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# Fintech Competition and Banks' Shrinking Margins in Brazil

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**Fintech Competition and Banks' Shrinking Margins in Brazil**  
**Prepared by Rui Xu**

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**ABSTRACT:** The rise of fintech lenders has intensified competition in the banking industry. This study utilizes Brazilian bank-level data to examine the causal impact of increased competition on commercial banks' lending rates and profitability. Employing a bank-specific Bartik exposure, constructed from comprehensive credit and balance sheet information across all Brazilian banks and fintech lenders, the analysis reveals that commercial banks sustained their loan portfolios primarily by lowering lending rates. Specifically, a one standard deviation increase in fintech competition exposure corresponds to a 3.7 percentage point reduction in average lending rates at commercial banks. Banks' operational efficiency increased due to heightened competition, but their net interest margins narrowed, adversely affecting overall profitability. Between 2018 and 2024, fintech competition is estimated to have lowered banks' average lending rates by 2.7 percentage points and reduced traditional banks' net interest margins by 0.9 percentage points.

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## WORKING PAPERS

# **Fintech Competition and Banks’ Shrinking Margins in Brazil**

Prepared by Rui Xu<sup>1</sup>

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# Introduction

Digital technology is transforming financial services. Over the past decade, financial technology (fintech) firms have experienced considerable expansion on a global scale. Beyond payment solutions, fintech lenders—including some digital banks—are increasing their market share and intensifying competition with established banking institutions. Nevertheless, the impact of this competition on traditional banks' lending rates, operational efficiency, and profitability remains an open question.

Brazil is a prime case for studying fintech competition's effect on banks, as fintech lending now significantly impacts traditional banks.<sup>1</sup> From 2018 to 2024, nonbank credit companies nearly doubled, becoming major competitors of banks (Figure 2A). Notably, four of the world's ten largest digital banks are Brazilian (Figure 2B). Collectively, nonbank credit companies account for a considerable portion of the unsecured consumer credit market, including 25 percent of the credit card sector (Figure 2C). The number of active borrowers from these fintech companies rose from nearly zero to 60 million (about 40 percent of the adult population) between 2018 and 2023, broadening credit access (Figure 2D). The new entrants also reduced concentration in the banking industry and increased competition in the credit market (see da Silva Neto and Silva, 2024; Figure 1C-D).<sup>2</sup>

Several factors contribute to the growth of fintech lending in Brazil, notably the high cost of credit and regulatory initiatives by the central bank designed to foster competition. In 2023, average market lending rates exceeded funding rates by 30 percentage points—a gap significantly greater than the global average spread of 5.9 percent (see Figure 1A). Among the primary drivers of credit costs in Brazil are bank profit margins and administrative expenses (Figure 1B). To mitigate elevated interest rates and promote competitive dynamics, the Central Bank of Brazil (BCB) has enacted various measures since 2016. Key developments include the facilitation of credit portability, the launch of the Pix instant payment system, progress in the open finance agenda, and the introduction of targeted regulations to encourage the participation of new entrants such as fintech firms.

This paper examines the responses of incumbent banks in Brazil to heightened competition. Key questions include whether banks lowered lending rates to maintain competitiveness or raised them to offset higher default risks associated with a riskier borrower pool. Additionally, it is uncertain whether incumbent banks improved operational efficiency by reducing administrative expenses, or incurred higher costs to better screen borrowers in a more competitive market. Ultimately, the study considers whether fintech competition has contributed to lower lending costs through compressed profit margins and decreased administrative expenditures—both significant contributors to Brazil's high credit costs. To address these questions, this paper introduces three innovations.

The first innovation involves constructing a comprehensive dataset comprising key accounting and credit information for each financial institution regulated by BCB from 2013 to 2024. The database allows for measurement of individual banks' exposure to fintech competition and permits a detailed examination of their

<sup>1</sup> Fintech lenders in this context are financial services firms operating in Brazil that utilize technology to extend credit directly to individuals and businesses. Unlike traditional banks, they do not possess full banking licenses and are designated by regulators as "non-bank credit companies."

<sup>2</sup> Previous studies suggest high banking sector concentration led to higher lending rates and lower competition in Brazil, such as de Araújo and others (2006), Dantas and others (2011), Martins (2012), Almeida and Divino (2015), Joaquim and others (2019), and Santos (2021).

strategic responses. Previous research has typically focused on a single credit segment for identification purposes (see Gissler and others, 2020; Cornelli and others, 2019; Ornelas and Pecora, 2022) or used commercial data vendors with coverage limited to parts of the financial system (for example, Ben Naceur and others, 2025; Bejar and others, 2022; Bakker and others, 2023). Martins and others (2023) analyzed similar BCB data from 2018-2022 but did not identify significant effects of fintech competition, likely due to the use of case studies and the absence of an identification strategy.

Second, the paper develops a Bartik exposure metric to quantify each bank's level of exposure to fintech competition. This measure calculates the evolving fintech market share within each credit segment and aligns it with each bank's credit portfolio composition. Specifically, a bank's exposure to fintech competition is determined as the weighted sum of fintech market shares across its loan segments, where the weights correspond to the bank's initial exposure to each segment. Given that fintech lending activity has been concentrated in specific loan segments, this exposure naturally varies among banks over time, with institutions more reliant on unsecured personal loans facing higher levels of fintech competition. This metric is also referred to as a "shift-share" exposure measure, in which the change in fintech market share constitutes the "shift", while each bank's initial loan composition represents the "share."

Third, this paper examines the causal effects of fintech competition on the entire commercial banking sector. According to Goldsmith-Pinkham and others (2020), the Bartik exposure provides a consistent estimator if either the shares are randomly distributed across banks, or the shocks are random across loan segments. Standard diagnostic tests confirm that initial loan shares are randomly allocated across banks in Brazil. Given these conditions, panel regressions conducted across commercial banks can yield consistent estimates regarding the effects of fintech competition. To the author's knowledge, this study is the first to analyze the macro-level causal effects of fintech competition on all commercial banks within an economy.

My findings indicate that commercial banks in Brazil reduced average lending rates in response to fintech competition, which was accompanied by a decrease in net interest margins and profitability. The influence of competition on lending rates can go both ways theoretically. According to the traditional industrial organization (IO) perspective, increased competition is associated with lower lending rates, as noted in studies by Ben Naceur and others (2023), Bejar and others (2022), Ornelas and Pecora (2022), and Joaquim and others (2023). Alternatively, some banks may face riskier borrowers and raise lending rates due to factors such as information asymmetry and the fixed costs associated with building bank-firm relationships, as discussed by Yannelis and Zhan (2023), Huynh (2023), and Benchimol and Bozou (2024). This study supports the traditional IO view. Specifically, a one standard deviation increase in fintech competition is associated with a 3.7 percentage point reduction in banks' average lending rates and a 1.3 percentage point decrease in net interest margins.

Incumbent banks managed to improve operational efficiency by cutting administrative costs. Before 2018, large commercial banks enjoyed significant market power and could sustain high profits despite low operational efficiency (FSSA, 2018). With rising competition from fintech companies and lower interest income, incumbent banks managed to reduce overhead costs by developing online banking and enhancing digital services. For instance, many banks developed their own digital brands and established partnerships with fintech to improve user experience (The Banking Report, 2021; Khan and others, 2024). Enhanced efficiency and innovation by incumbent banks were also identified among Chinese banks (Wang and others, 2021) and US banks (Modi and others, 2022).

The analysis also provides insight into the strategic approaches adopted by commercial banks in response to heightened competition. Increased competitive pressures resulted in a decline in customer numbers for commercial banks, particularly within credit segments characterized by intense rivalry, such as unsecured consumer loans. This observation aligns with existing literature, which suggests that incumbent banks often lose customers to fintech lenders due to the latter's superior modelling capabilities, cost efficiencies, and lighter regulatory oversight (see Buchak and others, 2018; Fuster and others, 2019; Tang, 2019; Berg and others, 2020; Gopal and Schnabl, 2022). Nonetheless, commercial banks in Brazil sustained their overall credit volumes by targeting high-value clientele and expanding average loan amounts per borrower. For example, several major banks introduced home equity loans featuring competitive rates and favorable terms specifically for mortgage clients.

There is no evidence of a change in incumbent banks' risk-taking behavior in response to increased fintech competition. Although non-performing loan (NPL) ratios for credit card loans rose significantly during 2021-23, this trend largely reflects the rapid expansion of fintech lenders catering to higher-risk, first-time borrowers. Fintech competition has not produced a discernible effect on commercial banks' risk profiles, as demonstrated by NPL ratios—which represent realized loan defaults—and provisioning expense ratios—which reflect *ex ante* risk assessment.

The findings have implications for consumer welfare and financial intermediation efficiency. Since 2018, commercial banks lowered their lending rates by approximately 2.7 percentage points in response to increased fintech competition. This figure is calculated by multiplying the change in average fintech competition (2018-2024) with the panel regression coefficient of lending rates on fintech competition exposure. Lower credit costs provide borrowers with reduced expenses and improve consumer welfare. During the same period, banks' net interest margins decreased while operational efficiency increased due to fintech competition. These developments indicate notable improvements in financial intermediation efficiency since the 2018 Financial Sector Assessment by the IMF (FSSA, 2018).

The findings also contribute to understanding the sustained credit growth observed since 2022, despite a restrictive monetary policy stance. Fintech lenders have stimulated credit demand by directly providing loans and introducing competitive pressure that has led commercial banks to lower lending rates. The analysis indicates that commercial banks have successfully maintained their loan portfolios in the face of increased competition from fintech institutions. As a result, the combined influence of both fintech lenders and commercial banks has supported continued consumer credit growth since 2022, regardless of tighter monetary conditions (see Figure 2F).

The rest of the paper is organized as follows. Section II provides an overview of fintech lenders in Brazil. Section III details the dataset and estimation strategy. Section IV presents the estimated effects of fintech competition on commercial banks. Section V shows robustness and Section VI concludes the paper.

## The Rise of Fintech in Brazil

In Brazil, fintech operates in a wide range of sectors, including digital banking, currency exchange, lending, financial management, investments, insurance and payment systems (Vieira and others, 2021). Fintech expansion has been particularly strong in Brazil, largely due to service gaps left by traditional banks, high smart phone usage (Rojas-Torres and others, 2021), and regulatory support (The Banking Report, 2020).

This paper examines the impact of nonbank credit companies. These fintech lenders, classified as n1 and n4 by BCB, include native digital banks and other non-banking institutions. Native digital banks, including entities like Nubank, accept deposits similarly to commercial banks; however, all transactions are conducted digitally, and they do not operate physical branches. Non-banking institutions utilize balance-sheet lending or peer-to-peer lending models instead of accepting deposits. Balance sheet lending fintechs, regulated as Direct Credit Societies (SCD) in Brazil, obtain funding either through their own equity or by securitizing credit operations. Peer-to-peer fintechs, regulated as Peer-to-Peer Loan Companies (SEP) in Brazil, facilitate connections between investors and borrowers without taking on permanent creditor or debtor roles. As of end-2024 approximately 195 non-banking credit companies operate in Brazil, all of which are considered in this analysis.

The government and financial regulators have been trying to foster greater competition in the banking and payment sectors. Key initiatives include credit portability, Pix instant payment system, open finance agenda and specific regulations to govern fintech companies engaged in credit operations (Mariani and others, 2025; The Banking Report, 2020). A few of the key fintech regulations are listed below.

- CMN Resolution 4,480, of April 25, 2016, brought the possibility to open, maintain, and close deposit accounts exclusively through digital channels, allowing banks and other financial institutions to deal with customers without their physical presence, which is a common feature of all fintechs.
- CMN Resolution 4,656, of April 26, 2018, defined specific regulations for credit fintechs to operate in the financial system with their own authorization, including the modalities of balance sheet lending (regulated as SCDs), and peer-to-peer lending (SEPs). With the regulation of SCDs, Brazil stands out as the first country to establish a specific financial license modality for this type of activity.
- CMN Resolution 4,658, of April 26, 2018, established the requirements for contracting data processing and cloud computing services, enhancing security in hiring companies to render technology services, including providers based abroad. This regulation has boosted the growth of fintechs as service providers for financial institutions.
- CMN Resolution 4,753, of September 26, 2019, facilitated digital relationships by establishing the possibility of more simplified procedures and requirements, proportionally to the risk and nature of the relationship.
- BCB Resolution 29/2020 and BCB 50/2020 established guidelines and procedures for the implementation of the Regulatory Sandbox for financial institutions. This technique consists in creating, under special and temporary authorization, a controlled environment for testing business models that could promote gains of efficiency, scope, capillarity, cost reduction, and increase security in the financial system.

The fintech companies helped enhance financial inclusion by bringing millions into the financial system. For instance, Nubank has reached 100 million customers in Brazil by end-2024, of which 22 million accessed formal financial services for the first time. According to BCB data, the number of active borrowers increased from 75 million in 2018 to 115 million in 2023, with most of the increase attributable to fintech companies (Figure 2D).

However, the ensuing credit expansion has increased household leverage and default risks, especially during monetary tightening. Household debt-to-income ratio rose from 37% in 2018 to nearly 50% in 2022. With the hiking cycle in 2022-23, over 45% of consumers defaulted on financial obligations in 2023, compared to less than 40% in January 2018. To help households de-leverage, the government started the *Desenrola* program in

July 2013, aiding over 15 million people to renegotiate around R\$50 billion in overdue debt by May 2024. The program also included financial education and consumer protection strategies.

The different regulatory frameworks governing banks and fintech firms, despite their involvement in comparable lending activities and exposure to similar risks, may result in unfair competition and increase systemic risks. Before 2022, payment institutions' capital requirement was 2 percent on the transactions carried out in the last 12 months. As credit fintech companies grow, they provide increasingly complex and bank-like services, with some of them reaching systemic scales. To level the playing field and contain systemic risks, the BCB imposed stricter capital requirements for fintech conglomerates that are controlled by a payment institution but integrated with a financial institution. Effective from January 2023 with progressive implementation until 2025, these conglomerates face the same capital requirement as banks of similar scales (Table 1).

## Empirical Strategy

Fintech penetration varies across different loan segments, which provides the necessary variation for identification. The BCB database classifies sixteen types of credit: seven categories are designated for households and nine for corporates. Fintech competition has increased primarily in credit card loans and nonpayroll personal loans, as these segments have lower entry barriers and higher interest spreads (see Figure 3).

Banks' exposure to fintech competition is influenced by the composition of their loan portfolios. Although commercial banks possess diversified portfolios, the allocation among various credit types differs significantly across banks. Institutions with a higher proportion of unsecured personal loans are more susceptible to competitive pressures from fintech firms. A Bartik exposure is constructed to measure each bank's exposure to fintech competition.

### A. Empirical specification

A Bartik exposure to fintech competition is constructed for each bank:

$$\text{Exposure to fintech competition}_{i,t} = \sum_n \text{Loan share}_{i,n} \cdot \text{Fintech\_share}_{n,t} \quad (1)$$

where  $\text{Loan share}_{i,n}$  is bank  $i$ 's share of loan portfolio in credit segment  $n$  before significant presence of fintech lenders; and  $\text{Fintech\_share}_{n,t}$  is the share of lending by fintech companies in credit segment  $n$  at  $t$ .<sup>3</sup>

Bartik exposure designs are popular and under the right conditions can provide exogenous variations. The use of these designs in economics began with Bartik (1991), estimating impacts of expected employment growth based on national trends for local industries. This "Bartik instrument" has been used to address various economic questions, such as migration impacts on labor markets (Card, 2001), food aid impacts on conflict (Nunn and Qian, 2014), and import competition from China on U.S. labor markets (Autor and others, 2013).

With this measure of exposure, I use panel regressions to estimate the effects of fintech competition.

<sup>3</sup> Here I calculate pre-existing loan composition using the average share before 2017.

$$y_{i,t} = \alpha_i + \beta \cdot \text{Exposure to fintech competition}_{i,t} + \gamma \cdot X_{i,t} + \delta_{year} \cdot I_{year} + \sigma_q \cdot I_q + \epsilon_{i,t} \quad (2)$$

Different outcome variables  $y_{i,t}$  of commercial banks are analyzed, including average lending rates, funding cost ratio, net interest margin, cost to assets ratio (to measure operational efficiency), credit risk (measured by NPL ratios and provisioning ratios), return on equity, and return on assets. The exposure to fintech competition is calculated as in equation (1) and standardized (by calculating the number of standard deviations from the mean) for easier interpretation of the coefficients. Standard bank-specific controls are included to capture bank characteristics, including market share and liquid asset ratio, in addition to bank fixed effects. Year fixed effects and quarter fixed effects are also included to control for macro environment, policy changes, and seasonality. Standard errors are clustered at bank level and shown in the parentheses.

## B. Data

The dataset is constructed from the central bank's quarterly reports of financial institutions (IF database). These reports cover balance sheet information, income statements and detailed loan portfolio information on type of credit and maturity, economic activity, number of clients and transactions, and risk levels. The database covers all financial institutions that are authorized to operate and in normal operation, including about 100 commercial banks, 900 credit unions, and 300 non-banking credit companies and payment institutions. The universal coverage allowed me to calculate market concentration and fintech competition precisely. This paper focuses on commercial banks which account for 85 percent of total credit in the financial system.<sup>4</sup>

The dataset covers the period of 2012 to 2024 with quarterly reports. The dataset provides enough data points before significant fintech competition to calculate the pre-existing exposure to different credit segments.

The summary statistics of the key variables are presented in Table 2. Net interest margin is calculated as annualized net interest income over total assets. Provision ratio is calculated as the annualized provision expenses over total loans. The cost of funding ratio is calculated as the funding expense over total funding. Average lending rates are calculated as income from credit operations divided by total loans. For all stock variables, such as assets, a four-quarter moving average is used in calculating ratios to minimize the effect of temporary fluctuations. For all calculated ratios, the top and bottom 5 percent of the observations are trimmed to minimize the effect of outliers.

## C. Exogeneity

The Bartik exposure yields consistent estimators when the loan shares are exogenous as shown in Goldsmith-Pinkham and others (2020). Two diagnostic tests can check the validity of the random share assumption. The first one is the balance check, where one can test the correlation between exposure and bank characteristics. If the exposure is random, it should be uncorrelated with fixed bank characteristics. The second is a placebo test. If impacts of exposure are only expected after significant fintech competition, one should not expect impacts of exposure on outcomes in earlier time periods.

The outcome variable of commercial banks passed the diagnostic tests. For the balance check, I tested the relationship between bank characteristics and the exposure to fintech competition, as well as the share of credit

<sup>4</sup> Commercial banks refer to the b1 category under the BCB's business model category. Investment bank (b2) and development banks (b4) are excluded. Fintech lenders refer to non-bank financial institutions with outstanding loans, i.e. categories n1, n2 and n4. I do not analyze the impact of fintech competition on credit unions given their specialized features, such as not-for-profit business model.

card loans that explains most of the variation (see Table 3). The correlations are not significant, suggesting random share. I also performed the placebo test and found no pre-trend in outcome variables before significant fintech competition (Figure 4).

## Banks' Response to Fintech Competition

Incumbent banks can respond to competition in several ways. They may lower lending rates to maintain their customer base (price effects), which can reduce interest margins and profitability and lead to efforts to minimize operational costs (efficiency effects). Banks might also adjust risk tolerance and compete with fintech lenders for new borrowers (risk effects), leading to higher interest rates on average. Regardless of these strategies, banks may experience a decrease in customer numbers and loan portfolios (quantity effects). These combined factors affect overall bank profitability.

Using the Bartik exposure, my findings indicate that commercial banks were able to preserve the total size of their loan portfolios by reducing lending rates without changing their overall risk tolerance. Nonetheless, the reduced net interest margins resulted in decreased profitability, despite achieving more efficient operations.

### A. Price Effects

The findings indicate that commercial banks in Brazil lower their average lending rates in response to increased competition from fintech. A one standard deviation increase in fintech competition leads to a 3.7 percentage point reduction in the average lending rates offered by commercial banks, as detailed in Table 4A, column 4. This effect is substantial, accounting for approximately one fifth of the interest rate spread observed between 2022 and 2024.

Fintech lenders may compete with commercial banks for funding, including stable deposits. However, my analysis shows no notable effect on bank funding costs, likely because digital banks comprised only 7% of total funding as of December 2024 (Financial Stability Report, 2025).

Lower lending rates reduce banks' net interest margins (NIM). A standard deviation increase in fintech exposure compresses commercial banks' NIM by 1.3 percentage points, as shown in Table 4A column 2, which is significant compared to Brazil's average NIM of 4.4 percent in 2021. This effect aligns with literature estimates: Bakker and others (2023) report fintech competition lowers NIM in EMDEs and Latin America/Caribbean by 0.2–2.7 percentage points, while Ben Naceur and others (2023) find a 2.1-percentage point drop for incumbents from 2012–2020. Net interest margins fell less than average lending rates, indicating banks compensated for reduced credit income with investment income.

### B. Quantity Effects

Banks experiencing higher levels of fintech competition saw a reduction in the number of borrowers. Notably, an increase of one standard deviation in fintech exposure was associated with a 32% reduction in borrowers, as shown in Table 4B, column 4. The decrease likely involved customers who had credit card or non-payroll personal loans, and who opted for fintech lenders due to lower service fees and high-quality online banking services. This effect aligns with the rapid growth in the number of fintech lender borrowers—illustrated in Figure 2D—reaching 60 million in 2023 and representing half of all borrowers in the financial system.

Despite a significant decline in customer numbers, commercial banks successfully maintained the overall size of their loan portfolios. The affected credit card and consumer loans involve many borrowers but small individual amounts, so they have a modest effect on overall credit volume. To compensate for the loss of customers, commercial banks increased the average loan size per customer by reducing lending rates and targeting high-value clients. As demonstrated in Table 4B column 6, a one standard deviation rise in fintech exposure corresponds to a 32% increase in loans per borrower. This expansion in borrowing per customer effectively offsets the reduction in the number of customers, resulting in stable overall loan volumes.

The findings highlight how commercial banks respond strategically to market competition. Facing more rivals in unsecured consumer loans, large banks leveraged their existing service networks to enhance credit relations with high-value clients. For instance, a large Brazilian bank launched a credit line for customers with existing mortgages in 2024, offering lower interest rates from 1.35% per month and extended payment terms up to 20 years.

### C. Efficiency Effects

Banks improved operational efficiency in response to increased fintech competition, which is evident in the reduction of administrative costs relative to total assets. Specifically, a one standard deviation rise in fintech exposure leads to a 0.5 percentage point decrease in the administrative cost-to-asset ratio, as indicated in Table 4C, column 2.<sup>5</sup> This effect represents approximately one third of the sample's median cost-to-asset ratio and aligns with the broader trends outlined in BCB's Financial Stability Report (2025).

High operating costs have been identified as a key factor contributing to elevated credit costs in Brazil. According to the BCB's Financial Stability Report (2025), approximately 24 percent of the interest rate spread—the difference between average lending rates and funding rates—is due to administrative expenses (Figure 1B). Structural aspects, including the need to serve remote regions and high default rates, may have contributed to higher overheads. Additionally, limited competition has reduced incentives to improve technology and operational efficiency.

Competition from fintech lenders has led commercial banks to seek greater efficiency, including through digitalization. Motivated by the operations of digital banks, commercial banks have increased investments in digital technologies to improve service quality and reduce costs (Thiago Christiano and others, 2021). Since 2017, Brazilian banks have closed some physical branches and opened digital branches. These virtual branches offer communication via text messages, emails, telephone, and internet messaging, along with extended customer service hours, which have influenced customer experience and operational expenses. Open finance initiatives by the government and the Pix instant payment system have also played a role in the sector's ongoing digital transformation.

### D. Risk Effects

Fintech competition does not appear to affect credit risks of commercial banks. Credit risks are measured by two metrics: non-performing loan ratios (NPL) and provisioning ratio (i.e. provisioning expenses over total loans). The former measures realized credit default and the latter measures the expected credit risk. The coefficients on exposure to fintech competition are insignificant for both measures of credit risk, as shown in Table C, column 3-6.

<sup>5</sup> Operational efficiency can also be measured by administrative expenses over operational income. This measure is not used in this paper because fintech competition has reduced interest income in addition to lowering administrative expenses.

Economic theory offers different perspectives regarding how competition influences banking risk. The competition-fragility perspective suggests that increased competition may lower bank profit margins, leading banks to take on greater risk in their loan portfolios (Hellman and others, 2000; Jiang and others, 2017; Feng, 2018). Conversely, the competition-stability view maintains that competition could reduce loan interest rates, thereby lowering consumers' debt service costs and reducing credit risk (Boyd and De Nicoló, 2005; Elekdag and others, 2025). Research also stresses that the competition-fragility and competition-stability influences are not mutually exclusive (e.g., Martinez-Miera and Repullo 2010), and the impact of competition on managerial incentives is theoretically ambiguous (e.g., Raith 2003).

My analysis demonstrates that these channels offset each other in Brazil. The entrance of fintech lenders into the unsecured consumer loan markets—specifically credit cards and nonpayroll loans—resulted in an increased overall borrower risk profile, as evidenced by rising NPL ratios (see Figure 2E). In response, commercial banks adapted by concentrating on high-value, low-risk borrowers and providing more favorable credit terms. Consequently, the aggregate credit risk for commercial banks remained largely stable after the emergence of fintech competitors.

### **E. Profitability**

Banks experienced a reduction in profitability as their exposure to fintech competition increased. This decline was primarily attributed to narrower net interest margins, although operational efficiencies provided some offsetting benefits. Analysis indicates that a one standard deviation rise in fintech exposure led to a 3.6 percentage point decrease in return on equity and a 0.7 percentage point reduction in return on assets. These effects are sizeable, given that the median return on equity stands at 9.1 percent and the median return on assets is 1.1 percent.

The reduced profitability is consistent with findings from previous cross-country studies. Ben Naceur and others (2023) reported negative associations between fintech and bank profitability, attributing these to lower interest rate margins and higher operational costs. Similarly, Hodula (2024) observed a stable negative correlation between the growth of fintech credit and traditional banking sector profitability, based on cross-country panel data from 2013 to 2019. Both papers assessed fintech at the country level and did not establish causal relationships.

### **F. Macro implications**

Drawing upon data from all commercial banks in Brazil, the estimated coefficients can inform the macroeconomic effects of increased fintech competition. From 2018 to 2024, average fintech competition rose by 0.7 standard deviations. Applying this change to the model's coefficients provides an approximate assessment of the overall impact (Figure 5).<sup>6</sup> Specifically, since 2018, heightened fintech competition has resulted in a 2.7 percentage point reduction in average lending rates, a 0.9 percentage point decrease in net interest margins, a 0.4 percentage point decline in the administrative costs-to-asset ratio, and a 0.5 percentage point reduction in return on assets. These outcomes are notable at the macro level—representing 15 percent of the interest rate spread, 20 percent of net interest margins, 12 percent of the administrative cost-to-asset ratio, and 33 percent of the return on asset ratio as measured in 2024.

<sup>6</sup> The effects are estimated for commercial banks, which account for over 80 percent of banking sector assets and more than 90 percent of the market credit operations.

The expansion of fintech lending institutions has helped sustain Brazil's credit growth, even in the context of restrictive monetary policy. The Central Bank of Brazil (BCB) led major central banks by initiating rate increases in 2022, followed by a new tightening cycle from September 2024 that raised the policy rate to 15 percent by June 2025, with real interest rates nearing 10 percent. Despite the effective transmission of these policies (Leigh and Xu, 2025), credit growth remains strong. This can be partly attributed to fintech lenders, who have expanded direct lending activities and driven commercial banks to lower lending rates due to intense competition. Evidence presented in this paper indicates that fintech lenders successfully grew their client base and loan portfolio without diminishing the loan portfolios of commercial banks, as incumbents responded by reducing lending rates and enhancing banking services.

## Robustness Checks

The baseline results are robust to using alternative estimators and controlling for other structural changes in the financial market.

Following the literature, I considered three alternative estimators. The first one is the leave-one-out Bartik exposure, where for each bank, its own credit is excluded when calculating the fintech shock. This addresses potential endogeneity issues, as the exposure measure no longer includes the credit of the bank that is being studied. Secondly, I considered an earlier base year (2016 instead of 2017) to fix the loan composition of commercial banks. This can help address the concern that banks may have already responded to fintech competition before fintech lenders reach a significant scale. Thirdly, I used the two-stage-least-squares (2SLS) with each loan segment share multiplying time period separately as instruments (i.e. Bartik instruments). The effect of fintech competition is robust to these alternative estimators, as shown in Table 5A.

Additionally, the observed impact of fintech competition remains when accounting for structural changes in the financial market. Two significant structural developments have occurred in the Brazilian financial market since 2010, alongside the emergence of fintech companies.

The first was the expansion of credit unions, influenced by factors such as their physical proximity to members and their presence in regions with limited access to banking services. Regulatory changes, including the Brazilian Cooperative Act, facilitated this growth by granting cooperatives legal authority comparable to banks for offering deposits, loans, and payments services, while also clarifying supervisory and legal frameworks. The majority of the expansion occurred prior to 2020, after which credit unions began consolidating (Figure 6).

The second development involved the implementation of the instant payment system, Pix. Users with bank or digital accounts can send and receive money instantly at any time without charge for individuals. Developed and operated by BCB, this system offers a public digital infrastructure available to all financial institutions, increasing financial inclusion and enhancing payment service efficiency. Since its launch in November 2020, usage of Pix has surged, with 90 percent of adults using the system and Pix transactions representing 49 percent of electronic payments in Brazil.

Table 5B shows that controlling for credit union presence and the number of Pix users does not significantly alter the effects of fintech competition. Credit unions, however, appear to raise lending rates and net interest margins at commercial banks, while Pix user numbers have little impact on bank performance.

## Conclusions

This paper identifies the causal effects of fintech competition on commercial banks in Brazil. This is achieved by constructing a bank-specific Bartik exposure using detailed credit and balance sheet data of Brazilian financial institutions. I find that banks were able to maintain their loan portfolio by reducing lending rates. Operational efficiency was also enhanced, but the overall profitability of commercial banks still took a hit due to narrower interest margins.

The paper quantifies the aggregate impact of fintech competition on incumbent banks in Brazil. Since 2018, a greater presence of fintech lenders has resulted in a decline in banks' average lending rates by 2.7 percentage points and reduced net interest margins by 0.9 percentage points. These developments have helped mitigate Brazil's historically elevated lending rates, which have been recognized as an obstacle to economic development. Some analysis indicates that aligning Brazil's lending spread with the global average may lead to a 5 percent increase in national output (e.g. Joaquim and others, 2023). Additionally, lower rates driven by heightened competition contribute positively to consumer welfare.

In addition, the paper presents evidence that commercial banks have improved operational efficiency in response to fintech competition. The Financial Stability Report (2025) indicates that the operational efficiency of financial institutions has increased since 2022. This paper suggests that fintech competition may account for a portion of these efficiency gains among commercial banks.

Brazil's post-pandemic recovery has been marked by robust growth in consumer credit. This paper identifies fintech lending as a key factor driving this trend through two channels. First, direct lending by fintech companies has expanded significantly, now accounting for 25% of the credit card market and 12% of the non-payroll personal loan market. The sector has reached 60 million borrowers, many of whom previously lacked access to credit. Second, increased competition from fintech firms has prompted commercial banks to lower lending rates to maintain their loan portfolios. Together, these dynamics have contributed to sustained consumer credit growth despite the current restrictive monetary policy environment.

Competition from fintech lenders will likely intensify as they expand beyond unsecured consumer loans. Payroll-backed loans used to have high entry barriers, requiring banks to partner with payroll administrators and be accredited by public bodies. In March 2025, the government reformed the private-sector payroll-guaranteed credit lines to simplify the process. Private-sector employees can now request loans through a centralized government app, using direct payroll deductions and 10 percent of their severance funds as collateral without requiring a bilateral agreement between the employer and a bank as was the case previously. This effectively lowered the entry barriers for fintech lenders. In addition, the credit portability program is being further developed by improving information sharing within the framework of Open Finance.

Brazil's approach to fintech innovation offers valuable insights for other countries. Entry barriers in finance are typically higher due to strict regulations and network effects. Brazil implemented proportional regulation through specific licenses and regulatory sandboxes for fintech operations, allowing these entities to grow without meeting established banks' requirements. When fintech companies reached scales similar to established banks, the BCB tightened regulations to ensure financial stability and a level playing field. Rapid consumer credit expansion has also increased household indebtedness, affecting consumer welfare. The role of

macroprudential measures, stronger consumer protection laws, and better financial education in helping safeguard financial stability and improve household financial health could be analyzed in future research.

## References

Almeida, Fernanda Dantas, and José Angelo Divino, "Determinants of the banking spread in the Brazilian economy: The role of micro and macroeconomic factors." *International Review of Economics & Finance*, 2015, 40, 29-39.

Argentieri Mariani, Lucas and Ornelas, Jose Renato Haas and Ricca, Bernardo. "Banks' Physical Footprint, Digital Payment Technologies, and Fintech Growth," *Working Paper Series 576*, 2025, Central Bank of Brazil.

Autor, David H., David Dorn, and Gordon H. Hanson. "The China Syndrome: Local Labor Market Effects of Import Competition in the United States," *American Economic Review*, 2013, 103 (6):2121–68.

Bajgar, Matej, Giuseppe Berlingieri, Sara Calligaris, Chiara Criscuolo, Jonathan Timmis. "Coverage and representativeness of Orbis data," *OECD Science, Technology and Industry Working Papers*, No. 2020/06, OECD Publishing, Paris.

Bakker, Bas B., Beatriz Garcia-Nunes, Weicheng Lian, Yang Liu, Camila Perez Marulanda, Adam Siddiq, Mariusz A. Sumlinski, Yuanchen Yang, and Dmitry Vasilyev. "The Rise and Impact of Fintech in Latin America," *Fintech Notes*, 2023, 003, International Monetary Fund.

Bartik, Timothy J. "Who Benefits from State and Local Economic Development Policies?" 1991. *Kalamazoo, MI: W.E. Upjohn Institute*.

Bejar, Pablo, Kotaro Ishi, Takuji Komatsuzaki, Ippei Shibata, Jasmin Sin, and Suchanan Tambunlertchai. "Can Fintech Foster Competition in the Banking System in Latin America and the Caribbean?" *Latin American Journal of Central Banking*, 2022, vol. 3(2), 100061.

Ben Naceur, Sami, Bertrand Candelon, Selim Elekdag, and Drilona Emrullahu. "Is FinTech Eating the Bank's Lunch?" *Journal of International Financial Management & Accounting*. 2025.

Benchimol, Jonathan and Caroline Bozou. "Desirable Banking Competition and Stability," *Journal of Financial Stability*, 2024. vol. 73, pp. 101266.

Berg, Tobias, Valentin Burg, Ana Gombović, and Manju Puri. "On the Rise of FinTechs: Credit Scoring Using Digital Footprints," *The Review of Financial Studies*, 2020, vol. 33, Issue 7

Boyd, John H. and Gianni de Nicolo. "The Theory of Bank Risk Taking and Competition Revisited," *The Journal of Finance*, 2025. vol. 60 (3), pages 1329-1343.

Buchak, Greg, Gregor Matvos, Tomasz Piskorski and Amit Seru. "Fintech, regulatory arbitrage, and the rise of shadow banks," *Journal of Financial Economics*, 2018, 130(3), 453–483.

Card, David. "Immigration and Inequality," *American Economic Review*, 2009, 99 (2): 1–21.

Central Bank of Brazil, The Banking Report (REB), 2020.

Central Bank of Brazil, The Banking Report (REB), 2021.

Central Bank of Brazil, Financial Stability Report, 2025 April.

Cornelli, Giulio, Jon Frost, Leonardo Gambacorta, and Julapa Jagtiani. "The Impact of Fintech Lending on Credit Access for U.S. Small Businesses," *Journal of Financial Stability*, 2024, vol. 73, 101290.

da Silva Neto, Estevao Collor and Thiago Christiano Silva. "Assessing Competition in Brazil's Banking Sector: The Impact of Fintechs through the H Statistic." 2024. Preprint, Catholic University of Brasilia

Dantas, José Alves, Otávio Ribeiro de Medeiros, and Edilson Paulo. "Relação entre concentração e rentabilidade no setor bancário brasileiro," *Revista Contabilidade & Finanças*, 2011, 22, 5-28.

de Melo Jorge Neto, Paulo, Luiz Alberto de Araújo, and David Agustín Salazar Ponce. "Competição E Concentração Entre Os Bancos Brasileiros," *Anais do XXXIII Encontro Nacional de Economia*, 2005.

Elekdag, Selim, Drilona Emrullahu, and Sami Ben Naceur. "Does FinTech Increase Bank Risk-taking?" *Journal of Financial Stability*, 2025, vol. 76.

Feng, Xiaochen. 2018. "Bank Competition, Risk Taking, and their Consequences: Evidence from the U.S. Mortgage and Labor Markets," *IMF Working Papers*, 2018, 157.

Fuster, Andreas, Matthew Plosser, Philipp Schnabl, and James Vickery. "The Role of Technology in Mortgage Lending," *The Review of Financial Studies*, 2019, 32(5), 1854–1899.

Gissler, Stefan, Rodney Ramcharan, and Edison Yu. "The Effects of Competition in Consumer Credit Markets," *The Review of Financial Studies*, 2020, 33(11), 5378-5415.

Goldsmith-Pinkham, Paul, Isaac Sorkin, and Henry Swift. "Bartik Instruments: What, When, Why, and How." *American Economic Review*, 2020, 110 (8): 2586–2624.

Gopal, Manasa and Philipp Schnabl. "The Rise of Finance Companies and FinTech Lenders in Small Business Lending," *The Review of Financial Studies*, 2022, 35(11).

Hellmann, Thomas F., Kevin C. Murdock, and Joseph E. Stiglitz. "Liberalization, Moral Hazard in Banking, and Prudential Regulation: Are Capital Requirements Enough?" *American Economic Review*, 2000, 90, 147–65.

Hodula, Martin. "Beyond innovation: Fintech credit and its ripple effects on traditional banking profitability," *Finance Research Letters*, 2024, Volume 63.

International Monetary Fund. "Brazil: Financial System Stability Assessment," 2018.

Jiang, Liangliang, Ross Levine, and Chen Lin. "Does competition affect bank risk?" *Journal of Money, Credit and Banking*, 2023, 55(5), 1043-1076.

Joaquim, Gustavo, Bernardus Ferdinandus Nazar van Doornik, and José Renato Haas Ornelas. "Bank competition, cost of credit and economic activity: evidence from Brazil." *BIS Working Papers* 1134, 2023, Bank for International Settlements.

Khan, Habib Hussain, Ali M. Kutan, and Fiza Qureshi. "Fintech integration: Driving efficiency in banking institutions across the developing nations," *Finance Research Letters*, 2024, Volume 67, Part A, 105772.

Leigh, Daniel and Rui Xu. "Monetary Policy Transmission to Lending Rates: Evidence from Brazil," *IMF Working Papers*, 2025, 152.

Martinez-Miera, David and Rafael Repullo. "Does Competition Reduce the Risk of Bank Failure?" *Review of Financial Studies*, 2010, 23, 3638–64.

Martins, Bruno. "Local Market Structure and Bank Competition: Evidence from the Brazilian Auto Loan Market," *Working Papers Series* 299, 2012, Central Bank of Brazil, Research Department.

Modi, Kosha, Nicola Pierri, and Yannick Timmer. "The Anatomy of Banks' IT Investments: Drivers and Implications." *IMF Working Paper*, 2022, No. 2022/244.

Montani Martins, Norberto, Paula Marina Sarno, Luiz Macahyba, and Dalton Boechat Filho. "Fintech Companies in Brazil: Assessing Their Effects on Competition in the Brazilian Financial System from 2018 to 2020." *The Fintech Disruption. Palgrave Studies in Financial Services Technology*, 2023, Palgrave Macmillan.

Nunn, Nathan and Nancy Qian. "US Food Aid and Civil Conflict." *American Economic Review*, 2014, 104 (6): 1630–66.

Ornelas, Jose Renato Haas and Alexandre Reggi Pecora. "Does Fintech Lending Lower Financing Costs? Evidence From an Emerging Market," *Working Paper Series 571*, 2022, Central Bank of Brazil, Research Department.

Raith, Michael. "Competition, Risk, and Managerial Incentives." *American Economic Review*, 2003, 93, 1425–36.

Rojas-Torres, Diana, Nir Kshetri, Mamduh M. Hanafi, and Samia Kouki. "Financial Technology in Latin America." *IT Professional*, 2021, 23(1), 95-98.

Silva, Thiago Christiano, Sergio Rubens Stancato de Souza, and Solange Maria Guerra. "COVID-19 and Local Market Power in Credit Markets." *Working Papers Series 558*, 2021, Central Bank of Brazil, Research Department.

Tang, Huan. "Peer-to-Peer Lenders Versus Banks: Substitutes or Complements?" *The Review of Financial Studies*, 2019, 32(5), 1900–1938.

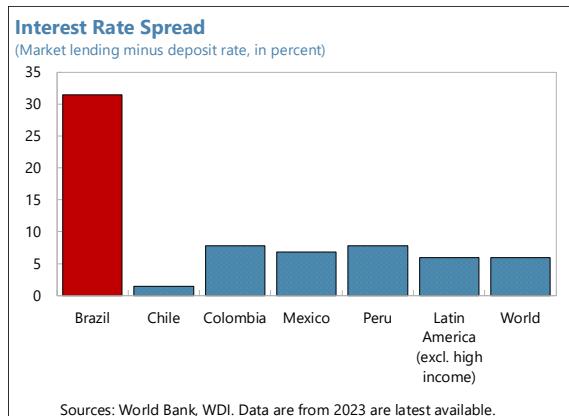
Trafane Oliveira Santos, Thiago. "High Lending Interest Rates in Brazil: cost or concentration?" *Working Papers Series 550*, 2021, Central Bank of Brazil, Research Department.

Wang, Yang, Sui Xiuping, and Qi Zhang. "Can fintech improve the efficiency of commercial banks? —An analysis based on big data," *Research in International Business and Finance*, 2021, vol. 55, 101338.

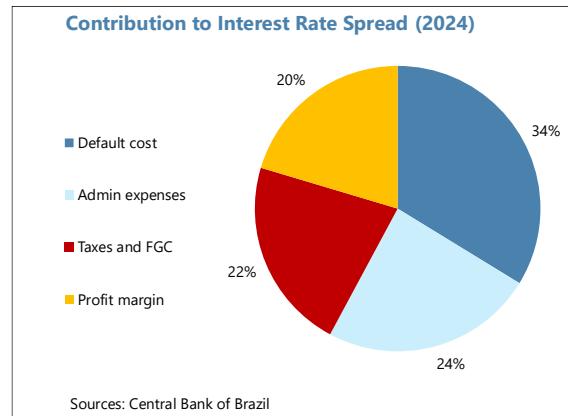
Yannelis, Constantine and Anthony Lee Zhang. "Competition and selection in credit markets." *Journal of Financial Economics*, 2023, vol. 150, pp. 103710.

**Figure 1. Brazil: Stylized Facts of Banking Sector Competition**

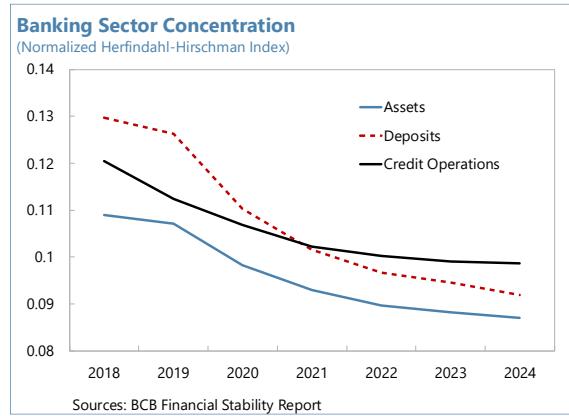
A. Brazil's lending rates are exceptionally high, with interest spread of more than 30 percent.



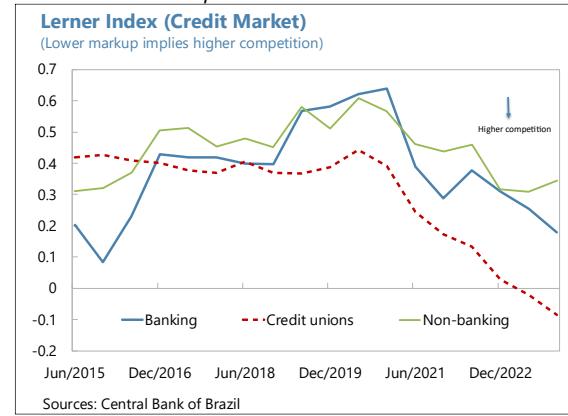
B. Administrative costs and profit margins explain nearly half of the interest rate spread in Brazil.



C. Banking sector concentration has also declined since 2018.

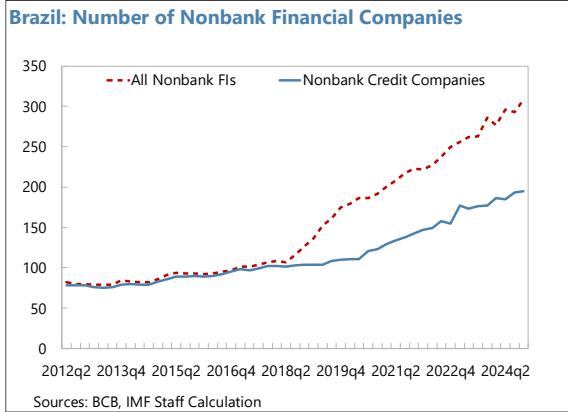


D. Markups have also declined since 2020, implying more competition.

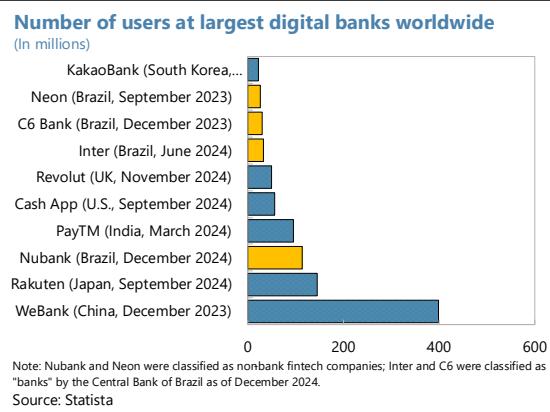


**Figure 2. Brazil: The Rise of Fintech Lenders**

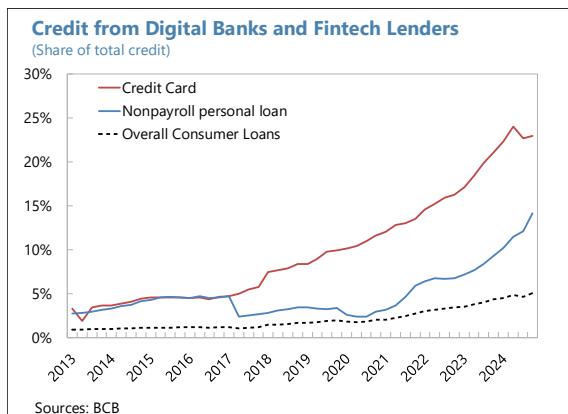
A. The number of nonbank credit companies, including digital banks, have doubled since 2018



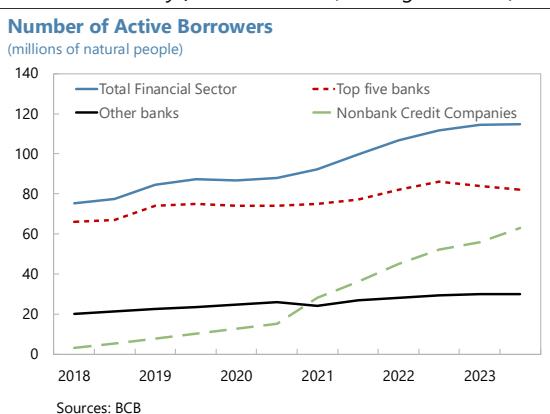
B. Four of the top ten digital banks worldwide are Brazilian.



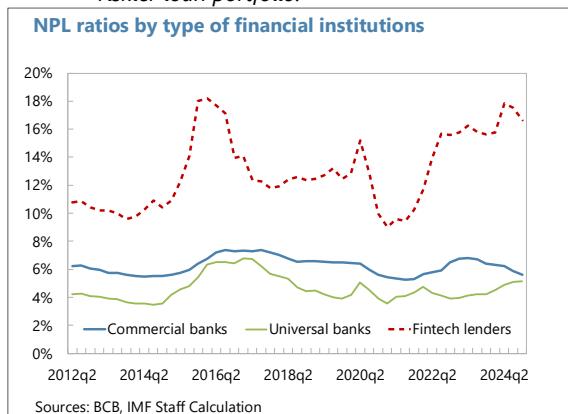
C. Fintech lending is concentrated in the unsecured consumer loans market.



D. Access to credit has improved in Brazil, mainly driven by fintech lenders (incl. digital banks).



E. Fintech lenders' NPL ratios are higher due to the riskier loan portfolio.



F. Nonbank consumer loan credit increased eightfold since 2018

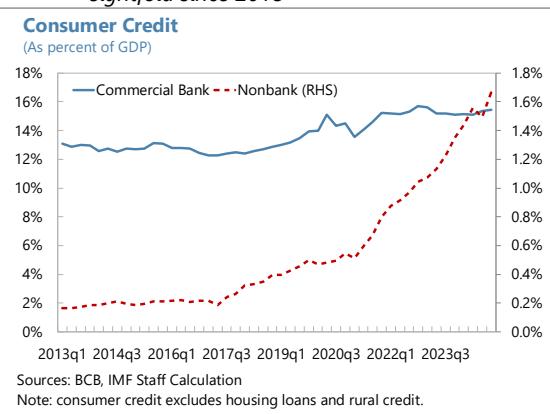
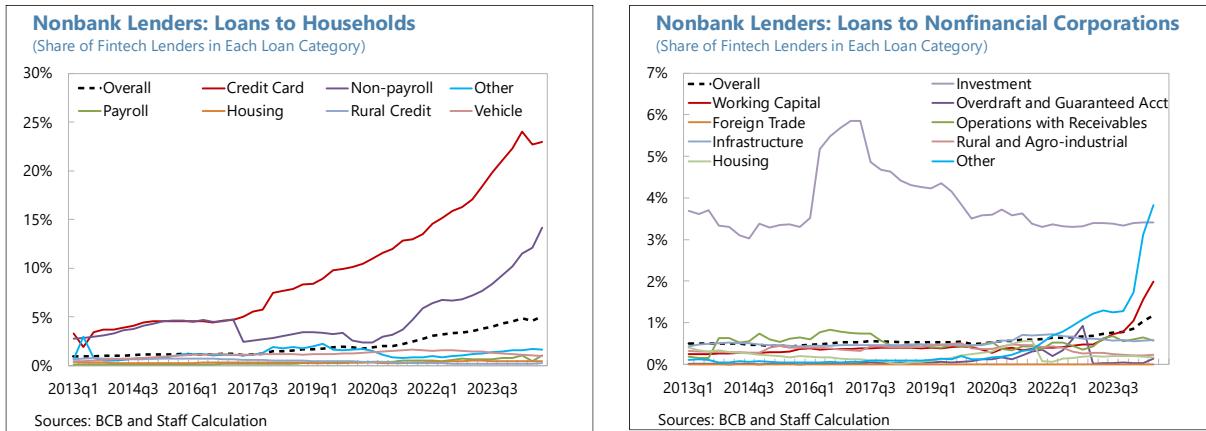
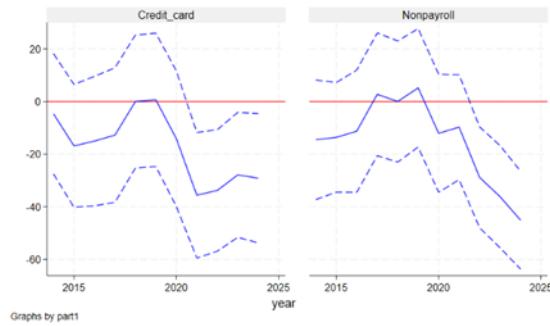
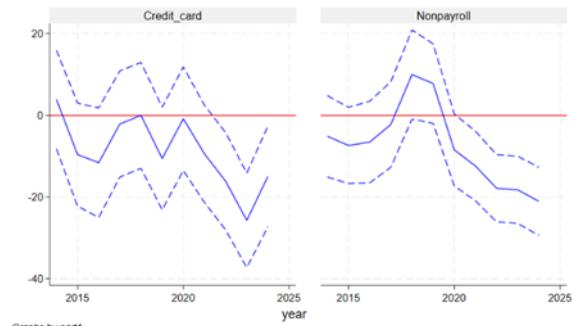
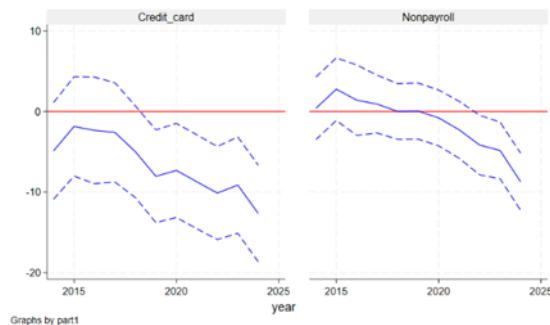
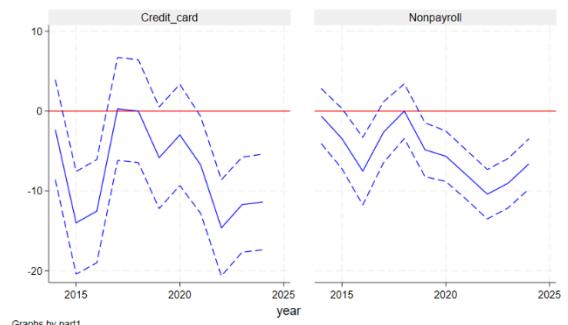


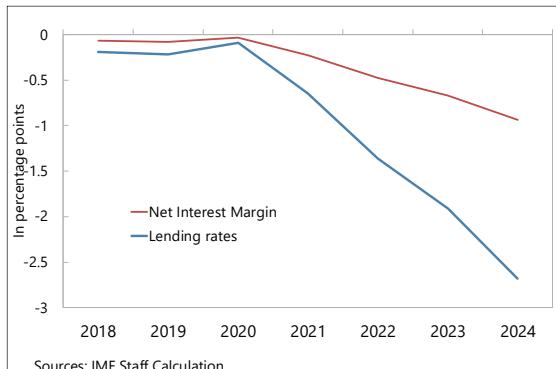
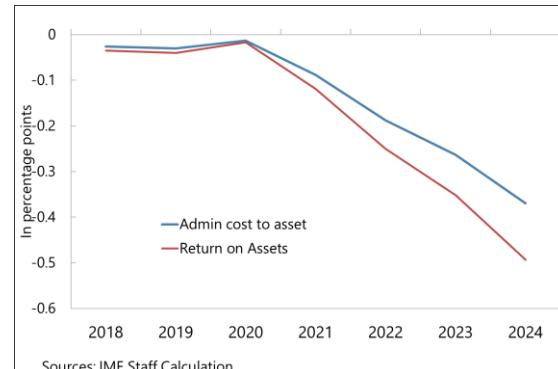
Figure 3. Market Share of Fintech Lenders



Note: fintech lenders refer to those classified as category n1 (nonbanking credit companies) in the BCB database.

**Figure 4. Pre-trends for Credit Segments with Strong Fintech Presence****Panel A: Average Lending Rates****Panel B: Net Interest Margins****Panel C: Administrative Cost to Asset Ratio****Panel D: Return on Assets**

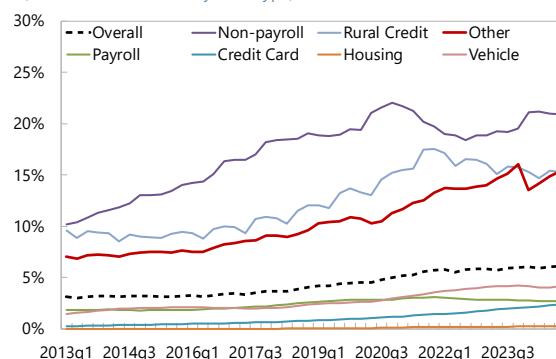
Notes: these figures report pre-trends for the exposure to fintech and the two main credit segments that were exposed to fintech competition as reported in Figure 3. The figures plot the reduced form effect of these credit shares on each of the four outcome variables, with credit shares and controls fixed at the pre-2018 levels. As in the main specification, the bank and time fixed effects are also included.

**Figure 5. Cumulative Effects of Fintech Lending on Commercial Banks****A. Lending Rates and Net Interest Margins****B. Administrative Costs and Profitability**

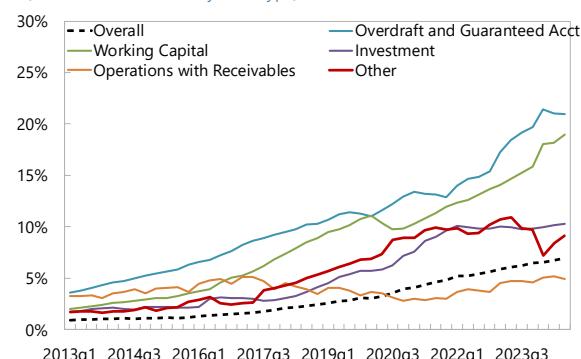
Note: the cumulative effects are determined by multiplying the average cumulative change in banks' exposure to fintech competition by the coefficients presented in Table 3.

**Figure 6. Market Share of Credit Union Lenders****Credit Union: Loans to Households**

(Share of Credit Unions by Loan Type)

**Credit Union: Loans to Nonfinancial Corporations**

(Share of Credit Unions by Loan Type)



Note: Credit unions refer to those classified as category B3S (nonbanking credit companies) in the BCB database.

**Table 1. Implementation of New Rules for Type 3 Conglomerates<sup>7</sup>**

	Jan - Dec 2023	Jan - Dec 2024	After Jan 2025
Minimum common equity	4.50%	4.50%	4.50%
Common equity tier 1	5.50%	6.00%	6.00%
Minimum total capital	6.75%	7.50%	8.00%
Capital conservation buffer	0.00%	1.25%	2.50%
Minimum total capital + capital conservation buffer	6.75%	8.75%	10.50%

Source: S&P Global Ratings.

**Table 2. Summary Statistics of Key Variables**

	Mean	Median	SD	Min	Max
Exposure to fintech competition	0.01	0.01	0.01	0.00	0.16
Net interest margin	6.92	5.02	6.74	-3.73	34.13
Average interest rate	28.78	25.60	14.14	7.72	68.47
Cost of funding ratio	2.80	2.34	2.83	-0.03	82.74
ROE	9.13	10.51	21.12	-82.10	54.76
ROA	1.07	1.24	3.54	-15.35	16.85
Operating cost over total assets	3.48	2.25	3.27	0.00	14.67
NPL	6.32	3.81	10.53	0.00	100.00
Provision ratio	3.45	2.66	3.62	-4.40	12.90
Market share	0.94	0.04	3.39	0.00	22.49
Liquid asset ratio	43.59	40.50	22.36	0.00	226.76

Note: the summary statistics are obtained after data cleaning, including trimming the outliers for accounting ratios.

<sup>7</sup> In Brazil, a Type 3 prudential conglomerate is a group of interconnected companies, led by a payment institution, that also includes at least one financial institution or other institution authorized to operate by the Central Bank of Brazil (BCB).

**Table 3. Balance Check: Relationship Between Credit Shares and Characteristics**

Dependent variable:	Credit Card	Nonpayroll	Working Capital	Other NFC Loans
	(1)	(2)	(3)	(4)
Market Share	0.002 (0.002)	-0.002 (0.004)	-0.011 (0.008)	-0.004 (0.006)
Liquid Asset Ratio	-0.000 (0.000)	-0.001 (0.001)	0.003 (0.002)	0.002 (0.002)
Equity Ratio	-0.000 (0.000)	-0.000 (0.001)	-0.000 (0.001)	-0.001 (0.001)
Constant	0.051*** (0.014)	0.091*** (0.027)	0.153*** (0.053)	0.001 (0.038)
Observations	136	136	136	136
Adjusted R-squared	0.030	0.000	0.054	0.040

Note: standard errors in parentheses. \*  $p<0.10$ , \*\*  $p<0.05$ , \*\*\*  $p<0.010$ . Each column reports a separate regression. Because correlations with exposure can be difficult to interpret, I examine the relationship between bank characteristics and specific credit segment shares that account for most of the variation in exposure, following established methods in the literature. The credit shares are fixed at the pre-2018 levels, consistent with the Bartik exposure construction. The findings indicate that there is no observed correlation between the covariates and the share of credit in segments with higher exposure to fintech competition, implying the exposure appears to be randomly distributed.

Table 4. Effects of Fintech Competition: Baseline Results

**A. Price Effects**

Dependent variable:	Net Interest Margin		Average Lending Rates		Cost of Funding ratio	
	(1)	(2)	(3)	(4)	(5)	(6)
Exposure to Fintech (normalized)	-1.30*** (0.48)	-1.29*** (0.48)	-3.76*** (0.95)	-3.70*** (0.94)	0.05 (0.15)	0.05 (0.15)
Market share		-0.32 (0.41)		-0.05 (1.35)		0.01 (0.10)
Liquid asset ratio		-0.02 (0.01)		-0.04 (0.03)		-0.00 (0.01)
Constant	6.90*** (0.02)	7.90*** (0.71)	28.31*** (0.08)	30.18*** (2.04)	2.46*** (0.00)	2.46*** (0.38)
Observations	2552	2552	2311	2311	2765	2765
Adjusted R-squared	0.693	0.693	0.610	0.610	0.649	0.649
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Quarter fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table reports estimate of equation (2) with different outcome variables using quarterly bank-level data from the BCB IF database. Standard errors are clustered at bank level and shown in parentheses. \* p<0.10, \*\* p<0.05, \*\*\* p<0.010.

**B. Quantity Effects**

Dependent variable:	Log(loans)		Log(customers)		Log(loans per customer)	
	(1)	(2)	(3)	(4)	(5)	(6)
Exposure to Fintech (normalized)	-0.00 (0.12)	-0.01 (0.11)	-0.31* (0.17)	-0.32** (0.16)	0.32*** (0.11)	0.32*** (0.11)
Liquid asset ratio		-0.02*** (0.01)		-0.01** (0.01)		-0.01* (0.00)
Constant	14.37*** (0.00)	15.22*** (0.24)	9.08*** (0.00)	9.69*** (0.29)	5.31*** (0.00)	5.57*** (0.14)
Observations	2759	2759	2739	2739	2726	2726
Adjusted R-squared	0.927	0.934	0.942	0.943	0.925	0.926
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Quarter fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table reports estimate of equation (2) with different outcome variables using quarterly bank-level data from the BCB IF database. Standard errors are clustered at bank level and shown in parentheses. \* p<0.10, \*\* p<0.05, \*\*\* p<0.010.

### C. Efficiency and Risk Effects

Dependent variable:	Admin cost to assets		NPL ratio		Provision ratio	
	(1)	(2)	(3)	(4)	(5)	(6)
Exposure to Fintech (normalized)	-0.50*** (0.16)	-0.51*** (0.16)	-0.96 (1.01)	-0.92 (0.96)	-0.08 (0.34)	-0.11 (0.34)
Market share		-0.00 (0.15)		-0.02 (0.44)		0.22 (0.22)
Liquid asset ratio		0.01 (0.01)		0.08** (0.04)		0.02** (0.01)
Constant	3.32*** (0.01)	3.06*** (0.29)	6.00*** (0.00)	2.57 (1.76)	3.13*** (0.03)	2.19*** (0.42)
Observations	2515	2515	2772	2772	2279	2279
Adjusted R-squared	0.818	0.818	0.464	0.472	0.493	0.495
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Quarter fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table reports estimate of equation (2) with different outcome variables using quarterly bank-level data from the BCB IF database. Standard errors are clustered at bank level and shown in parentheses. \* p<0.10, \*\* p<0.05, \*\*\* p<0.010.

### D. Profitability

Dependent variable:	ROE		ROA	
	(1)	(2)	(3)	(4)
Exposure to Fintech (normalized)	-3.62** (1.59)	-3.63** (1.59)	-0.68*** (0.18)	-0.68*** (0.18)
Market share		0.54 (1.67)		0.10 (0.26)
Liquid asset ratio		-0.01 (0.04)		0.00 (0.01)
Constant	10.28*** (0.03)	10.35*** (2.45)	1.24*** (0.00)	0.98** (0.44)
Observations	2613	2613	2680	2680
Adjusted R-squared	0.486	0.486	0.474	0.474
Bank fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Quarter fixed effects	Yes	Yes	Yes	Yes

Notes: The table reports estimate of equation (2) with different outcome variables using quarterly bank-level data from the BCB IF database. Standard errors are clustered at bank level and shown in parentheses. \* p<0.10, \*\* p<0.05, \*\*\* p<0.010.

Table 5. Robustness Checks

## A. Robustness to Alternative Estimators

	Baseline	Leave-one-out	Base year	2SLS	Baseline	Leave-one-out	Base year	2SLS	Baseline	Leave-one-out	Base year	2SLS
Dependent variable:												
Net Interest Margin												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Exposure to Fintech	-1.29*** (0.48)	-1.30*** (0.48)	-1.50*** (0.35)	-1.45*** (0.55)	-3.70*** (0.94)	-3.71*** (0.94)	-3.83*** (0.86)	-4.64*** (1.08)	-0.53*** (0.17)	-0.52*** (0.17)	-0.55*** (0.17)	-0.71*** (0.18)
Market share	-0.32 (0.41)	-0.32 (0.41)	-0.32 (0.41)	-0.31 (0.43)	-0.05 (1.35)	-0.05 (1.35)	-0.07 (1.34)	0.10 (1.40)	-0.00 (0.15)	-0.00 (0.15)	-0.01 (0.15)	0.11 (0.12)
Liquid asset ratio	-0.02 (0.01)	-0.02 (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.04 (0.03)	-0.04 (0.03)	-0.04 (0.03)	-0.04 (0.03)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)
Constant	7.90*** (0.71)	7.90*** (0.71)	7.92*** (0.70)	6.17*** (0.89)	30.18*** (2.04)	30.18*** (2.04)	30.34*** (2.04)	21.69*** (2.20)	3.03*** (0.29)	3.03*** (0.29)	3.06*** (0.29)	2.12*** (0.32)
Observations	2552	2552	2552	2342	2311	2311	2311	2133	2533	2533	2533	2331
Adjusted R-squared	0.693	0.693	0.696		0.610	0.610	0.612		0.818	0.818	0.818	
Bank fixed effects	Yes											
Year fixed effects	Yes											
Quarter fixed effects	Yes											

Note: The "leave-one-out" estimator excludes the bank's own credit when calculating the share of fintech credit for each credit segment. The "base-year" estimator uses 2016 as an alternative base year instead of the base year of 2018 used in the baseline specification. The 2SLS estimator uses a set of Bartik instruments constructed by multiplying each loan segment share with time period separately as in Goldsmith-Pinkham and others (2020). Standard errors are clustered at bank level and shown in parentheses. \* p<0.10, \*\* p<0.05, \*\*\* p<0.010.

## B. Robustness to Controlling for Other Structural Changes

	Credit Union		Pix Keys		Credit Union		Pix Keys		Credit Union		Pix Keys	
Dependent variable:	Net Interest Margin				Average Lending Rates				Admin cost to assets			
	(1)	(2)	(3)		(4)	(5)	(6)		(7)	(8)	(9)	
Exposure to Fintech	-1.29*** (0.48)	-1.24** (0.49)	-1.40*** (0.47)		-3.70*** (0.94)	-3.49*** (0.94)	-4.09*** (0.96)		-0.53*** (0.17)	-0.52*** (0.18)	-0.59*** (0.19)	
Exposure to Credit Union		1.45* (0.81)				4.90*** (1.48)				0.34 (0.31)		
Log (Pix Users)			0.03 (0.04)				0.07 (0.09)			0.01 (0.01)		
Market share	-0.32 (0.41)	-0.27 (0.42)	-0.33 (0.36)		-0.04 (1.34)	0.11 (1.35)	-0.07 (1.26)		-0.00 (0.15)	0.00 (0.15)	-0.01 (0.15)	
Liquid asset ratio	-0.02 (0.01)	-0.02 (0.01)	-0.01 (0.01)		-0.04 (0.03)	-0.04 (0.03)	-0.03 (0.03)		0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	
Constant	7.90*** (0.71)	7.90*** (0.71)	7.72*** (0.67)		30.31*** (2.04)	30.33*** (2.02)	29.77*** (2.00)		3.03*** (0.29)	3.04*** (0.29)	3.00*** (0.30)	
Observations	2552	2552	2523		2311	2311	2279		2533	2533	2501	
Adjusted R-squared	0.693	0.695	0.694		0.610	0.615	0.613		0.818	0.818	0.817	
Bank fixed effects	Yes	Yes	Yes		Yes	Yes	Yes		Yes	Yes	Yes	
Year fixed effects	Yes	Yes	Yes		Yes	Yes	Yes		Yes	Yes	Yes	
Quarter fixed effects	Yes	Yes	Yes		Yes	Yes	Yes		Yes	Yes	Yes	

Note: In the "Credit Union" specification, I control for each bank's exposure to credit union competition, measured using the same methodology as the exposure to fintech. In the "Pix Keys" specification, I control for the logarithm of the number of Pix users at each bank. Standard errors are clustered at bank level and shown in parentheses. \* p<0.10, \*\* p<0.05, \*\*\* p<0.010.



## PUBLICATIONS

**Fintech Competition and Banks' Shrinking Margins**  
Working Paper No. WP/2026/007