Effect of macroprudential instruments on the composition of bank revenue

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Abstract This study investigates the effect of the implementation of restrictive macroprudential policies on bank revenue composition. Specifically, we analyze changes in the ratio of non-interest income to bank revenue, where bank revenue is defined as the sum of interest income and non-interest income. To do so, we estimate fixed-effects panel regressions using quarterly data from 557 banks across 27 countries, including both emerging and developed economies, covering the period from 2010 to 2021. Our results indicate that the implementation of macroprudential policies increases the share of non-interest income in the composition of banks' revenue, particularly through restrictions on foreign currency lending (LFC) and foreign exchange exposure (LFX). These results highlight the potential effects of macroprudential instruments on bank profitability and revenue composition, which financial regulators should take into account when designing policies to enhance financial stability.

Keywords: Macroprudential policy; Bank profitability; Financial stability.

JEL codes: E44, E58, G21, G28.

1. Introduction

The recent global financial crisis has highlighted the importance of macroprudential policy to mitigate financial instability and sources of externalities in the banking sector, with a focus on limiting the risk-taking behavior of financial entities and mitigating banks' strategic interactions during the financial

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expansion cycles. In this context, Basell III has developed macroprudential instruments, and many countries worldwide have implemented such instruments as in 2010. Recent empirical and theoretical studies have assessed the relative success and effectiveness of these instruments in mitigating financial system imbalances, housing and credit markets, and the risk-taking behavior of financial intermediaries (Claessens et al., 2013; Cerutti et al., 2017; Altunbas et al., 2018; Akinci and Olmstead-Rumsey, 2018; Poghosyan, 2020; Ely et al., 2021).

The implementation of restrictive macroprudential policies may also affect bank revenue composition, as regulatory constraints can encourage banks to seek alternative income sources and adjust their investment portfolio. Such policies may restrict banks' ability to generate interest income from traditional lending activities, prompting them to reshape their business models by increasing reliance on non-interest income. Non interest income can help banks mitigate potential declines in interest income and improve their performance (Pennathur et al., 2012; Meslier et al., 2014). However, it also heightens banks' exposure to potentially riskier and less regulated non-interest activities (Williams, 2016). These factors underscore the importance of understanding the implications of macroprudential policies not only for financial stability but also for bank revenue. Despite its significance, the extent to which macroprudential policies influence revenue composition remains an open question in the empirical literature.

This study aims to address this gap in the literature by examining whether the adoption of restrictive macroprudential policies alters the proportion of non-interest income on the composition of banks' revenue. Specifically, we analyze changes in the ratio between revenue from other sources -non-interest income- and the sum of interest income with revenue from other sources. Non-interest income includes fees and commissions, trading income, income from asset management, and other financial operations not directly linked to interest income activities. These components represent diversified income streams that can reduce banks' reliance on traditional lending and interest revenue.

The study most closely related to ours is Davis et al. (2022), who examine the effects of macroprudential policies on bank profitability. However, while they use return on average assets (ROAA) and return on average equity (ROAE) as key profitability measures, we investigate how macroprudential policies influence the share of non-interest income relative to bank revenue. Davis et al. (2022) provide evidence that a number of policies negatively impact profitability, though these effects depend on factors such as a country's level of economic development and bank type.

To carry out this study we used a comprehensive accounting database of 557 financial institutions in 27 emerging and developed countries with quarterly data from 2010 to 2021, including data from the Thompson Reuters, Organization for Economic Cooperation and Development (OECD) and Integrated Macroprudential Policy Database (iMaPP). From the iMaPP database, macroprudential indices were created to identify the first restrictive implementation of the following macroprudential instruments: countercyclical capital buffer (CCB), limits on foreign exchange positions (LFX), systemically important financial institutions (SIFI), liquidity limits (LIQ), foreign currency limits (LFC), and leverage limits (LVR). With respect to the classification of measures, we grouped the following supply measures: capital, credit, and liquidity targets.

Our findings suggest that the implementation of macroprudential policies influences the composition of bank revenue, particularly through regulations that affect foreign currency exposure and liquidity management. Our results show that restrictions on foreign currency lending (LFC) and foreign exchange exposure (LFX) play a key role in shifting bank revenue away from traditional interest-based sources as their implementation increases the share of non-interest income in bank revenue composition. Furthermore, liquidity regulations appear to play a role in diversification of revenue composition. Taken together, these results reinforce the idea that regulatory measures designed to strengthen financial stability can rebalance the business models of financial institutions.

From a policy perspective, our results suggest that financial regulators should consider these effects when designing regulations aimed at promoting financial stability and mitigating financial imbalances while also accounting for banks' profitability and revenue composition. As banks play a crucial role, even in a world with faster growth in non-bank financial intermediation, traditional banks still play a central role in channeling resources to the real side of the economy, especially in less developed and heavily regulated economies.

This paper is organized as follows. In the next section, we provide a review of the relevant literature (2). Section 3 outlines our data sources. Section 4 discusses the methodology used. Section 5 the results of the empirical analyzes and Section 6 concludes.

2. Literature review

Our study relates to several strands of literature. The first strand focuses on the effectiveness of macroprudential policies in mitigating financial system imbalances, enhancing financial stability, addressing housing and credit mar-

ket dynamics and influencing risk-taking behavior.[1]. Poghosyan (2020) and Bedayo et al. (2020) advocate for the use of macroprudential policies based on the CCB (countercyclical capital buffers) to smooth the credit cycle, while Jiménez et al. (2017) highlights the usefulness of this instrument to reduce credit restrictions during recessions. Cerutti et al. (2017) examined up to 119 countries between 2000 and 2013 and concluded that macroprudential policies were correlated with lower real growth in private non-financial sector bank credit, particularly in emerging markets, with a particular impact on real estate credit.

Altunbas et al. (2018) assessed the impact of macroprudential policy on two measures of bank risk, the change in expected default frequency and the change in Z-Score. The authors' results show a negative effect of broad categories of macroprudential policies on bank risk. The negative effect on bank risk was greater during periods of high risk and for small, less capitalized banks. Akinci and Olmstead-Rumsey (2018) investigated the effectiveness of macroprudential policies in restraining real credit and asset price growth in 57 advanced and emerging countries between 2001 and 2013. According to the authors, macroprudential policies are often implemented alongside bank reserve requirements, capital flow restrictions, and monetary policy. The study suggests that policies such as loan-to-value and debt-to-income ratios targeting credit growth in specific sectors, such as real estate, are the most effective.

Meuleman and Vander Vennet (2020) examine the impact of macroprudential policies on systemic risk in EU banks from 2000 to 2017. The authors conclude that, on average, macroprudential tools reduce individual bank risk. However, certain measures, such as liquidity-based policies, also contribute to decreasing the systemic linkage of banks. Gaganis et al. (2020) assessed how macroprudential policies and corporate governance jointly affect bank risk through a sample of 365 banks in 50 countries between 2002 and 2017. According to the authors, macroprudential policy is associated with the quality of corporate governance, which is a measure of a bank's commitment and effectiveness in adhering to corporate governance principles in risk-taking. In this regard, better corporate governance is associated with a greater reduction in the risk assumption of macroprudential policy, although this interaction exists only in developed countries and not in emerging economies. Ely et al.

[1]The works of (Claessens et al., 2013 Freixas et al., 2015; Moreno, 2011; Galati and Moessner, 2013; Claessens, 2015; Lim et al., 2011) summarized the main prudential instruments (micro and macroprudential) implemented by developed and developing countries. Other empirical works connected with the first strand of the literature are (Igan and Kang, 2011; Aiyar et al., 2014; Wong and Hui, 2010; Tabak et al., 2017; Khan et al., 2017; Gropp et al., 2019; Camors et al., 2019; Allen et al., 2020 e Auer and Ongena, 2016).

(2021) investigate the transmission mechanisms of the effect of a set of 12 macroprudential instruments on bank risk-taking. They find that the leverage channel has a considerable effect on reducing systemic risk. In general, macroprudential measures tend to limit bank leverage, thereby reducing exposure to risk.

Another significant strand of the literature relates macroprudential policies to bank revenue or determinants of profitability. According to Davis et al. (2022), macroprudential policies negatively affect the profitability of small, highly capitalized banks more than larger, less capitalized banks. Two other important points are that some macroprudential instruments reduce the amount of lending but not profitability and there are potential penalties for banks that are adequately capitalized. The factors influencing bank revenue or determinants of profitability are typically divided into two groups: internal and external determinants.

Internal determinants include bank-specific factors based on financial statement information, such as bank size, capital/leverage ratios, incurred risks, and management efficiency. These can be seen as related to the banks' business model, as in Beck et al. (2013) and Davis et al. (2020). Korytowski (2018) argue that, for European banks between 2011 and 2015, bank size has a negative and significant effect on ROA and an insignificant effect on ROE.

In relation to external determinants, that is, macroeconomic factors beyond banks' control, these include exchange rate fluctuations, interest rates, economic growth, and inflation. Studies such as Athanasoglou et al. (2008) and Chronopoulos et al. (2015) have identified a positive relationship between inflation and GDP growth with bank profitability. Athanasoglou et al. (2006) conclude that a higher exposure to credit risk, measured by provisions for loan losses as a percentage of total loans, is associated with lower bank profitability.

Lastly, a significant strand of the literature explores the potential unintended consequences of macroprudential policies on the real economy. These researches suggest that, in certain contexts, macroprudential policies may negatively affect bank competition, reduce economic activity -particularly consumption and investment— and exacerbate income and wealth disparities. (Teixeira and Venter, 2023; Teixeira, 2023; Belkhir et al., 2022; Gonzalez, 2022; Ahnert et al., 2021; Scalco et al., 2021; Forbes, 2021; Gurrea-Martínez and Remolina, 2019).

3. Data

To investigate the effect of implementing restrictive macroprudential policies on the composition of banks' revenue, we use a quarterly dataset com-

prising 557 banks from 27 countries — encompassing both emerging and developed economies — spanning the period from 2010 to 2021. As noted by Altunbas et al. (2018), selecting a global sample of countries with diverse economic experiences and macroprudential policies helps mitigate omitted variable bias. In the following sections, we detail the data sources and the construction of the indices and variables used in the analysis.

The smaller sample size compared to Davis et al. (2022) arises primarily from reliance on the Thomson Reuters database, which provides fewer observations for emerging and developed economies relative to other datasets. This study prioritized data consistency and completeness for the selected macroprudential instruments, which required narrowing the sample size to ensure robust and comparable results.

3.1 Macroprudential policies

To construct the macroprudential policy indices, this study utilizes data from the Integrated Macroprudential Policy Database (iMaPP). The iMaPP database was originally built by Alam et al. (2019), combining information from multiple databases and the IMF Macroprudential Policy Survey, and is regularly updated by IMF staff in accordance with the Macroprudential Policy Survey cycle. On this basis, a monthly value of +1, -1 or 0 is assigned to each of the seventeen available macroprudential instruments, per country. The value +1 refers to an instrument that had more tightening actions in the month, while the value -1 refers to an instrument with more loosening actions in the period. A value of zero means that either no action occurred or that tightening and loosening actions canceled each other out. The monthly values from the iMaPP database are transformed into quarterly values for compatibility with the rest of the available data.

This study uses the values of six macroprudential instruments available in the database in question: Countercyclical Capital Buffer (CCB), Limits on foreign exchange positions (LFX), Systemically relevant financial institutions (SIFI), Liquidity limits (LIQ), Limits on Foreign Currency (LFC), and Leverage Limits (LVR). According to Alam et al. (2019), the macroprudential instruments present in the iMaPP database can be categorized into three large blocks, related to the sector in which the regulation is directed: capital-oriented instruments, credit-oriented instruments, and liquidity-oriented instruments. By working with at least one instrument from each block, this study aimed to encompass a sample of instruments that provided a general understanding of the main MPs.

The CCB, LVR, and SIFI are representative macroprudential instruments

aimed at capital regulation. The CCB is a requirement established for banks to maintain additional capital during periods of economic expansion, being able to reduce it in times of recession. LVR is a leverage limit, calculated by dividing a measure of capital by the bank's exposures not weighted by risk. Among its functions, this instrument aims to avoid an increase in the economy's financial vulnerability resulting from advances in loans with large maturity mismatches between assets and liabilities, as in the case of real estate credit. In turn, the measures related to SIFI seek to mitigate systemic risks, both global and domestic, associated with systemically important financial institutions, including capital and liquidity surcharges. According to Alam et al. (2019), these policies form a robust framework for maintaining economic stability, particularly in periods of financial stress, by strengthening capital adequacy, limiting excessive credit expansion, and safeguarding the overall financial system.

Among the macroprudential instruments focused on credit, this study examines the LFC. This instrument consists of limits on loans in foreign currencies and also rules and recommendations for loans in these currencies Alam et al. (2019). Finally, the LIQ and LFX instruments are representatives of those focused on liquidity. LIQs are measures taken to mitigate systemic liquidity and financing risks, including minimum requirements for liquidity coverage ratios and liquid asset ratios. LFXs are limits on net or gross open foreign exchange positions, such as limits on foreign exchange exposures and financing and currency mismatch regulations. Its use is almost exclusive to Emerging or Developing Economies, according to FSB (2022).

Using the values available for these six instruments in the iMaPP database, we construct a macroprudential index (MP-I) for each instrument. The index can only take two values: 0 or +1. As long as the macroprudential instrument is not used restrictively by the country, the value of the index is zero. When the instrument is used restrictively for the first time by the country, the index becomes +1 for that nation until the end of its sample period. These indices enable the investigation of the effect of the restrictive implementation of macroprudential instruments on other variables. Table 1 below presents the quarter in which each instrument was first implemented restrictively in each country during the sample period.

As a robustness check, we construct an alternative index (MP-AI), which is an accumulative measure that accounts for both tightening and loosening actions. The index value starts at 0 and increases (or decreases) by one unit each time a tightening (or relaxation) of the policy occurs. This approach enables us to capture and retain the impact of these policy changes, whether

Table 1
Implementation of restrictive MPs in the sample countries

	Macroprudential Instruments					
Countries	CCB	LVR	LFC	LIQ	LFX	SIFI
Germany	2019 Q4			2015 Q4		2016 Q1
Austria		2021 Q2	2010 Q1	2015 Q4		2016 Q2
Belgium		2021 Q2		2017 Q1		2016 Q1
Brazil		2015 Q4	2021 Q4	2015 Q4		2017 Q1
Canada	2018 Q1	2014 Q4		2015 Q1		2016 Q1
Chile				2020 Q1		2020 Q4
Republic of Korea		2015 Q1	2010 Q3	2015 Q1	2014 Q4	2016 Q1
Colombia		2021 Q1		2017 Q1	2017 Q2	2021 Q1
Slovenia	2020 Q3	2021 Q2		2021 Q2		2019 Q1
United States		2014 Q1		2015 Q1		2016 Q1
Hungary		2021 Q2	2010 Q3	2012 Q1	2016 Q1	2017 Q1
Finland		2021 Q2		2010 Q2		2016 Q1
Greece		2021 Q2		2015 Q4		2019 Q1
India		2015 Q2		2015 Q1	2013 Q1	2016 Q2
Indonesia		2015 Q1		2016 Q3	2015 Q1	2016 Q1
Iceland	2017 Q1			2013 Q4		2016 Q2
Israel		2018 Q1		2015 Q2		2017 Q1
Japan		2019 Q1		2015 Q1		2016 Q1
Lithuania	2018 Q4	2021 Q2		2015 Q4		2016 Q4
Mexico		2016 Q2		2015 Q1		2015 Q4
Norway	2015 Q3	2017 Q2		2015 Q4		2015 Q3
Poland		2021 Q2	2014 Q1	2015 Q4		2016 Q4
Portugal		2021 Q2		2015 Q4		2018 Q1
Czech Republic	2017 Q1	2021 Q2		2015 Q4		2014 Q4
Turkey		2014 Q1	2018 Q2	2015 Q1	2020 Q4	2019 Q1
Sweden	2015 Q3	2021 Q2		2013 Q1		2014 Q3
Switzerland		2016 Q3		2015 Q1		2013 Q1
Total	8	24	6	27	6	27

Note: The table presents the first quarter in which a macroprudential policy was implemented in each country during the sample period. Data were obtained from the iMaPP database, originally constructed by (Alam et al., 2019).

they involve tightening or loosening.

While both indices capture aspects of macroprudential policy, their interpretations differ. MP-I reflects the implementation of a policy, which is the primary focus of our analysis, whereas MP-AI captures policy tightening, accounting for incremental adjustments over time. This distinction is important, as MP-I measures the effect of having a policy in place, while MP-AI allows us to analyze how a policy tightening influences bank revenue composition. MP-AI serves as an important robustness check as it helps ensure that our findings are not solely driven by the initial adoption of a policy but also reflect its evolving impact over time.

3.2 Macroeconomic and banking variables

For banking variables, quarterly data is obtained from the Thomson Reuters database. The main variable of interest is the composition of banks' revenue (dependent variable). It is the ratio between revenue from other sources (non-interest income) and the sum of interest income and income from other sources. The other variables of interest are the five banking controls: bank size indicator (Size), represented by the natural logarithm of total assets; indicator of net loans (Loans), calculated by the ratio between net loans and total assets; deposits indicator (Deposits), calculated by the ratio between bank deposits and total assets; liquidity indicator (Liquidity), calculated by the ratio of money owed to the bank to total assets; cost ratio, calculated as the ratio between interest expenses and interest income.

It is important to note that money owed to the bank represents short-term receivables or obligations due to the bank, such as interbank loans or unsettled payments. Additionally, the cost ratio focuses on interest expenses and income as this variable aims to control for the increase or decrease of costs associated with lending operations.

Macroeconomic control variables are also used, with variations by country. The values were obtained from the Organization for Economic Co-operation and Development (OECD) database. The variables are: ΔGDP, which represents the variation in Gross Domestic Product; ΔExchange, which represents the exchange rate variation; Interest rate; Inflation rate. Table 2 below presents the relevant descriptive statistics of this study.

Regarding the composition of banks' revenue, we restricted the values to fall between zero and one. Finally, for all banking variables, we applied winsorization by quarter at the 1st and 99th percentiles to address potential outliers.

4. Methodology

To investigate the effect of implementing restrictive macroprudential policies on the composition of banks' revenue, we use a fixed-effect panel data structure. This approach is particularly relevant for capturing the unobservable and time-invariant characteristics of banks, such as their governance structure, business strategy, and organizational culture. The use of fixed effects helps control for these factors, which could otherwise bias the results, ensuring that the estimates reflect changes within banks over time. We also include time fixed effects to control for period-specific shocks, such as global economic crises or coordinated policy responses.

Table 2
Descriptive statistics

Variables	Description	Mean	S.D	Min	Max
Composition	Ratio between Non-Interest Income and Non-Interest Income + Interest Income	0.2482	0.1373	0.0071	0.7614
Size	Bank size indicator	15.7596	2.0347	11.7553	21.5328
Liquidity	Liquidity indicator	0.0533	0.0592	0.0010	0.3579
Deposits	Deposit indicator	0.7716	0.1251	0.2036	0.9418
Cost Ratio	Cost indicator	0.2117	0.1684	–0.0092	0.9262
Loans	Net Loans Indicator	0.6431	0.1249	0.1597	0.8808
Δ GDP	GDP variation	0.5536	2.0921	–23.0582	21.3984
Interest Rate	Interest Rate	1.4415	2.4894	–0.8950	22.5000
Inflation	Inflation Rate	2.1394	2.1725	–2.3797	25.8484
ΔExchange Rate	Exchange Rate variation	0.0037	0.0267	–0.1018	0.3058

Note: The table presents descriptive statistics for the 557 sample banks across 27 countries, comprising a total of 22,237 observations. Data were obtained from the Thomson Reuters database and the Organization for Economic Cooperation and Development (OECD).

While time fixed effects do not directly resolve reverse causality, they help mitigate biases arising from global events that could simultaneously drive the implementation of macroprudential policies and affect banking outcomes. It is important to note, however, that the absence of an instrumental variable (IV) limits the ability to establish definitive causal relationships between macroprudential policies and observed outcomes. This consideration is particularly important given the diverse contexts in which macroprudential policies are implemented across countries and banks.

The regression has the following specification:

$$\begin{aligned} Y_{i,k,t} = \alpha + \beta_1 \text{MP-I}_{k,t-1} + \beta_2 \text{BankControl}_{i,k,t-1} \\ + \beta_3 \text{MacroControl}_{k,t} + \gamma_i + \delta_t + \varepsilon_{i,k,t}, \end{aligned} \tag{1}$$

in which i,k,t means, respectively, bank, country, and time (quarter).

As a dependent variable ($Y_{i,k,t}$), we have the composition of banks' revenue, which is the ratio between revenue from other sources (non-interest income) and the sum of interest income with revenue from other sources. $\text{MP-I}_{k,t-1}$ represents the lagged value of the macroprudential index described in section 3.1 for each instrument (CCB-I, LVR-I, SIFI-I, LFC-I, LIQ-I, and LFX-I). BankControl's$_{i,k,t-1}$ are the lagged values of the banks' control variables. The use of lagged values helps minimize the risk of reverse causality. Macro Control's$_{k,t}$ are the macroeconomic control variables. All controls are described in section 3.2. Finally, γ_i is the fixed effect of banks and δ_t are time fixed effects.

The main coefficient of interest is β_1. Our hypothesis predicts a positive value for this coefficient, indicating that the implementation of macropru-

dential policies increases the share of non-interest income in bank revenue composition.

5. Results

This section presents the results regarding the effect of the implementation of the six macroprudential policies on the composition of banks' revenue. To this end, the six MP-I indices described in section 3.1 are used: CCB-I, LVR-I, SIFI-I, LFC-I, LIQ-I, and LFX-I.

Tables 3, 4, 5, 6, 7 and 8 present the results for the main macroprudential policy index (MP-I) across different model specifications. The first column (Macroprudential) includes only the effect of the macroprudential instrument. Column 2 (Bank Controls) includes the effects of the macroprudential instrument and bank control variables. Column 3 (Macro Controls) includes the macroprudential instrument, the banking control variables and the macroeconomic control variables. Finally, column 4 (Time Fixed Effects) includes all controls and time fixed effects.

In the Appendix, Tables A1, A2, A3, A4, A5, and A6 present the results for the alternative index (MP-AI), as described in Section 3.1. They follow the same structure as the previous tables.

In relation to the MP-I index, our most comprehensive specification, which includes all banking and macroeconomic controls as well as time fixed effects, shows that the implementation of LFC (Limits on Foreign Currency Lending) and LFX (Limits on Foreign Exchange Positions) are associated with a statistically significant increase in the share of income from other sources in the composition of bank revenues. These results align with our hypothesis and suggest that restrictions on foreign currency may incentivize banks to diversify their revenue stream.

As shown in Table 3, we observe that when LFC is implemented, the share of non-interest income increases by approximately 3 percentage points relative to bank revenue. The implementation of the LFC instrument affects a bank's ability to lend in foreign currencies, which can reduce its interest income. Additionally, banks may focus, for example, on providing currency conversion services to clients involved in international transactions. These services can generate non-interest-related revenue for banks, potentially contributing to an increase in the proportion of non-interest-related revenue.

For foreign exchange exposure limits (LFX), as shown in Table 4, our results indicate that implementing the LFX instrument increases the proportion of non-interest income relative to bank revenue by 2.4 percentage points.

This increase may result from a reduction in interest income as well as an increase in income from other sources. In response to the limits on foreign exchange positions, banks may seek to diversify their income sources to reduce their dependence on interest-bearing assets that are affected by exchange rate fluctuations. Additionally, these fluctuations may create opportunities for banks to earn profits through foreign exchange trades.

Notably, when using the alternative index (MP-AI) instead of the original index (MP-I), the results for both policies remain consistent. As shown in Tables A2 and A3, tightening the policies leads to a significant increase in the share of income from other sources in the composition of bank revenue.

The Liquidity measure (LIQ-I) is not significant when time fixed effects are considered, as presented in Table 5. Without time fixed effects, the policy coefficient is statistically significant, with the share of revenue from other sources relative to bank revenue increasing by 1.5 percentage points following the implementation of the policy. This finding suggests that temporal factors may play an important role in shaping bank revenue composition, potentially overshadowing the direct impact of liquidity regulations. Moreover, when using the alternative index (LIQ-AI), as shown in Table A4 in the Appendix, our results indicate that tightening the macroprudential policy leads to a statistically significant increase in the share of non-interest income in bank revenue considering time fixed effects.

This macroprudential policy focuses on strengthening banks' funding and liquidity positions to withstand events of financial stress. In other words, there is a decrease in the volume of resources available to conduct lending business. Banks may adopt more robust funding strategies or maintain higher liquidity in response to these measures. Non-interest income activities can provide an additional source of earnings that do not depend on more volatile revenue during periods of uncertainty. These measures to mitigate liquidity risk can also lead to a reduction in interest income.

Finally, regarding the other macroprudential policies, in Table 6 we observe that the Countercyclical Capital Buffer (CCB-I) is not significant when we include time fixed effects. This result may be attributed to its inherently countercyclical nature. Regarding Table 8, we observe that Systemically Important Financial Institutions (SIFI-I) also do not show statistical significance when we include time-fixed effects. Without these effects, we observe an increase in the share of income from other sources in the composition of bank revenue. Lastly, as shown in Table 7, the LVR results (LVR-I) were contrary to our hypothesis. All of these findings remain largely unchanged when using the alternative index (MP-AI), as shown in Tables A1, A6, and A5.

Table 3
LFC effects on banks' income composition

	Macro-prudential	Bank Controls	Macro Controls	Time Fixed Effects
L.LFC-I	0.041***	0.024*	0.053***	0.030**
	(0.011)	(0.012)	(0.018)	(0.014)
L.Size		–0.007	–0.005	–0.031***
		(0.004)	(0.004)	(0.006)
L.Liquidity		0.196***	0.205***	0.124***
		(0.034)	(0.033)	(0.034)
L.Deposits		–0.035	–0.037	–0.042*
		(0.025)	(0.025)	(0.025)
L.Cost Ratio		–0.192***	–0.164***	–0.105***
		(0.015)	(0.015)	(0.016)
L.Loans		–0.143***	–0.117***	–0.131***
		(0.019)	(0.021)	(0.022)
ΔGDP			0.000*	0.001***
			(0.000)	(0.000)
Interest Rate			–0.005***	–0.004***
			(0.001)	(0.001)
Inflation			–0.001***	0.000
			(0.001)	(0.001)
$\Delta ExchangeRate$			0.000	–0.004
			(0.021)	(0.024)
Observations	22237	22237	22237	22237

Note: The table presents the results of regression (1) using the LFC-I index. In the first column, the results are based solely on the index. In the second column, bank controls are added. In the third column, macroeconomic controls are included. In the fourth column, time fixed effects are incorporated. The coefficients for the quarter dummies and the constant are omitted for space considerations. Standard errors are reported in parentheses.. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Our results align with those of Davis et al. (2022). In analyzing the effects of macroprudential policies on bank profitability, the authors suggest that some macroprudential measures may not necessarily reduce bank profits, as banks can shift their activities from interest-earning to non-traditional sources, thereby increasing overall non-interest income when regulatory constraints are imposed. According to their findings, this is the case with LFX policy. Our results reinforce this argument by showing that LFX is associated with a significant increase in the share of non-interest income in total bank revenue, suggesting that restrictions on foreign exchange exposure encourage banks to diversify their sources of revenue.

Moreover, according to Davis et al. (2022), LFC has the strongest negative

Table 4
LFX effects on banks' income composition

	Macro-prudential	Bank Controls	Macro Controls	Time Fixed Effects
L.LFX-I	0.032***	0.037***	0.035***	0.024***
	(0.008)	(0.007)	(0.008)	(0.008)
L.Size		–0.008*	–0.007	–0.031***
		(0.004)	(0.004)	(0.006)
L.Liquidity		0.215***	0.219***	0.139***
		(0.034)	(0.034)	(0.035)
L.Deposits		–0.030	–0.034	–0.040
		(0.025)	(0.025)	(0.025)
L.Cost Ratio		–0.194***	–0.173***	–0.115***
		(0.015)	(0.015)	(0.017)
L.Loans		–0.139***	–0.120***	–0.131***
		(0.019)	(0.021)	(0.021)
ΔGDP			0.000*	0.001***
			(0.000)	(0.000)
Interest Rate			–0.004***	–0.004***
			(0.001)	(0.001)
Inflation			–0.001	0.001
			(0.001)	(0.001)
$\Delta ExchangeRate$			0.013	0.004
			(0.022)	(0.024)
Observations	22237	22237	22237	22237

Note: The table presents the results of regression (1) using the LFX-I index. In the first column, the results are based solely on the index. In the second column, bank controls are added. In the third column, macroeconomic controls are included. In the fourth column, time fixed effects are incorporated. The coefficients for the quarter dummies and the constant are omitted for space considerations. Standard errors are reported in parentheses.. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

effect on bank profitability. We extend this finding by demonstrating that while LFC may reduce bank profits, it also leads to a substantial increase in the proportion of non-interest income relative to revenue, indicating that banks actively respond to these constraints by rebalancing their revenue composition. Taken together, our results complement Davis et al. (2022) by providing empirical evidence that macroprudential policies, particularly LFC and LFX, not only influence bank profitability, but also drive shifts in revenue composition.

Our results are consistent with the empirical evidence presented by García-Suaza et al. (2012), Khan et al. (2017), and Tabak et al. (2017). These studies emphasize the significant impact of macroprudential policies on banks' financial strategies. By limiting specific risk exposure, these regulations encourage

Table 5
Liquidity effects on banks' income composition

	Macro-prudential	Bank Controls	Macro Controls	Time Fixed Effects
L.LIQ-I	0.013***	0.013***	0.015***	0.006
	(0.003)	(0.003)	(0.003)	(0.006)
L.Size		–0.016***	–0.016***	–0.032***
		(0.005)	(0.005)	(0.006)
L.Liquidity		0.166***	0.164***	0.120***
		(0.033)	(0.032)	(0.034)
L.Deposits		–0.027	–0.033	–0.042*
		(0.025)	(0.025)	(0.025)
L.Cost Ratio		–0.174***	–0.144***	–0.110***
		(0.015)	(0.015)	(0.017)
L.Loans		–0.166***	–0.143***	–0.137***
		(0.019)	(0.021)	(0.021)
ΔGDP			0.000***	0.001***
			(0.000)	(0.000)
Interest Rate			–0.005***	–0.003**
			(0.001)	(0.001)
Inflation			0.000	0.001
			(0.001)	(0.001)
$\Delta ExchangeRate$			0.030	0.004
			(0.022)	(0.024)
Observations	22237	22237	22237	22237

Note: The table presents the results of regression (1) using the LIQ-I index. In the first column, the results are based solely on the index. In the second column, bank controls are added. In the third column, macroeconomic controls are included. In the fourth column, time fixed effects are incorporated. The coefficients for the quarter dummies and the constant are omitted for space considerations. Standard errors are reported in parentheses.. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

banks to seek new revenue streams. The noted rise in non-interest income relative to total income demonstrates how financial institutions adjust their business models to counteract regulatory effects while sustaining profitability.

Furthermore, research conducted by Cerutti et al. (2017), Davis et al. (2017), Carreras et al. (2018), Claessens et al. (2013), and Alam et al. (2019) demonstrated that macroprudential policies are associated with reduced credit growth, both for households and entrepreneurs, which affects bank profitability, as measured by traditional indicators such as Return on Assets (ROA) and Return on Equity (ROE). Our results follow this same line, showing that the implementation of a set of macroprudential instruments not only modifies the composition of revenues but also reduces the dependence on interest-based

Table 6
CCB effects on banks' income composition

	Macro-prudential	Bank Controls	Macro Controls	Time Fixed Effects
L.CCB-I	0.041***	0.016	0.017*	0.007
	(0.013)	(0.010)	(0.010)	(0.011)
L.Size		–0.007	–0.005	–0.032***
		(0.004)	(0.004)	(0.006)
L.Liquidity		0.194***	0.200***	0.120***
		(0.034)	(0.033)	(0.034)
L.Deposits		–0.036	–0.038	–0.043*
		(0.025)	(0.025)	(0.025)
L.Cost Ratio		–0.190***	–0.170***	–0.109***
		(0.015)	(0.015)	(0.017)
L.Loans		–0.146***	–0.128***	–0.137***
		(0.019)	(0.021)	(0.021)
ΔGDP			0.000*	0.001***
			(0.000)	(0.000)
Interest Rate			–0.004***	–0.003**
			(0.001)	(0.001)
Inflation			–0.001**	0.001
			(0.001)	(0.001)
$\Delta ExchangeRate$			0.013	0.004
			(0.022)	(0.024)
Observations	22237	22237	22237	22237

Note: The table presents the results of regression (1) using the CCB-I index. In the first column, the results are based solely on the index. In the second column, bank controls are added. In the third column, macroeconomic controls are included. In the fourth column, time fixed effects are incorporated. The coefficients for the quarter dummies and the constant are omitted for space considerations. Standard errors are reported in parentheses.. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

revenues, promoting diversification as a strategic response of banks.

6. Conclusions

This study examines the impact of implementing restrictive macroprudential policies on bank revenue composition by specifically assessing whether the share of non-interest income increases or decreases relative to bank revenue. To investigate this relationship, we employed a fixed-effects panel data model. Our analysis is based on a comprehensive accounting database covering 557 financial institutions in 27 emerging and developed economies from 2010 to 2021.

Table 7
LVR effects on banks' income composition

	Macro-prudential	Bank Controls	Macro Controls	Time Fixed Effects
L.LVR-I	0.009***	0.005*	0.007**	–0.016***
	(0.003)	(0.003)	(0.003)	(0.004)
L.Size		–0.010**	–0.010*	–0.031***
		(0.005)	(0.005)	(0.006)
L.Liquidity		0.185***	0.187***	0.115***
		(0.034)	(0.033)	(0.033)
L.Deposits		–0.034	–0.038	–0.041*
		(0.025)	(0.025)	(0.025)
L.Cost Ratio		–0.186***	–0.159***	–0.117***
		(0.016)	(0.016)	(0.017)
L.Loans		–0.154***	–0.134***	–0.133***
		(0.020)	(0.022)	(0.021)
ΔGDP			0.000**	0.001***
			(0.000)	(0.000)
Interest Rate			–0.004***	–0.002*
			(0.001)	(0.001)
Inflation			–0.001	–0.001
			(0.001)	(0.001)
$\Delta ExchangeRate$			0.011	0.001
			(0.022)	(0.024)
Observations	22237	22237	22237	22237

Note: The table presents the results of regression (1) using the LVR-I index. In the first column, the results are based solely on the index. In the second column, bank controls are added. In the third column, macroeconomic controls are included. In the fourth column, time fixed effects are incorporated. The coefficients for the quarter dummies and the constant are omitted for space considerations. Standard errors are reported in parentheses.. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Our findings suggest that macroprudential policies influence the composition of bank revenue, particularly through measures that target foreign currency exposure and liquidity management. The results indicate that restrictions on foreign currency lending (LFC) and foreign exchange exposure (LFX) play key roles in shifting bank revenue away from traditional interest-based sources, leading to greater diversification. Additionally, our findings provide evidence that liquidity regulations may contribute to changes in revenue composition. Taken together, these results reinforce the idea that regulatory measures designed to strengthen financial stability can rebalance the business models of financial institutions.

Macroprudential policies are tools aimed at reducing systemic risk, and

Table 8
SIFI effects on banks' income composition

	Macro-prudential	Bank Controls	Macro Controls	Time Fixed Effects
L.SIFI-I	0.010***	0.012***	0.014***	–0.003
	(0.003)	(0.003)	(0.003)	(0.006)
L.Size		–0.016***	–0.016***	–0.032***
		(0.005)	(0.005)	(0.006)
L.Liquidity		0.166***	0.167***	0.119***
		(0.033)	(0.032)	(0.034)
L.Deposits		–0.034	–0.037	–0.042*
		(0.025)	(0.025)	(0.025)
L.Cost Ratio		–0.182***	–0.156***	–0.110***
		(0.014)	(0.015)	(0.017)
L.Loans		–0.163***	–0.144***	–0.137***
		(0.019)	(0.021)	(0.021)
ΔGDP			0.000***	0.001***
			(0.000)	(0.000)
Interest Rate			–0.004***	–0.004**
			(0.001)	(0.001)
Inflation			–0.001**	0.001
			(0.001)	(0.001)
$\Delta ExchangeRate$			0.026	0.004
			(0.022)	(0.024)
Observations	22237	22237	22237	22237

Note: The table presents the results of regression (1) using the SIFI-I index. In the first column, the results are based solely on the index. In the second column, bank controls are added. In the third column, macroeconomic controls are included. In the fourth column, time fixed effects are incorporated. The coefficients for the quarter dummies and the constant are omitted for space considerations. Standard errors are reported in parentheses.. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

as indicated by the results of this study, can affect banks' financial performance. Investigating the effects stemming from the implementation of these policies on bank variables, such as revenue composition, becomes relevant for policymakers and the financial system as a whole, given the impact of these implementations on bank profitability and, consequently, on the stability of the financial system and the real economy.

Furthermore, it is essential that future studies consider the possibility that the persistence of macroprudential policies may induce structural changes in banking behavior, not only in terms of revenue diversification, but also in how banks manage regulatory constraints. The tendency to shift resources to non-bank financial institutions in search of greater flexibility and fewer regulations

warrants further investigation. These dynamics may alter the financial system's equilibrium and create new forms of systemic risk, thus challenging traditional macroprudential tools. Understanding these interactions is crucial for regulators to adapt their strategies to increasingly dynamic and interconnected financial environments.

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References

Ahnert, T., Forbes, K., Friedrich, C. and Reinhardt, D. (2021). Macroprudential FX regulations: Shifting the snowbanks of FX vulnerability?, *Journal of Financial Economics*, *140*(1), 145–174.

Aiyar, S., Calomiris, C. W. and Wieladek, T. (2014). Does macro-prudential regulation leak? Evidence from a UK policy experiment, *Journal of Money, Credit and Banking*, *46*(s1), 181–214.

Akinci, O. and Olmstead-Rumsey, J. (2018). How effective are macroprudential policies? An empirical investigation, *Journal of Financial Intermediation*, *33*, 33–57.

Alam, Z., Alter, M. A., Eiseman, J., Gelos, M. R., Kang, M. H., Narita, M. M., Nier, E. and Wang, N. (2019). Digging deeper–Evidence on the effects of macroprudential policies from a new database, , .

Allen, J., Grieder, T., Peterson, B. and Roberts, T. (2020). The impact of macroprudential housing finance tools in Canada, *Journal of Financial Intermediation*, *42*, 100761.

Altunbas, Y., Binici, M. and Gambacorta, L. (2018). Macroprudential policy and bank risk, *Journal of International Money and Finance*, *81*, 203–220.

Athanasoglou, P. P., Brissimis, S. N. and 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.

Athanasoglou, P. P., Delis, M. and Staikouras, C. (2006). Determinants of bank profitability in the South Eastern European region, , .

Auer, R. and Ongena, S. (2016). buffer and the composition of bank lending, , .

Beck, T., De Jonghe, O. and Schepens, G. (2013). Bank competition and stability: Cross-country heterogeneity, *Journal of financial Intermediation*, *22*(2), 218–244.

Bedayo, M., Estrada, Á. and Saurina, J. (2020). Bank capital, lending booms, and busts: Evidence from Spain over the last 150 years, *Latin American Journal of Central Banking*, *1*(1-4), 100003.

Belkhir, M., Ben Naceur, S., Candelon, B. and Wijnandts, J.-C. (2022). Macroprudential regulation and sector-specific default risk, , .

Camors, C. D., Peydró, J.-L. and Tous, F. R. (2019). Macroprudential and monetary policy: Loan-level evidence from reserve requirements, , .

Carreras, O., Davis, E. P. and Piggott, R. (2018). Assessing macroprudential tools in OECD countries within a cointegration framework, *Journal of Financial Stability*, *37*, 112–130.

Cerutti, E., Claessens, S. and Laeven, L. (2017). The use and effectiveness of macroprudential policies: New evidence, *Journal of Financial Stability*, *28*, 203–224.

Chronopoulos, D. K., Liu, H., McMillan, F. J. and Wilson, J. O. (2015). The dynamics of US bank profitability, *The European Journal of Finance*, *21*(5), 426–443.

Claessens, S. (2015). An overview of macroprudential policy tools, *Annual Review of Financial Economics*, *7*(1), 397–422.

Claessens, S., Ghosh, S. R. and Mihet, R. (2013). Macro-prudential policies to mitigate financial system vulnerabilities, *Journal of International Money and Finance*, *39*, 153–185.

Davis, E. P., Karim, D. and Noel, D. (2017). Macroprudential policy and financial imbalances, *Brunel Economics and Finance Working Paper 17-22*, Brunel University of London.

Davis, E. P., Karim, D. and Noel, D. (2020). The bank capital-competition-risk nexus–A global perspective, *Journal of International Financial Markets, Institutions and Money*, *65*, 101169.

Davis, E. P., Karim, D. and Noel, D. (2022). The effects of macroprudential policy on banks' profitability, *International Review of Financial Analysis*, *80*, 101989.

Ely, R. A., Tabak, B. M. and Teixeira, A. M. (2021). The transmission mechanisms of macroprudential policies on bank risk, *Economic Modelling*, *94*, 598–630.

Forbes, K. J. (2021). The international aspects of macroprudential policy, *Annual Review of Economics*, *13*, 203–228.

Freixas, X., Laeven, L. and Peydró, J.-L. (2015). Systemic risk, crises, and macroprudential regulation, , .

FSB, F. S. B. (2022). Promoting global financial stability: 2022 FSB annual report, , .

Gaganis, C., Lozano-Vivas, A., Papadimitri, P. and Pasiouras, F. (2020). Macroprudential policies, corporate governance and bank risk: Cross-country evidence, *Journal of Economic Behavior & Organization*, *169*, 126–142.

Galati, G. and Moessner, R. (2013). Macroprudential policy–A literature review, *Journal of Economic Surveys*, *27*(5), 846–878.

García-Suaza, A. F., Gómez-González, J. E., Pabón, A. M. and Tenjo-Galarza, F. (2012). The cyclical behavior of bank capital buffers in an emerging economy: Size does matter, *Economic Modelling*, *29*(5), 1612–1617.

Gonzalez, F. (2022). Macroprudential policies and bank competition: International bank-level evidence, *Journal of Financial Stability*, *58*, 100967.

Gropp, R., Mosk, T., Ongena, S. and Wix, C. (2019). Banks response to higher capital requirements: Evidence from a quasi-natural experiment, *The Review of Financial Studies*, *32*(1), 266–299.

Gurrea-Martínez, A. and Remolina, N. (2019). The dark side of implementing basel capital requirements: Theory, evidence, and policy, *Journal of international economic law*, *22*(1), 125–152.

Igan, M. D. and Kang, M. H. (2011). Do loan-to-value and debt-to-income limits work? Evidence from Korea, , .

Jiménez, G., Ongena, S., Peydró, J.-L. and Saurina, J. (2017). Macroprudential policy, countercyclical bank capital buffers, and credit supply: Evidence from the Spanish dynamic provisioning experiments, *Journal of Political Economy*, *125*(6), 2126–2177.

Khan, M. S., Scheule, H. and Wu, E. (2017). Funding liquidity and bank risk taking, *Journal of banking & finance*, *82*, 203–216.

Korytowski, M. (2018). Banks' profitability determinants in post-crisis European Union, *International Journal of Finance & Banking Studies (2147-4486)*, *7*(1), 1–12.

Lim, C. H., Costa, A., Columba, F., Kongsamut, P., Otani, A., Saiyid, M., Wezel, T. and Wu, X. (2011). Macroprudential policy: What instruments and how to use them? Lessons from country experiences, , .

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

Meuleman, E. and Vander Vennet, R. (2020). Macroprudential policy and bank systemic risk, *Journal of Financial Stability*, *47*, 100724.

Moreno, R. (2011). Policymaking from a'macroprudential'perspective in emerging market economies, , .

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

Poghosyan, T. (2020). How effective is macroprudential policy? Evidence from lending restriction measures in EU countries, *Journal of Housing Economics*, *49*, 101694.

Scalco, P. R., Tabak, B. M. and Teixeira, A. M. (2021). Prudential measures and their adverse effects on bank competition: The case of Brazil, *Economic Modelling*, *100*, 105495.

Tabak, B. M., Fazio, D. M., Ely, R. A., Amaral, J. M. and Cajueiro, D. (2017). The effects of capital buffers on profitability: An empirical study, *Economics Bulletin*, *37*(3), 1468–1473.

Teixeira, A. (2023). Does macroprudential policy affect wealth inequality? Evidence from synthetic controls, *Journal of Financial Stability*, *67*, 101135.

Teixeira, A. and Venter, Z. (2023). Macroprudential policy and aggregate demand, *International Journal of Central Banking*, *19*(4), 1–40.

Williams, B. (2016). The impact of non-interest income on bank risk in Australia, *Journal of Banking & Finance*, *73*, 16–37.

Wong, E. and Hui, C. (2010). Loan-to-value ratio as a macro-prudential tool–Hong Kong experiences, *Technical report*, mimeo, Research Department, Hong Kong Monetary Authority.

A. Appendix

Table A1
CCB effects on banks' income composition (alternative index)

	Macro-prudential	Bank Controls	Macro Controls	Time Fixed Effects
L.CCB-AI	0.012***	0.004	0.004	0.001
	(0.003)	(0.003)	(0.003)	(0.003)
L.Size		–0.007	–0.005	–0.032***
		(0.004)	(0.004)	(0.006)
L.Liquidity		0.195***	0.201***	0.120***
		(0.034)	(0.033)	(0.034)
L.Deposits		–0.036	–0.038	–0.043*
		(0.025)	(0.025)	(0.025)
L.Cost Ratio		–0.191***	–0.171***	–0.109***
		(0.015)	(0.015)	(0.017)
L.Loans		–0.146***	–0.128***	–0.137***
		(0.019)	(0.021)	(0.021)
ΔGDP			0.000*	0.001***
			(0.000)	(0.000)
Interest Rate			–0.004***	–0.003**
			(0.001)	(0.001)
Inflation			–0.001**	0.001
			(0.001)	(0.001)
$\Delta ExchangeRate$			0.011	0.003
			(0.022)	(0.024)
Observations	22237	22237	22237	22237

Note: The table presents the results of regression (1) using the CCB-AI index. In the first column, the results are based solely on the index. In the second column, bank controls are added. In the third column, macroeconomic controls are included. In the fourth column, time fixed effects are incorporated. The coefficients for the quarter dummies and the constant are omitted for space considerations. Standard errors are reported in parentheses.. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A2
LFC effects on banks' income composition (alternative index)

	Macro-prudential	Bank Controls	Macro Controls	Time Fixed Effects
L.LFC-AI	0.063***	0.045***	0.070***	0.052***
	(0.018)	(0.017)	(0.020)	(0.019)
L.Size		–0.007*	–0.005	–0.031***
		(0.004)	(0.004)	(0.006)
L.Liquidity		0.196***	0.205***	0.127***
		(0.034)	(0.033)	(0.034)
L.Deposits		–0.032	–0.034	–0.039
		(0.025)	(0.025)	(0.025)
L.Cost Ratio		–0.188***	–0.157***	–0.099***
		(0.015)	(0.014)	(0.016)
L.Loans		–0.143***	–0.115***	–0.127***
		(0.019)	(0.021)	(0.022)
ΔGDP			0.000**	0.001***
			(0.000)	(0.000)
Interest Rate			–0.005***	–0.005***
			(0.001)	(0.001)
Inflation			–0.002***	0.000
			(0.001)	(0.001)
$\Delta ExchangeRate$			–0.001	–0.007
			(0.022)	(0.024)
Observations	22237	22237	22237	22237

Note: The table presents the results of regression (1) using the LFC-AI index. In the first column, the results are based solely on the index. In the second column, bank controls are added. In the third column, macroeconomic controls are included. In the fourth column, time fixed effects are incorporated. The coefficients for the quarter dummies and the constant are omitted for space considerations. Standard errors are reported in parentheses.. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A3
LFX effects on banks' income composition (alternative index)

	Macro-prudential	Bank Controls	Macro Controls	Time Fixed Effects
L.LFX-AI	0.013***	0.016***	0.013***	0.010**
	(0.003)	(0.003)	(0.004)	(0.004)
L.Size		–0.009**	–0.007	–0.031***
		(0.004)	(0.005)	(0.006)
L.Liquidity		0.221***	0.222***	0.143***
		(0.035)	(0.034)	(0.036)
L.Deposits		–0.026	–0.031	–0.038
		(0.026)	(0.026)	(0.025)
L.Cost Ratio		–0.195***	–0.175***	–0.116***
		(0.015)	(0.016)	(0.017)
L.Loans		–0.136***	–0.118***	–0.130***
		(0.019)	(0.021)	(0.022)
ΔGDP			0.000*	0.001***
			(0.000)	(0.000)
Interest Rate			–0.004***	–0.003***
			(0.001)	(0.001)
Inflation			–0.001	0.001*
			(0.001)	(0.001)
$\Delta ExchangeRate$			0.014	0.005
			(0.022)	(0.024)
Observations	22237	22237	22237	22237

Note: The table presents the results of regression (1) using the LFX-AI index. In the first column, the results are based solely on the index. In the second column, bank controls are added. In the third column, macroeconomic controls are included. In the fourth column, time fixed effects are incorporated. The coefficients for the quarter dummies and the constant are omitted for space considerations. Standard errors are reported in parentheses.. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A4
Liquidity effects on banks' income composition (alternative index)

	Macro-prudential	Bank Controls	Macro Controls	Time Fixed Effects
L.LIQ-AI	0.003***	0.002**	0.003***	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)
L.Size		–0.008**	–0.008*	–0.029***
		(0.004)	(0.004)	(0.007)
L.Liquidity		0.177***	0.174***	0.110***
		(0.033)	(0.032)	(0.033)
L.Deposits		–0.027	–0.030	–0.035
		(0.025)	(0.025)	(0.025)
L.Cost Ratio		–0.190***	–0.162***	–0.107***
		(0.015)	(0.015)	(0.017)
L.Loans		–0.155***	–0.134***	–0.134***
		(0.019)	(0.021)	(0.021)
ΔGDP			0.000***	0.001***
			(0.000)	(0.000)
Interest Rate			–0.005***	–0.004***
			(0.001)	(0.001)
Inflation			–0.001	0.002*
			(0.001)	(0.001)
$\Delta ExchangeRate$			0.018	0.001
			(0.022)	(0.024)
Observations	22237	22237	22237	22237

Note: The table presents the results of regression (1) using the LIQ-AI index. In the first column, the results are based solely on the index. In the second column, bank controls are added. In the third column, macroeconomic controls are included. In the fourth column, time fixed effects are incorporated. The coefficients for the quarter dummies and the constant are omitted for space considerations. Standard errors are reported in parentheses.. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A5
LVR effects on banks' income composition (alternative index)

	Macro-prudential	Bank Controls	Macro Controls	Time Fixed Effects
L.LVR-AI	−0.006***	−0.004***	−0.003*	−0.013***
	(0.002)	(0.001)	(0.002)	(0.002)
L.Size		−0.003	−0.002	−0.032***
		(0.004)	(0.005)	(0.006)
L.Liquidity		0.194***	0.201***	0.090***
		(0.034)	(0.034)	(0.032)
L.Deposits		−0.039	−0.039	−0.040
		(0.025)	(0.025)	(0.025)
L.Cost Ratio		−0.197***	−0.179***	−0.110***
		(0.015)	(0.015)	(0.016)
L.Loans		−0.134***	−0.123***	−0.136***
		(0.019)	(0.021)	(0.021)
Δ*GDP*			0.000	0.001***
			(0.000)	(0.000)
Interest Rate			−0.003**	−0.003*
			(0.001)	(0.001)
Inflation			−0.001**	−0.001
			(0.001)	(0.001)
Δ*ExchangeRate*			0.007	−0.019
			(0.022)	(0.025)
Observations	22237	22237	22237	22237

Note: The table presents the results of regression (1) using the LVR-AI index. In the first column, the results are based solely on the index. In the second column, bank controls are added. In the third column, macroeconomic controls are included. In the fourth column, time fixed effects are incorporated. The coefficients for the quarter dummies and the constant are omitted for space considerations. Standard errors are reported in parentheses.. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A6
SIFI effects on banks' income composition (alternative index)

	Macro-prudential	Bank Controls	Macro Controls	Time Fixed Effects
L.SIFI-AI	0.002*	0.004***	0.004***	–0.008***
	(0.001)	(0.001)	(0.001)	(0.003)
L.Size		–0.019***	–0.018***	–0.028***
		(0.006)	(0.006)	(0.007)
L.Liquidity		0.180***	0.184***	0.093***
		(0.033)	(0.033)	(0.034)
L.Deposits		–0.040	–0.042*	–0.034
		(0.025)	(0.025)	(0.025)
L.Cost Ratio		–0.191***	–0.170***	–0.101***
		(0.015)	(0.015)	(0.018)
L.Loans		–0.157***	–0.140***	–0.133***
		(0.019)	(0.021)	(0.021)
ΔGDP			0.000***	0.001***
			(0.000)	(0.000)
Interest Rate			–0.004***	–0.004***
			(0.001)	(0.001)
Inflation			–0.001**	0.001
			(0.001)	(0.001)
$\Delta ExchangeRate$			0.018	0.008
			(0.022)	(0.024)
Observations	22237	22237	22237	22237

Note: The table presents the results of regression (1) using the SIFI-AI index. In the first column, the results are based solely on the index. In the second column, bank controls are added. In the third column, macroeconomic controls are included. In the fourth column, time fixed effects are incorporated. The coefficients for the quarter dummies and the constant are omitted for space considerations. Standard errors are reported in parentheses.. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$