that NII adds to the overall bank profitability and reduces bank riskiness. In addition, we demonstrate a compensating effect of NII and financial intermediation earnings on each other, meaning that as one increases, the other decreases in relation to their effect on overall bank profitability. Finally, we show the negative side of this compensation effect when comparing large and small Brazilian banks. NII is more relevant to profitability than financial intermediation earnings for larger banks. For this group, financial intermediation earnings have a lower impact on profitability when compared to the remaining banks in the financial system, with the opposite effect occurring with NII, indicating a propensity for larger banks to focus on non-interest products rather than financial intermediation. For small banks, financial intermediation earnings are more relevant, and NII offers a lower impact on profitability when compared to other banks in the financial system. This difference in results shows that larger banks shall be, at first, the most affected by the potential loss of NII due to an upcoming increase in competition with the *fintechs*.

[1] http://www.bcb.gov.br

The remainder of this paper is structured as follows: first, section 1.2 provides a literature review of the construction of our hypothesis. Section 1.3 presents data, model, and methodology to support our hypotheses and research questions. Section 1.4 shows results, with an alternative analysis to provide robustness, and finally, section 1.5 synthesizes our findings.

1.2. Literature review and hypothesis development

1.1.1. Competitive changes in the banking industry and the importance of non-interest income

The business model of universal banks spread worldwide during the late 90s. In many jurisdictions, the rise of financial conglomerates indicated that banks were merging to survive the new competitive environment. In Brazil, the same process of banking concentration occurred, and Brazilian banks successfully explored financial intermediation while making a substantial return from non-interest income (NII). As Apergis (2015) shows in a study that used data from 50 countries from 2010 to 2012, including Brazil, empirical evidence shows that the banking sector suffers from monopolistic competition in emerging markets.

A new business model evolved after the reversal of the Glass Steagal Act (1999) (Gramm-Leach-Bliley Act, 1999), which allowed commercial and investment banks to stay under the same umbrella. Banks became universal, offering financial intermediation and a wide range of financial services, increasing the scalability of operations, thus, increasing banking concentration. With this new model, NII became increasingly relevant for banks' earnings, and they started a consolidation process to gain economies of scale and scope in their operations. Deregulation in the banking industry made it possible for banks to compete in non-traditional niches, such as NII generated from fees and commissions from securities brokerage, annuity sales, investment banking, advisory, and derivatives trading activities (Chen *et al.*, 2017).

Bos *et al.* (2013) argue that the deregulation of prices, products, and geographic restrictions on banking activities increased the market forces that fostered financial innovation. This financial innovation, such as the creation of ATMs, offered a possibility of decentralization that increased competition in the banking system and enhanced the financial

intermediation process. Some innovations, such as custodian services, cash management services, and payment infrastructure, allowed financial institutions to diversify their income beyond financial intermediation.

Financial innovation increases the array of products banks can offer to their customers. Innovations such as credit scoring increased bank lending (Frame *et al.*, 2001; Berger, Demirgüç-Kunt, Levine & Haubrich, 2004), internet usage increased small banks' profitability (DeYoung, Lang, & Nolle, 2007), and credit derivatives and risk management lowered interest spreads to customers (Saretto & Tookes, 2013). As Aghion, Harris, Howitt, & Vickers (2001) pointed out, the literature on competition argues that competition fosters innovation.

NII of current players in the banking industry is at risk due to competition and financial innovation. In November 2020, a new free payment system, PIX[2], was launched in Brazil. This payment system represents a direct assault on banks' NII since it is easy to use and available to smaller financial system participants, reducing the costs of wired transfer among individuals and companies. The lower barrier of entry in the payment system allows small banks to diversify their customer base, offering a full range of financial services, and have access to a broader deposit base, which enables them, in the future, to enhance further cross-selling of financial products.

Hence, assuming that an increase in competition from *fintechs* and financial innovation can reduce NII, affecting bank profitability, our first hypothesis aims to assess the importance of NII in overall bank profitability. As some authors say that NII has no impact on bank profitability (Stiroh & Rumble, 2006; Lee *et al*., 2014) but offers a greater income stabilization benefit over the business cycle (Albertazzi & Gambacorta, 2009; Shim, 2013), it is important to assess the overall importance of NII for Brazilian banks, and this will be noted and pointed in our first hypothesis.

Hypothesis 1: NII has an overall positive effect on bank profitability

NII can be gained in the shape of trading activities or transaction fees, and other financial services. Therefore, the riskiness that it brings to the system is not linear, depending on the region's specificity and how the financial markets evolved there. There are several contradictory studies regarding the relationship between non-interest revenue and systemic

[2] Taken by the Central Bank of Brazil web site (http://https://www.bcb.gov.br/en/pressdetail/2334/nota): "To be launched in November 2020, PIX is the Brazilian instant payment scheme that will perform transfers and payments, in a few seconds, between people, companies and the government, at any time of the day — including on the weekend and on holidays — in a safe and practical way. The streamlined procedure — carried out by natural or legal persons — may start with a QR Code reading by an app or just by the costumer informing the email, cell phone number or tax identification number."

risk. Williams (2016) finds a positive risk relationship for Australian banks. Similarly, Murphy (2009) and Chen & Zhang (2017) find that trading and non–trading activities induce more bank risk, especially for small banks, which significantly increases their risk exposure when engaging in commission and fee activities. Conversely, Lepetit, Nys, Rous, & Tarazi (2008) document that a larger share in trading income is associated with lower risk exposure and lower default risk for small, listed banks, while Nguyen (2012) finds that there are diseconomies of scope in the joint production of intermediation-based and non-traditional banking activities and Kohler (2015) shows that the greater the share of NII in the bank's statements, the lower the risk. In a recent study, Brunnermeier, Dong, & Palia (2020) show that banks with higher NII contribute to systemic risk, and those with greater liquidity and interest income reduce systemic risk.

The difference in results may be due to the unobservable fixed effects of each market. For example, the variation in non-interest revenues in other markets may not be similar to Brazil's. In addition, the composition of non-interest revenue may be different. In the USA, for example, corporate customer non-interest revenues are robust, with advisory, mergers and acquisitions, investment banking, and brokerage services. In Brazil, a large part of NII comes from retail customers through tariffs charged for services.

It should be noted that the resource management and capital market segment, which is predominant in developed financial market countries such as the USA, are not representative in Brazil. Much of the non-interest revenue of the national financial system is concentrated in fees related to payment arrangements and account maintenance. Park, Park & Chae (2019) analyzes this effect on retail banks in the USA in a structure more similar to Brazilian banks. In his work, it was found that NII was a stabilizing factor for these banks during the 2008 financial crisis.

As Lee *et al*. (2014) mention, the risk is reduced with the increase of NII. However, they find that profitability is not affected by it. Hence, considering the conflicting evidence regarding the effect of NII and risk, the second hypothesis of this study is:

Hypothesis 2: NII decreases bank riskiness

Although conflicting in the literature, due to the characteristics of the Brazilian bank industry, we expect NII positively impacts banks' profitability and negatively influence bank riskiness, as NII in Brazil is mainly made of tariffs and services charges, which provides a great contribution margin to the overall earnings and shall be a steady source of income.

1.1.2. Importance of non-interest income for earning diversification and persistence, and financial stability

An increase in competition can lead to excessive risk-taking by banks. According to Beck (2008), competition may erode the profitability of some banks' business lines, and profits serve as buffers against weaknesses and provide incentives for banks not to take excessive risk. Due to limited liability, shareholders only participate in the positive tail of risk. Therefore, when there is pressure on profit, bank management will become more prone to risk, resulting in greater fragility for the financial system. When this pressure for profits diminishes, banks may take lesser risks, favoring financial stability. In addition, with increased competition, each banking entity will gain less from the competitive advantage of having information about its customers.

Consequently, management will tend not to be rigorous in assessing borrowers, increasing the risk to the financial system (Allen & Gale, 2004). The described situation is backed by the *competition-fragility* hypothesis, which says that concentrated banking systems have larger banks than competitive systems. As these institutions increase in size, they diversify their earning portfolio, which benefits financial stability (Beck, 2008).

Financial stability is defined as the ability of capital markets to perform their essential function, which is to channel funds to entities that have productive investments. Factors preventing the flow of these funds may generate financial instability, which can evolve towards a severe interruption of financial intermediation, inducing a financial crisis. Therefore, the system's stability is linked to the capacity of the agents of the financial system to financial intermediate (Mishkin, 1992).

The importance of NII to financial stability is that it provides a way for institutions to protect themselves from swings in the credit cycle by acting countercyclically with the flow from other types of revenues that do not result from financial intermediation. The demand for this type of income is less correlated with economic conditions than interest portfolio income; therefore, it serves as an excellent stabilizer for a bank's capital, providing compensatory income during times of scarce intermediation, as financial intermediation is procyclical with economic conditions (Borio *et al.*, 2001; Brunnermeier, Crockett, Goodhart, Persaud, & Shin, 2009). In this regard, Shim (2013) documents a negative relationship between the business cycle and the capital buffer, suggesting that the Basel III agreement that a countercyclical

capital buffer in the banking sector is necessary to soften the financial system's effect exerts on the economic cycle.

Banks' behavior regarding capital buffers is likely to vary according to the stage of the business cycle and banks' own financial situation (Ayuso, Pérez, & Saurina, 2004). An important feature for reducing bank capital requirements is income diversification if the overall earnings' volatility is diminished (Shim, 2013). In this sense, NII is a great tool for bank efficiency, risk reduction, and forward-looking planning, as banks will increase or reduce investments in these types of markets according to the business cycle.

The literature points out that diversification of income is positive for the franchise value of banks because these extra revenues do not request new fixed costs or bank capital to be realized, thus increasing efficiency (Barth, Lin, Ma, Seade, & Song, 2013). This additional steady revenue is an essential capital planning strategy. According to the Pecking Order theory (Myers, 1984), companies prefer internal to external funding, so they raise capital by retaining earnings first, second by issuing debt, and lastly by issuing equity. This last option may be difficult, especially if banks' profits are deteriorated (Schuermann, 2014). So, earning NII during harsh times can be vital, as capital may be sustained with earnings retention from NII. According to Albertazzi & Gambacorta (2009), after a drop in bank profitability, if equity is low and costly to issue, banks will naturally reduce lending, which will cause a reduction in intermediation activity, potentially leading to a financial crisis. If NII can alleviate the drop in capital during harsh times, then the decline in lending will also be buffered, maintaining, thus, financial stability.

Banks benefit from cross-selling. Theories of financial intermediation stress that banks can obtain inside information by developing close relationships with clients, and thereby mitigate asymmetric information problems (Berger, 1999; Boot & Thakor, 2000), get lower collateral requirements, more available credit (Petersen & Rajan,1994; Berger & Udell, 1995), and mitigate risk (Puri, Rochell, & Steffen, 2011). There is also evidence of cross- subsidization for several NII activities and traditional lending-borrowing businesses, especially for large banks (Abedifar *et al*., 2018).

Other previous work also finds the relationship between risk and income diversification in the banking sector in different countries. Lepetit *et al.* (2008) also examine European banks and record a positive relationship between NII activities and bank risk. Nisar, Peng, Wang. & Ashraf (2018) point out that types of NII generating activities impact bank

performance and stability. While fees and commission income harm the profitability and stability of South Asian commercial banks, other non-interest income has a positive impact, showing that banks can benefit from revenue diversification if they diversify into specific types of NII-generating activities. Lee *et al.* (2014) showed a different perspective when comparing the riskiness of the bank and income diversification. Their findings suggest that the effect of diversification on the riskiness of the bank depends on the type of banking specialization.

Additionally, they found that NII reduces bank profitability in Asian banks overall. A common trace in these studies is Return on Assets (ROA) as a measurement of the importance of non-interest and net-interest income in banking. ROA is vastly used in the banking literature as a profitability proxy (Molyneux &Thornton, 1992; Claessens & Laeven, 2004; Mamatzakis & Bermpei, 2016; Williams & Prather, 2010; Nguyen, 2012; Shim, 2013; De Moraes & De Mendonça, 2019).

Banks need to show resilience and sound profitability. Volatility in banks' financial statements can increase banks' risk perception and causes a higher cost of funding, narrowing the financial intermediation margin and reducing its franchise value (Couto, 2002; De Haan & Poghosyan, 2012). Not surprisingly, businesses with more persistent earnings have better equity valuations (Sloan, 1996; Richardson, Sloan, Soliman, & Tuna, 2005). Earnings persistence can be analyzed from both cash flow persistence and accruals persistence. As NII is almost free of accruals, it becomes desirable to have this kind of revenue offsetting an increase in loan loss provisions, a major cost of the financial intermediation process. It improves earning quality and levels off final earnings.

The leveling of bank profitability is an important benefit of NII when financial intermediation is reduced. Naturally, if banks lose revenue from financial intermediation, they will raise revenues from NII whenever possible. On the contrary, if they lose revenue from NII, they will try to raise revenue from financial intermediation. Banks may raise revenue from financial intermediation in two ways: by increasing the loan portfolio or by growing margins. Lopez, Rose, & Spiegel (2020) find that banks offset the interest revenue losses with the increase in NII, the rise in the volume of lending activity, and the increase in margins due to a lower cost of funding. A problem with compensating for the loss of NII with financial intermediation is that, according to the literature (Foos, Norden, & Weber, 2010; and Köhler, 2015), excessive loan growth increases bank riskiness and may jeopardize financial stability. Therefore, this may be an unwanted consequence of the change in the competitive

environment, and it reinforces the question of the paper, so regulators, depositors, investors, and stockholders can be prepared by answering the following question: what is at stake?

From the importance of NII in leveling off profitability during the downcycle of financial intermediation to the importance of cross-subsidization and the negative impact that a lack of profit diversification may have on excess risk-taking by banks, we test hypothesis 3.

Hypothesis 3: There is a compensatory effect of NII and financial intermediation earnings that smooth bank profitability.

For banks, size matters, as large banks can explore economies of scale (Beck, 2008). There are divergences regarding economies of scale and scope in whether NII is beneficial for banks. Laeven & Levine (2007) and Boot (2016) also mention that diversification benefits can bring discounts to bank valuation, and economics of scope does not compensate for agency problems and inefficiencies caused by cross-subsidization. This assertion was refuted in later studies that said that economies of scale seem to play a more prominent role for small institutions, and larger ones can benefit from both economies, scale and scope, increasing, thus, banking profitability (Feng & Serletis, 2010; Elsas *et al*., 2010). Corroborating with that, Abedifar *et al*. (2018) find that large banks can cross-subsidize lending with NII. In contrast, small banks suffer from diseconomies of scope, and an increase in non-interest activities can actually decrease overall profits.

As there may be a compensatory effect between NII and financial intermediation earnings, and this relation may be affected by banks of different sizes, as economies of scope and scale come into play, we will proceed with the fourth hypothesis. An important factor to see with this preposition is whether large and small banks differ in how NII and financial intermediation earnings affect profitability to analyze which group of banks will be affected the most by the risk of losing NII to the potential market entrants in the financial services business in banking.

Hypothesis 4: NII and financial intermediation earnings have different impacts on profitability according to bank segmentation

1.3. Data and methodology

1.2.1. Sample

This paper analyses the relationship between NII and overall profitability and riskiness and investigates whether NII compensates for changes in financial intermediation earnings, smoothing bank's profitability, and competes with financial intermediation earnings, reducing its relevance in banks' profitability for large banks; thus, curbing financial intermediation appetite.

We perform a longitudinal analysis of the Brazilian banking system through a dynamic panel model to answer the research objectives. The data is from Financial Institutions/Conglomerates Balance Sheets and IF.data from the Central Bank of Brazil. Our sample comprises a quarterly panel of 95 Brazilian banks, spanning from March 2003 to December 2019, totaling 5,524 observations. The sample is representative of the Brazilian banking system, as it consists of over 90% of the system's total assets.

This sample consists of bank conglomerates and individual banks if the prior is not a conglomerate. Banks that did not have a loan portfolio for a given period were excluded from the sample. To avoid endogeneity in our data, the flow variables were scaled by one lagged period of total assets figures. Stock variables were scaled by contemporaneous figures. As there were mergers and acquisitions (M&A) during the observed period, we made the proper M&A adjustments.

1.2.2. Research design

Several studies use this dynamic model to analyze banks, such as Valverde & Fernandez (2007), De Moraes & De Mendonça (2019), Abedifar *et al*. (2018), and Albertazzi & Gambacorta (2007). According to Arellano & Bond (1991), dynamic panel models can eliminate non-observed effects on regressions, and the estimates are reliable even in the presence of omitted variables. The Generalized Method of Moments (GMM) solves this problem and provides a more consistent estimator for the author.

Blundell & Bond (1998) argue that the first difference GMM has bias and low precision, and Arellano & Bover (1995) mention that lagged levels can generate weak

instruments, especially if the variables behave close to a *random walk*. To correct this problem, the latter authors propose using the System GMM (S-GMM), which provides a low bias estimator and eliminates the problems of omitted variables present in the equation. Besides these advantages, the dynamic panel allows us to build a more parsimonious model, presenting greater insightfulness and simplicity of analysis (Wawro, 2002).

In banking research, the problem of endogeneity is important, as not all explanatory variables of the models are known and measured (De Moraes & De Mendonça, 2019). Therefore, in this paper, we use the S-GMM and perform two diagnostic tests to justify it: the Hansen test for over-identifying restrictions, which validates instruments' appropriateness, and the Arellano–Bond test for the autocorrelation in residuals, which is necessary to ensure no second-order autocorrelation. In addition, we keep the number of cross-sections greater than the number of instrumental variables to avoid biased results due to overfitting (De Mendonça & Barcelos, 2015; De Moraes & De Mendonça, 2019), and we use the Windmeijer (2005) finite-sample correction to the standard errors in the two-step estimations, so we make our results robust to heteroskedasticity. In addition, to account for unobserved effects, such as changes in macroeconomic conditions, we included time dummies to remove time-fixed effects.

1.3.2.1. Empirical model and explanation of variables

To answer the research questions, we examine, in equation q.1, whether NII and financial intermediation earning affect a bank's profitability. We will use net-interest income after provision (NINC) as a variable for financial intermediation earning. For equation 1.2, we use Z-score (ZSCORE) as a *proxy* of bank riskiness and use it as a dependent and lagged dependent variable. We propose the baseline model (a) and add SIZE and LIQ (models b and c) as bank-specific controls for both equations.

$$RRRRRR_{ii,tt} = \beta\beta_0 + \beta\beta_1 RRRRRR_{ii,tt-1} + \beta\beta_2 \boldsymbol{NNNNNN_{ii,tt}} + \beta\beta_3 NNNNNNNN_{ii,tt} + \beta\beta_4 SSNNSSSS_{ii,tt} + \beta\beta_5 LLNNLL_{ii,tt} + \varepsilon\varepsilon_{ii,tt} \quad (1.1)$$

$$SSSSNNRRRRSS_{ii,tt} = \beta\beta_0 + \beta\beta_1 SSSSNNRRRRSS_{ii,tt-1} + \beta\beta_2 \boldsymbol{NNNNNN_{ii,tt}} + \beta\beta_3 NNNNNNNN_{ii,tt} + \beta\beta_4 SSNNSSSS_{ii,tt} + \beta\beta_5 LLNNLL_{ii} + {}_{ii,tt} \quad (1.2)$$

Here subscript i =1,2,…,94,95 is the bank; t=1,2,…,68 is the time period, and ε is the disturbance term. After understanding how NII and NINC affect bank profitability, we need

to assess whether NII presents a compensatory effect on NINC. To investigate it, we interact *NII and NINC* and investigate the marginal effect of NII on NINC in equation 1.3. If the interaction term is negative, it will be an indication that both NII and NINC are relevant for bank profitability, as one of them increases (decreases), the other decreases (increases), which represents a moderating effect of NII on NINC and vice-versa.

$$RRRRRR_{ii,tt} = \delta\delta_0 + \delta\delta_1 RRRRRR_{ii,tt-1} + \delta\delta_2 NNNNNN_{ii,tt} + \delta\delta_3 NNNNNNNN_{ii,tt} + \boldsymbol{\delta\delta_{44} NNNNNNNN_{ii,tt} * NNNNNN_{ii,tt}} + \delta\delta_5 SSNNSSSS_{ii,tt} + \delta\delta_6 LLNNLL_{ii,tt} + \alpha_{ii,tt} \quad (1.3)$$

In addition to the moderating effects, it is important to see how NII and NINC behave for different segments of the banking system. To assess their behavior regarding NII and NINC, we will use dummy variables to distinguish two groups of banks: the larger ones, represented by the Systemically important banks (SIB), and the small banks (SMALL). The Central Bank of Brazil defines the criteria for this classification of SIB, Resolution 4.553 (Central Bank of Brazil, 2017), which segments banks according to their importance to the economy and the financial system.

$$RRRRRR_{ii,tt} = \gamma\gamma_0 + \gamma\gamma_1 RRRRRR_{ii,tt-1} + \gamma\gamma_2 NNNNNN_{ii,tt} + \gamma\gamma_3 NNNNNNNN_{ii,tt} + \gamma\gamma_4 SSNNSS_{ii,tt} + \boldsymbol{\gamma\gamma_{55} SSNNSS_{ii,tt} * NNNNNN_{ii,tt}} + \boldsymbol{\gamma\gamma_{66} SSNNSS_{ii,tt} * NNNNNNNN_{ii,tt}} + v_{ii,tt} \quad (1.4)$$

$$RRRRRR_{ii,tt} = \gamma\gamma_0 + \gamma\gamma_1 RRRRRR_{ii,tt-1} + \gamma\gamma_2 NNNNNN_{ii,tt} + \gamma\gamma_3 NNNNNNNN_{ii,tt} + \gamma\gamma_4 SSSSRRLLLL_{ii,tt} + \boldsymbol{\gamma\gamma_{55} SSSSSSSSSS_{ii,tt} * NNNNNN_{ii,tt}} + \boldsymbol{\gamma\gamma_{66} SSSSSSSSSS_{ii,tt} * NNNNNNNN_{ii,tt}} + \iota_{ii,tt} \quad (1.5)$$

The literature shows that NII can be affected by other income statement variables and bank-specific factors. The variables used in the panel study are:

ROA- Return on Assets – This is the dependent variable and the proxy for profitability. It is calculated by having the annualized ratio of *nnnnnn nneeeenneenneeee*$_{tt}$ divided by *average total assets* of the period. This measure of profitability is well known and used in several papers, such as Williams & Prather (2010), Nguyen (2012), Shim (2013), and De Moraes & Mendonça (2019).

ZSCORE is a well-known metric in the banking literature to reflect a bank's probability of insolvency (Roy, 1952; Boyd, Graham., & Hewitt, 1993, Foos *et al.*, 2010, Bouvatier , Lepetit, Rehault, & Strobel., 2018). It is calculated by the return on assets (ROA) plus the equity to asset ratio divided by a rolling window standard deviation of ROA of the previous

eight quarters. As banks increase loan growth, they become riskier and tend to become less stable. An increase/decrease in this variable corresponds to a decrease/increase in solvency risk.

NII-Non-interest income **-** This will be our independent variable, mainly composed of fees, commissions, and service charges. It is scaled by $nnttnneett\ eeeeeennnnee_{tt-1}$ and is presented in percentage terms. Previous studies from Abedifar *et al.* (2018) use this variable as an independent variable to see its partial impact on credit risk for US banks. Another work from Albertazzi & Gambacorta (2009) uses it as a dependent variable in an S-GMM estimation to assess how the business cycle impacts European banks' profitability. Nisar *et al.* (2018) and Williams (2016) also use this variable to verify whether NII affects banks' business risk, financial stability, and profitability.

NINC - Net interest income after provision — This is earnings from the financial intermediation activity. It is composed by the $nnnnnn\ eennnnnneenneenn\ eenniittiinn_{tt}$ minus $tttteenn\ tttteeee\ ppeettppeeeeeettnn_{tt}$. As the latter is also a major cost of financial intermediation. This variable is scaled by $nnttnneett\ eeeeeennnnee_{tt-1}$ and is presented in percentage terms. It includes all the revenues from financial intermediation reduced by the costs, which are funding and provisioning costs. Many studies use only the net interest income as the source of financial intermediation profits. However, the accounting of the Brazilian banks includes this variable in the financial statement as the result of financial intermediation activity. The literature shows that it is correlated with NII and that some form of cross-subsidization can exist between them (William, 2016).

SIZE **– Log of *total assets* t.** They represent bank-specific characteristics. (Kohler, 2014; Shim, 2013, De Moraes & Mendonça 2019). The larger the bank is, the more competitive it is in non-interest products.

LIQ – SSiiLLLLiiLL aaaaaaaattaa$_{tt}$. It is an important measure of risk. It acts as a buffer against bank runs or other shortfalls of asset-liability management. This variable is scaled by $nnttnneett\ eeeeeennnnee_{tt}$ and is presented in percentage terms. Other studies use this variable as a risk factor, such as Shim (2013) and Kohler (2014).

SIB and Small **-** These are dummies that divide the banks into two segments. As the classification of the segments was only done in 2017 by the Central Bank of Brazil for macroprudential reasons, we manually classified the institutions before this period according to the same criteria in case they didn't have a classification. With these treatments, we could

replicate the segmentation of banks in Brazil to the initial point of observation, which was March 2003. As per this classification, the segmentation is divided in our sample: SIB with eight banks and SMALL with 58 banks.

NIM - Net interest income before provision — It is composed by the *nnnnnn eennnnnneenneenn eenniittiinn*$_{tt}$ solely. It only includes the cost of funding without including the cost of provisioning. We will use this variable as an alternative robustness analysis of our findings. This variable is scaled by *nnttnneett eeeeeennnnee*$_{tt-1}$ and is presented in percentage terms.

1.3.3. Preliminary analysis of the data

Table 1.1 presents summary statistics and the correlation Tables for our variables. It is interesting to note that NII and NINC have a low correlation in panel B, and NINC has a much higher correlation to ROA than NII to ROA. It is also important to observe that SIZE and ROA are uncorrelated, but SIZE and ZSCORE are positively correlated. This result can indicate that bank SIZE impacts bank riskiness more than bank profitability.

Table 1.1: Summary statistics

Panel A: Descriptive statistics

Variables	obs.	Mean	Std. Dev.	Min	Max
ROA	5,524	0.02	0.06	-0.78	0.98
ZSCORE	5,443	17.57	18.89	-6.94	277.51
NII	5,524	0.52	1.13	0.00	21.88
NINC	5,524	1.85	2.32	-21.93	28.14
NIM	5,524	2.42	2.56	-8.86	29.63
SIZE	5,524	21.76	2.30	16.15	27.89
LIQ	5,524	23.47	17.60	0.01	97.78
d.SIB	5,524	0.09	0.28	0.00	1.00
d.SMALL	5,524	0.57	0.49	0.00	1.00

Panel B: Correlation matrix*

	Variable		(1)	(2)	(3)	(4)	(5)	(6)
(1)	ROA	1.00						
(2)	ZSCORE	0.05	1.00					
(3)	NII	0.12	-0.08	1.00				
(4)	NINC	0.48	-0.06	0.10	1.00			
(5)	NIM	0.33	-0.09	0.10	0.90	1.00		
(6)	SIZE	0.01	0.30	-0.03	-0.27	-0.27	1.00	
(7)	LIQ	0.01	-0.07	0.08	0.07	-0.00	-0.15	1.00

*Pearson correlation

1.4. Empirical results

1.4.1. Overall bank profitability and riskiness

Table 1.2. shows the results for hypotheses 1 and 2, which testes whether NII impacts positively overall bank profitability and reduces bank riskiness, using equations 1.1 and 1.2. NII is expected to benefit bank profitability and reduce bank riskiness, which will validate both hypotheses and confirm NII's importance for the banking system.

Table 1.2: S-GMM for overall bank profitability and riskiness

	Panel A			Panel B		
VARIABLES	(1a) ROA	(1b) ROA	(1c) ROA	(2a) ZSCORE	(2b) ZSCORE	(2c) ZSCORE
ROA (-1)	0.1602***	0.0721**	0.0678*			
	(0.051)	(0.036)	(0.035)			
ZSCORE (-1)				0.8897***	0.8891***	0.8891***
				(0.014)	(0.014)	(0.014)
NII	0.0104*	0.0115**	0.0105**	0.1392***	0.1481***	0.1461***
	(0.006)	(0.006)	(0.004)	(0.041)	(0.041)	(0.042)
NINC	0.0039**	0.0161***	0.0169***	-0.1912***	-0.1364***	-0.1387***
	(0.002)	(0.004)	(0.003)	(0.045)	(0.042)	(0.042)
SIZE		0.0158	0.0042***		0.2060***	0.1971***
		(0.024)	(0.001)		(0.071)	(0.070)
LIQ			-0.0001			-0.0063
			(0.000)			(0.007)
Constant	0.0104	-0.3740	-0.1043***	1.9262**	-2.6960	-2.3589
	(0.009)	(0.530)	(0.031)	(0.832)	(1.707)	(1.690)
Observations	5,435	5,436	5,436	5,353	5,353	5,353
Number of banks	95	95	95	95	95	95
Instr./Cross Sec.	0.82	0.79	0.81	0.79	0.80	0.81
Time effect	Yes	Yes	Yes	Yes	Yes	Yes
J-statistic	15.81	4.49	7.40	4.69	4.47	4.67
p-value	*0.05*	*0.34*	*0.19*	*0.46*	*0.49*	*0.46*
AR(1)	-3.69	-3.71	-3.66	-5.11	-5.10	-5.11
p-value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
AR(2)	1.53	0.95	0.95	-0.13	-0.13	-0.13
p-value	*0.13*	*0.34*	*0.34*	*0.90*	*0.90*	*0.90*

Note: Levels of significance (***) represents 0.01, (**) represents 0.05, and (*) represents 0.1.Standard errors between parentheses. N.Inst / N. Cross sec. should be at most equal to 1 in each regression to avoid excessive use of instruments.The J-test (Hansen) indicates that the models are correctly identified. The autocorrelation tests AR (1) and AR (2) reject the hypothesis of the presence of first and second-order autocorrelation.

As expected, in Table 1.2, both NII and NINC are statistically relevant for bank profitability. As we add bank-specific controls for these two variables, the model specification

improves and the values and significance of the coefficients change slightly, showing the results' robustness. The NINC coefficient is marginally higher than NII's, indicating that NII is also important to bank profitability compared to NINC. The result documented in Table 1.2 is opposite to Stiroh & Rumble (2006), who show that NII has no impact on bank profitability, and to Lee *et al*. (2014), who document an adverse effect of NII on banks' profitability. This disparity in the results may come from differences in the source of NII in the countries studied. As mentioned priorly, NII for Brazil is mainly composed of tariffs, which according to Kohler (2014) and Park *et al.* (2019), reduces bank riskiness and increase profitability. Therefore, the relative performance of NII to NINC concerning profitability and risk is favorable to NII, as it is a more steady form of income. In other countries, a considerable amount of NII comes from trading activities, which is volatile and may increase bank riskiness. It is noteworthy that SIZE positively impacts profitability, which indicates that the larger the bank is, the greater the benefits from economies of scale and scope. (Feng & Serletis, 2010; Elsas *et al*., 2010; Abedifar *et al*. 2018).

There is an interesting result regarding bank riskiness. NII has a positive impact on ZSCORE, which means that it decreases banks' distance-to-default. At the same time, NINC harms ZSCORE, with its coefficient having the opposite sign of NII. As NINC increases bank riskiness, NII reduces it, indicating the importance of NII in leveling off bank riskiness. The result for ZSCORE is a further indication of how NII and NINC are complementary.

This result reinforces the literature that says that NII reduces bank riskiness (Kohler, 2014; Park *et al.*, 2019). This relation can be explained by the nature of NII in Brazil, which is mainly composed of fees from retail banking (Inter-American Development Bank, 2018; Park *et al.*, 2019).

As our results show that NII positively affects overall bank profitability and reduces bank riskiness*, ceteris paribus*, we find that hypotheses 1 and 2 are confirmed. These results contradict Stiroh & Rumble (2006) and Lee *et al.* (2014), as they affirm that NII has no impact on bank profitability. Concerning bank riskiness, the result is in conformance with Stiroh & Rumble (2006), Lee *et al.* (2014), Kohler (2014), and Park *et al.* (2019), who also suggest that NII reduces bank riskiness depending on bank specialization. Their studies indicate that NII effects on banking are not linear and depend on NII products' characteristics.

1.4.2. Compensatory effect of NII and NINC on bank profitability

In this section, differently from hypotheses 1 and 2, where we assess NII impact on bank profitability and risk, *ceteris paribus*, we test hypothesis 3, which tries to uncover whether NII and NINC have a compensatory effect on each other in relation to bank profitability, by using the marginal effect interaction based on equation 1.3. The results can be seen in Table 1.3, panel A below. If there is a compensation effect, the interaction term will be significant and negative.

Table 1.3: S-GMM for marginal effect of NII and NINC on bank profitability and segmented analysis of the effect of NII and NINC on bank profitability

	Panel A			Panel B	
	(3a)	(3b)	(3c)	(4a)	(4b)
VARIABLES	ROA	ROA	ROA	ROA	ROA
ROA (-1)	0.0445	0.0533**	0.0634*	0.0589**	0.0611*
	(0.039)	(0.021)	(0.033)	(0.023)	(0.036)
NII	0.0114*	0.0248**	0.0199***	0.0119**	0.0408***
	(0.006)	(0.011)	(0.006)	(0.005)	(0.012)
NINC	0.0194***	0.0271***	0.0224***	0.0236***	0.0134***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
NII*NINC	-0.0014**	-0.0031***	-0.0023***		
	(0.001)	(0.001)	(0.001)		
d.SIB				-0.3368**	
				(0.156)	
NII* d.SIB				0.0629**	
				(0.030)	
NINC* d.SIB				-0.0284***	
				(0.007)	
d.SMALL					0.1514**
					(0.070)
NII* d.SMALL					-0.0316**
					(0.013)
NINC* d.SMALL					0.0109***
					(0.004)
SIZE		0.0908***	0.0598**	0.0687**	0.0509**
		(0.023)	(0.028)	(0.031)	(0.022)
LIQ			0.0010	0.0022	0.0021
			(0.003)	(0.002)	(0.002)
Constant	-0.0167***	-2.0391***	-1.3820**	-1.5819**	-1.2931**
	(0.005)	(0.516)	(0.637)	(0.700)	(0.550)
Observations	5,436	5,436	5,436	5,436	5,436
Number of banks	95	95	95	95	95
Instr./CrossSec.	0.88	0.82	0.88	0.89	0.92
Time effect	Yes	Yes	Yes	Yes	Yes
J-statistic	16.97	4.76	12.36	7.64	14.72
p-value	*0.20*	*0.58*	*0.34*	*0.66*	*0.26*
AR(1)	-3.32	-3.74	-3.57	-3.83	-3.78
p-value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
AR(2)	0.38	-0.43	0.18	0.17	0.27
p-value	*0.70*	*0.67*	*0.86*	*0.86*	*0.79*

Note: Levels of significance (***) represents 0.01, (**) represents 0.05, and (*) represents 0.1.Standard errors between parentheses. N.Inst / N. Cross sec. should be at most equal to 1 in each regression to avoid excessive use of instruments. The J-test (Hansen) indicates that the models are correctly identified. The autocorrelation tests AR (1) and AR (2) reject the hypothesis of the presence of first and second-order autocorrelation.

As we see in Table 1.3, for hypotheses 3a to 3c on panel A, bank profitability is affected by the interaction of NII and NINC. Hypothesis 3a shows no statistical significance of the lagged dependent variable, which indicates that it is not a proper model. As the variable SIZE is added to the equation, the lagged dependent variable becomes significant, improving the model. This relation shows the importance of bank size to the relation of NII and NINC to bank profitability. The literature mentions that bank diversification is important for income

stabilization (Albertazzi & Gambacorta; 2009, Shim, 2013. Lopez *et al*., 2020), confirmed by hypothesis 3. As per Beck (2008), Feng & Serletis (2010), Elsas *et al*. (2010), and Abedifar *et al*. (2018), bank size may play a role in this, as larger banks, which follow the universal bank model, may have higher benefits from NII than other banks in the financial system.

The interaction of NII and NINC in hypotheses 3b and 3c presents a negative relationship with ROA, suggesting a moderating or compensatory effect between these two forms of income in relation to bank profitability. It is interesting to note that this compensatory effect refers to the entire banking industry. This negative interaction term shows us that a decrease (increase) in NINC is accompanied by a higher (lower) impact of NII on ROA. This negative interaction can also be a consequence of cross-subsidization, as pointed out by Williams (2016) and Abedifar *et al*. (2018). Another explanation for it is that a decrease in profitability from NINC during the downtrend of the credit cycle leads banks to pursue more NII to compensate for the loss of revenue from financial intermediation, which is similar to what Lopez *et al*. (2020) found.

At first sight, this would be a good outcome, as it levels off the bank's business cycle, which is important to reduce bank procyclicality of profits that can jeopardize financial stability (Borio *et al.*, 2001; Brunnermeier *et al.*, 2009). In addition, as Allen & Gale (2004) mentioned, banks may reduce the scrutiny of borrowers, increasing the total risk of the system. Another important factor is that banks may focus on NII and forgo the financial intermediation activity, as the latter is riskier and more capital intensive.

An additional analysis of how NII and NINC interact can be seen in Figures 1.1 and 1.2, with the predictive margins and the average marginal effects graphs. The predictive margin graph in Figure 1.1 shows the effect of the changes of NII on profitability, taking into consideration the marginal effect of NII on ROA given a change in NINC, with the coefficients based on hypothesis 3c from Table 1.3.

Specifically, Figure 1.1 shows that as NINC increases, the impact of NII on ROA decreases, which indicates a negative marginal effect. The plotted line flattens when it reaches the threshold mark of 10 for NINC (% of total assets), and it inverts when NINC moves further up from the threshold. This predictive margin graph shows that after the threshold point of 10 for NINC is reached, an increase in NII will have a negative impact on bank profitability, defined by ROA. This relation can also be observed in the average marginal effect graph, which isolates the effect of NII on ROA given a change in NINC. It shows that NII has a negative marginal relation to ROA given a positive change in NINC and that after

the mark of NINC=10, additional NII will have a negative impact on overall bank profitability.

The same compensatory effect of NII on NINC exists. As we see in Figure 1.2, when NII increases, it diminishes the impact of NINC on profitability. Until the threshold point of NII= 8, an additional unit of NINC increases ROA. After the threshold mark, an increase in NINC will have an overall negative impact on ROA.

Thus, this analysis shows that banks can maintain profitability by increasing/decreasing NINC/NII whenever needed and possible. The loss of this compensating effect may cause additional volatility in banking earnings. As the graph shows, the loss of NII may put banks overly dependent on NINC to maintain profitability. An increase in NINC is a consequence of a prior increase in the credit portfolio. According to the literature, excessive loan growth increases bank riskiness (Foos *et al.*, 2010; Köhler, 2015). Therefore, as the graph of the interactive effect suggests, banks may try to compensate for the loss of NII with an increase in NINC, which may elevate the riskiness of the financial system.

Figure 1.1: Predictive and the marginal effect of NII on ROA given a change in NINC

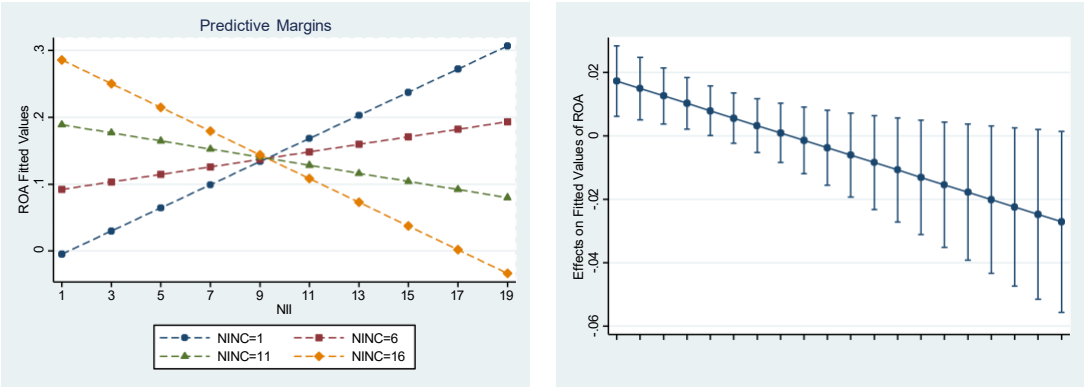
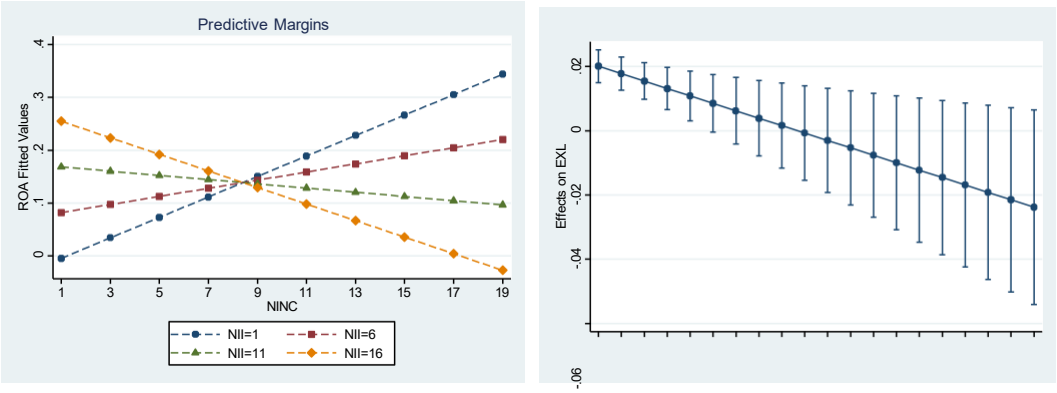


Figure 1.2:Predictive and the marginal effect of NINC on ROA given a change in NII



The results for Table 1.3 show a compensatory effect of NII and NINC. Unlike hypothesis 1, which assesses whether NII and NINC affect a bank's profitability, *ceteris paribus*, hypothesis 3 tests how these two variables interact with each other in relation to the bank's ROA. At this point, we see that both NII and NINC affect overall bank profitability, but as one increases/decreases, the other decreases/increases in relation to ROA, indicating a stabilizing effect of these two variables on the bank's return. As the banking system in Brazil has a high degree of heterogeneity, the next section will answer hypothesis 4, which assesses whether NII and NINC affect bank profitability to the same degree for different bank segments, specifically SIBs and Small banks.

1.4.3. Non-interest income for the Systemically Important and Small banks

The segmented analysis in Table 1.3, panel B, hypotheses 4a and 4b, confirms that the systemically important banks – SIBs use NII to a great extent, thus reducing NINC relevance to profitability. This result confirms hypothesis 4 that NII and NINC are different in relevance for bank profitability depending on bank segmentation. We see that by analyzing the dummy slopes [3]***NII*d.SIB*** *and* ***NINC*d.SIB***. When comparing these coefficients, we see that the dummy slope ***NII*d.SIB*** is positive, which indicates that NII is more profitable for SIBs than for the rest of the banking system. In opposite, the dummy slope ***NINC*d.SIB*** is negative, which indicates that NINC has a lower relevance for profitability when compared to the rest of the Brazilian banking system for the larger banks. Thus, for this segment, NII is a more attractive line of business than NINC, raising banks' propensity to curb financial intermediation and focus on NII products.

For the group of small banks, the coefficient of ***NINC*d.SMALL.*** is positive and statistically significant in hypothesis 4b. The opposite result is found for ***NII*d.SMALL***, whose coefficient is negative. These results indicate that NII is lower and NINC is higher in relevance for bank profitability of small banks. It also shows that small banks may have the propensity to focus on financial intermediation more than the largest banks, which supports Abedifar *et al*. (2018), which say that larger banks can take advantage of NII in a better way than small institutions. In addition, other previous studies show that small banks cannot

[3] Many authors do not include dummy intercepts when analyzing dummy slopes. We decided to include the intercepts in this paper, as their exclusion might increase the problem of omitted variable and have a bias in the dummy slope, although it has no economic value.

capture economies of scope for NII, and they might actually lose profitability from it (Feng & Serletis, 2010; Elsas *et al.*, 2010; and Abedifar *et al.* 2018).

It is notable comparing the results from Table 1.3 to the predictive margin in Figures 1.1 and 1.2. For SIBs, the predictive margin in Figure 1.2 offers clear visualization of the trade-off between NII and NINC. As NII is more relevant for bank profitability, additional units of NINC will cause a negative impact on bank profitability. For Small banks, the predictive margin in Figure 1.1 offers the same frame of the trade-off. As NINC is more relevant for bank profitability, additional units of NII will cause a negative impact on bank profitability.

Hypothesis 4 shows that NII "competes" with NINC, reducing the relevance of the latter in banks' profitability for large banks. As larger banks hold approximately 80% of the system's total assets, a possible reduction of NII will undoubtedly alter the dynamics of financial intermediation in Brazil, as SIB banks may end up lending more to make up for the loss of revenue of interest-earning products. A possible setback from a higher income from a non-interest revenue stream is the low propensity of larger banks to lend. If the propensity to lend increases due to the loss of NII, then a higher level of financial intermediation will be achieved, which is beneficial for the economy. At the same time, the loss of NII may induce banks to excessively lend to make up for the loss of profitability of non-interest revenue products. Additionality, the loss of the compensatory effect of NII on financial intermediation may increase bank riskiness and cause financial instability.

1.4.4. Additional analysis

As a *proxy* of financial intermediation earnings, this paper uses *net interest income after provision*-NINC. It reflects all the revenues and costs of financial intermediation, which are interest revenues, interest expenses, and loan loss provision. Additionally, this is how Brazilian banks report their earnings in relation to financial intermediation. As many authors in the literature use *net-interest income before provisions*-NIM (Albertazzi & Gambacorta, 2009; Nuyen, 2012; Shim, 2013, Abedifar *et al.* 2018), we will replace this variable as the new *proxy* for financial intermediation earnings for equations 1.1 through 1.4, as a robustness test for our previous results.

As it can be seen in Table 1.4, the results corroborate the previous findings presented in Tables 1.4 and 1.5, concluding that: (1) both NII is relevant for bank profitability and (2) decreases bank riskiness; (3) the marginal effects of NII and NIM on bank profitability are negative, indicating a moderating effect between these two variables.

In addition, Table 1.5 shows that (4) NII and NIM have different relevance to profitability for SIBs and small banks. NII has a higher relevance on bank profitability doe SIBs when compared to other segments. In contrast, still for larger banks, NIM is less relevant to bank profitability. For small banks, NIM has a higher relevance on bank profitability when compared to other segments of the banking system. These findings indicate that SIBs may have the propensity to focus more on NII than NIM, as NII is more profitable than NIM. The opposite occurs with small banks that may focus more on NIM, as it has a more positive impact on profitability than NII.

Table 1.4: S-GMM for overall bank profitability and riskiness

	Panel A			Panel B		
VARIABLES	(1a) ROA	(1b) ROA	(1c) ROA	(2a) ZSCORE	(2b) ZSCORE	(2c) ZSCORE
ROA (-1)	0.1652***	0.0809**	0.0994***			
	(0.038)	(0.036)	(0.029)			
ZSCORE (-1)				0.8913***	0.8944***	0.8938***
				(0.013)	(0.016)	(0.016)
NII	0.0107	0.0146*	0.0185***	0.1466***	0.1427***	0.1363***
	(0.013)	(0.008)	(0.007)	(0.050)	(0.050)	(0.049)
NIM	0.0035***	0.0205***	0.0225**	-0.1409***	-0.1044***	-0.1073***
	(0.001)	(0.008)	(0.009)	(0.036)	(0.034)	(0.035)
SIZE		0.0742*	0.0801*		0.1993***	0.1898**
		(0.044)	(0.045)		(0.076)	(0.076)
LIQ			0.0039			-0.0070
			(0.004)			(0.006)
Constant	0.0004	-1.6497*	-1.8868*	2.1696***	-2.3940	-2.0111
	(0.006)	(0.975)	(1.059)	(0.811)	(1.723)	(1.726)
Observations	5,436	5,437	5,437	5,354	5,354	5,354
Number of banks	95	95	95	95	95	95
Instr./Cross Sec.	0.78	0.81	0.84	0.77	0.80	0.81
Time effect	Yes	Yes	Yes	Yes	Yes	Yes
J-statistic	2.46	6.04	6.25	2.12	3.94	4.21
p-value	*0.65*	*0.42*	*0.62*	*0.55*	*0.56*	*0.52*
AR(1)	-4.00	-3.61	-3.74	-5.08	-5.10	-5.10
p-value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
AR(2)	1.55	0.20	-0.28	-0.11	-0.11	-0.11
p-value	*0.12*	*0.84*	*0.78*	*0.91*	*0.91*	*0.91*

Note: Levels of significance (***) represents 0.01, (**) represents 0.05, and (*) represents 0.1.Standard errors between parentheses. N.Inst / N. Cross sec. should be at most equal to 1 in each regression to avoid excessive use of instruments. The J-test (Hansen) indicates that the models are correctly identified. The autocorrelation tests AR (1) and AR (2) reject the hypothesis of the presence of first and second-order autocorrelation.

Table 1.5: S-GMM for marginal effect of NII and NIM on bank profitability and segmented analysis of the effect of NII and NIM on bank profitability

	Panel A			Panel B	
	(3a)	(3b)	(3c)	(4a)	(4b)
VARIABLES	ROA	ROA	ROA	ROA	ROA
ROA (-1)	0.0682*	0.0962**	0.0713*	0.0971***	0.1055**
	(0.036)	(0.044)	(0.037)	(0.035)	(0.049)
NII	0.0122	0.0211**	0.0138**	0.0134***	0.0295**
	(0.008)	(0.008)	(0.005)	(0.005)	(0.014)
NIM	0.0173***	0.0212***	0.0172***	0.0210***	0.0086**
	(0.002)	(0.003)	(0.002)	(0.003)	(0.004)
NII*NIM	-0.0014*	-0.0021***	-0.0014**		
	(0.001)	(0.001)	(0.001)		
d.SIB				-0.3204*	
				(0.164)	
NII* d.SIB				0.0558**	
				(0.025)	
NIM* d.SIB				-0.0373**	
				(0.015)	
d.SMALL					0.0292
					(0.074)
NII* d.SMALL					-0.0187
					(0.014)
NIM* d.SMALL					0.0127***
					(0.005)
SIZE		0.0484*	0.0051***	0.0740**	0.0172
		(0.029)	(0.002)	(0.034)	(0.019)
LIQ			0.0000	0.0040*	0.0017
			(0.000)	(0.002)	(0.002)
Constant	-0.0284***	-1.0939*	-0.1358***	-1.7448**	-0.4676
	(0.006)	(0.639)	(0.049)	(0.773)	(0.469)
Observations	5,437	5,437	5,437	5,437	5,437
Number of banks	95	95	95	95	95
Instr./CrossSec.	0.88	0.85	0.91	0.91	0.92
Time effect	Yes	Yes	Yes	Yes	Yes
J-statistic	16.17	6.12	12.57	10.05	14.37
p-value	*0.24*	*0.73*	*0.48*	*0.53*	*0.28*
AR(1)	-3.32	-3.69	-3.52	-3.68	-3.54
p-value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
AR(2)	0.40	0.40	0.40	0.02	0.67
p-value	*0.69*	*0.69*	*0.69*	*0.98*	*0.50*

Note: Levels of significance (***) represents 0.01, (**) represents 0.05, and (*) represents 0.1.Standard errors between parentheses. N.Inst / N. Cross sec. should be at most equal to 1 in each regression in order to avoid excessive use of instruments. The J-test (Hansen) indicates that the models are correctly identified. The autocorrelation tests AR (1) and AR (2) reject the hypothesis of the presence of first and second-order autocorrelation.

1.5. Concluding remarks

This paper analyzed the effect of non-interest income (NII) in the banking system in Brazil, focusing on its overall impact on bank profitability and riskiness, and its compensatory effects on financial intermediation earnings (NINC) in relation to bank profitability.

With a sample of quarterly data, from 2003 to 2019, from 95 Brazilian banks, using an S-GMM dynamic panel approach, we show that NII increases overall bank profitability and decreases bank riskiness. These results for bank profitability contradict Stiroh & Rumble (2006); and Lee *et al.*, 2014, as they find that NII has no impact on overall bank profitability. The results for bank riskiness are in conformance with Köhler (2014) and Abedifar *et al*. (2018), which say that NII can actually reduce bank riskiness. The difference in the results of our study may be due to the differences in the NII products in each market, as in Brazil, NII is mainly composed of fees and services charges (Inter-American Development Bank, 2018; Park *et al*. 2019), providing a steady stream of income with low risk. In addition, these extra revenues do not require many new fixed costs or bank capital to be realized, which leads to an improvement in bank efficiency (Barth *et al.*, 2013).

Additionally, they have a compensating effect on each other, meaning that as one increases (decreases), the other decreases (increases) in relation to their effect on overall bank profitability. This effect can be positive during a downturn in the economic cycle (Albertazzi & Gambacorta; 2009; Shim, 2013), reducing the procyclicality in the banking industry, which according to Borio *et al.* (2001) and Brunnermeier *et al.*(2009), jeopardizes financial stability. However, the compensating effect has its negative consequence due to the higher opportunity cost to undertake financial intermediation when NII becomes relevant. As Abedifar *et al*. (2018) show, larger banks can capture the benefits of NII in a better way than small institutions. As NII is profitable and reduces risk, the natural tendency is to focus on it to the detriment of financial intermediation activities. This relation is evident when we compared the large and small banks in Brazil and how NII was more relevant to bank profitability for the large banks than for small ones. This potential trade-off may turn financial intermediation in Brazil into a less than optimal activity.

This work added to the literature by unveiling how the NII impacts overall profitability and reduces bank riskiness, compensating or moderating the reduction in NINC. Also, we revealed how NII could compete with NINC, reducing the relevance of the latter in

banks' profitability. As technology changes the banking industry by lowering the barrier of entry to new entrants, banks are at risk of losing non-interest revenues.

We suggest further exploring this deviation from financial intermediation towards NII for future studies and how this affects bank spreads. Also, it is important to assess the impact of non-interest revenue on the monetary policy channel, as the propensity of the financial system to act as a financial intermediator shall become less sensitive to monetary policy, as NII provides a desired profitability for banks that make them less keen to engage in financial intermediation.

1.6. References

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