Economic Change and Restructuring (2023) 56:4629–4660
https://doi.org/10.1007/s10644-023-09570-0

Bank market power and firm finance: evidence from bank and loan-level data

Jose E. Gomez-Gonzalez[1,5] · Sebastian Sanin-Restrepo[2] · Cesar E. Tamayo[3] · Oscar M. Valencia[4]

Received: 25 April 2023 / Accepted: 16 October 2023 / Published online: 7 November 2023

Abstract

We investigate the impact of bank market power on the interest rates charged for loans to nonfinancial firms within the context of a developing country. Employing a distinctive amalgamation of data encompassing banks, firms, and loan specifics, alongside panel data fixed-effect models, we elucidate that banks wielding greater market power tend to impose higher interest rates on their loan products. This effect becomes more pronounced for banks positioned at the upper echelons of the market power spectrum (*relative* market power) and in instances of lengthier credit relationships. However, its severity can be mitigated for firms managing multiple credit connections (*subjective* market power). Our findings shed light on the presence of practices aimed at extracting economic rents and accentuate the substantial costs associated with changing lending partners in the corporate credit landscape. Various papers have delved into the empirical examination of how competition impacts the accessibility and expenses tied to bank credit for nonfinancial firms, yielding a mosaic of outcomes. Our contribution to this body of the literature manifests as a more incisive empirical analysis, enabling us to disentangle the opposing dynamics at play. This analytical depth is achievable solely due to the exceptional dataset we have curated. Significantly, our study stands out as one of the initial endeavors to interlink dynamic, bank-level gauges of market power with directly observed interest rates at the firm level, all while controlling for bank and loan-specific characteristics.

Keywords Bank competition · Market power · Lerner · Colombia · Cost of firm finance · Loan-level data

For comments and suggestions we thank Thorsten Beck, Julian Caballero, Hans Degryse, Andrew Powell, Banjamin Tabak, Lars Norden, and seminar participants at Lehman College, EAFIT, Universidad de La Sabana, Banco de Mexico, Banco de la Republica and ICESI, the IDB "Workshop on Bank Competition in Latin America" (Washington, D.C., October 3rd, 2017), IFABS Porto Conference (2017), the 1st Colombian Economic Conference (2018), and the IDB-Banco Central do Brasil "International Workshop on the Cost of Credit" (Brasilia, November 26–27th, 2018). Laura C. Diaz, Juan A. Paez and Juan G. Salazar provided superb research assistance. Financial support by the IDB ESW-RG-K1342 is gratefully acknowledged.

Extended author information available on the last page of the article

JEL Classification G21 · D22 · O16

1 Introduction

The persistently elevated interest rate differentials observed in developing economies have been a subject of substantial concern for both economists and policymakers. While various factors such as limited contract enforcement, economies of scale, and heightened risk attributed to volatile sectors like commodity production might contribute, the role of diminished bank competition as a potential catalyst for elevated credit costs has frequently garnered attention (Gelos 2009; Haber 2009).

The interplay between bank competition and the parameters affecting firms' access to credit is intricate. On one hand, foundational principles of industrial organization economics imply that if financial intermediaries possess market power, they can extract economic rents from borrowers, thereby amplifying credit expenses and constricting financial access. Conversely, some degree of market power may be requisite for intermediaries to recuperate the expenses incurred in procuring information within an environment characterized by asymmetric information.

This research delves into the influence of bank market power on the interest rates attached to loans extended to nonfinancial firms within the developmental context of a given country. This exploration is facilitated through the construction and analysis of an exclusive dataset that correlates individual loans with comprehensive firm and bank-level data, encompassing aspects such as market power and other pertinent bank attributes. Notably, only two recent studies have employed such an integrated dataset to investigate competition within credit markets: one concerning Brazil by Ornelas et al. (2022) and another investigating Mexico by Cañón et al. (2022). Several advantages emanate from this methodology. Primarily, it allows for direct observation of interest rates pertaining to each loan, thereby avoiding the need for implicit derivation from accounting data and facilitating control over loan-specific parameters including tenure, quantum, and collateral. Secondly, and critically, the amalgamation of bank and loan-level data facilitates the creation of two pivotal variables: the duration of a credit relationship and the count of credit relationships a firm sustains at the juncture of acquiring a new loan. Consequently, this framework enables an exploration of the roles played by information dynamics, lock-in challenges, and costs associated with search and switching in shaping the impact of market power on the financial outlays for firms.

Principal findings of this study demonstrate that heightened market power of banks, gauged via the Lerner and adjusted Lerner indices, correlates with a direct and immediate escalation in the interest rates levied on loans. This outcome, akin to results attained by Ornelas et al. (2022) and Cañón et al. (2022), underscores the tendency for banks to engage in immediate rent-seeking behavior upon gaining augmented market power. This observation persists across diverse empirical specifications encompassing varying control variables, interactions, and fixed effects.

However, the comprehensive impact of augmented bank market power on loan pricing is markedly contingent on the tenure of the bank-firm rapport. In alignment with outcomes documented in the empirical domain of relationship-based lending

[e.g., Menkhoff and Suwanaporn (2007) and Gómez-González and Reyes (2011)], an elongated credit relationship is found to temper the magnitude of the direct effect of heightened market power on the cost of corporate loans. Indeed, for sufficiently protracted credit relationships, the net influence of heightened market power assumes a negative trajectory. Such findings underscore the strategic advantages that ensue from establishing enduring relationships with financial institutions. Importantly, this synthesis bridges the theoretical constructs of the traditional industrial organization literature with the tenets of information economics applied to the banking sector.

The robustness of our analysis against endogeneity bias lends credence to the causal interpretation of these findings. Specifically, our dependent variable is inherently implicated in the computation of the Lerner index, establishing a mechanistic interconnection. However, our utilization of loan-specific interest rates obtained from the Credit Registry, juxtaposed with market power indicators derived from bank-level accounting data, minimizes interdependence, since each individual loan's interest rate plays just a marginal role in the aggregate rates enforced by banks. Moreover, the integration of various fixed effects neutralizes time-invariant latent factors that could potentially influence both bank competition and interest rate spreads. We introduce fixed effects related to bank-firm associations and temporal dimensions to elucidate the driving forces behind our findings, revealing that neither measurement discrepancies in the focal variable (market power) nor unobservable, time-evolving firm-specific heterogeneities, such as demand shocks, underpin these outcomes. Our extension of the Lerner index to accommodate systematic deviations from cost and profit efficiency, along with the incorporation of firm-time fixed effects, reaffirms the congruence of these results with baseline regressions.

This investigation is entrenched in a growing body of the literature scrutinizing the ramifications of banking competition on the dynamics of firms' market entry to credit avenues. Leveraging firm-level data from the Enterprise Surveys, Love and Martinez-Peria (2015) and Leon (2015) proffer empirical evidence attributing constrained financial access to diminished competition, as quantified by subdued average market power within the banking sector. In a broader context, Ryan et al. (2014) ascertain that heightened bank market power exacerbates financing hurdles for small and medium-sized enterprises across an expansive cohort spanning 20 European nations. Conversely, grounded in an analysis of publicly-listed enterprises across six Latin American countries, Alvarez and Jara (2016) posit that augmented bank competition engenders more stringent financial constraints for firms.

Tightly aligned with the present empirical inquiry are the works of Fungacova et al. (2017) and van Leuvensteijn et al. (2013) both delving into the interplay between competition and interest rates. Fungacova et al. (2017), employing an extensive dataset covering European firms, conclude that competition amplifies credit costs, with this effect exhibiting heightened potency for smaller entities. Conversely, leveraging data from European banks, van Leuvensteijn et al. (2013) discern that escalated competition translates to narrower interest rate spreads across a spectrum of loan products.

The discordant conclusions across these studies may stem from disparities in data sources and methodologies applied for quantifying bank market power and relationship-based lending (Kysucky and Norden 2016). Alternatively, these divergent results might signify the operation of counteracting dynamics, mirroring early postulations of relationship banking. For instance, according to Petersen and Rajan (1995)'s information hypothesis, market power potentially allows banks to recoup expenses tied to acquiring firm-specific information, thereby leading to lowered interest rates for such entities. Conversely, Sharpe (1990)'s dynamic theory of customer relationships in banking shows that the natural consequence of the asymmetric evolution of information is a potential for ex-post monopoly power. Similarly, Greenbaum et al. (1989) argue that the enduring nature of information accrued through relationship banking, coupled with elevated search costs, creates the conditions for bank capture even within competitive market environments.

The outcomes of our investigation harmoniously align with this intricate interplay between relationship-based banking and credit markets. Heightened bank market power indeed correlates with elevated interest rates. However, firms engaged in lengthier credit relationships exhibit a comparatively restrained escalation in loan costs on average, thereby corroborating the theory of switching costs. Notably, entities nurturing steadfast, long-term liaisons with commercial banks experience a diminished augmentation of loan interest rates amid elevated bank market power. Intriguingly, for firms ensconced in suitably protracted relationships, a surge in bank market power even culminates in lowered interest rates for loans. These observations underscore the salient benefits of relationship-based lending, especially over protracted time horizons. These findings assume paramount significance within the context of Colombia and several analogous developing economies, wherein bank market power has demonstrated an increasing trend over the preceding decade.

The implications of our findings hold substantial import for policy considerations. The central finding—that augmented bank market power amplifies firms' financing expenses—underscores the necessity for regulatory actions aimed at fostering enhanced bank competition within developing economies. Strategies such as facilitating the entry of foreign competitors and embracing the operations of fintech entities capable of challenging traditional banks assume heightened relevance considering these results.

An efficiently operating financial system stands as a linchpin for bolstering economic growth, an assertion underscored by numerous contemporary studies [see, for instance, Batrancea et al. (2021), Batrancea et al. (2022a), Batrancea et al. (2022b)]. Within this context, the vitality of robust bank competition emerges as a pivotal factor in cultivating a well-functioning financial landscape.

The subsequent sections of this paper are structured as follows: Section 2 expounds upon the methodologies and data employed to scrutinize the hypothesis pertaining to market power and interest rates. Section 3 presents the principal findings of our analysis and underscores their resilience against robustness checks. The concluding section encapsulates the study's insights.

2 Literature review

Early empirical investigations into bank competition revealed notable findings regarding US banks operating within concentrated local markets, as measured by the Herfindahl Index. These studies, such as the work by Berger and Hannan (1989), observed that such banks tended to levy higher interest rates on loans extended to small and medium-sized enterprises (SMEs), while simultaneously offering lower rates on retail deposits. Additionally, these studies noted a sluggish responsiveness of deposit rates to fluctuations in open-market interest rates, a phenomenon highlighted by Neumark and Sharpe (1992). Expanding beyond the confines of the USA, Beck et al. (2004) argued that across a spectrum of 74 countries, market concentration seemed to constrain access to financial resources. This influence, however, appeared more pronounced in countries with relatively lower levels of economic and institutional development.

Nonetheless, these concentration-based conclusions were subsequently contested by researchers advocating for the efficient structure hypothesis. This viewpoint, championed by researchers like Smirlock (1985), proposed that elevated concentration inherently indicated the ascendance of efficient firms in the market. In recent years, the inadequacies of concentration as a competition metric have become evident, as emphasized in works such as Carbo-Valverde et al. (2009). Several scholars have illustrated that concentration and competition may not consistently exhibit correlation, and in some cases, they might even exhibit a positive correlation, as suggested by Kroszner and Strahan (1999) and Claessens and Laeven (2004).

Considering these developments, contemporary research has shifted focus toward non-structural gauges of competition. These measures, in contrast to structural metrics, directly observe firms' behaviors within the market to discern competitive dynamics. Among these non-structural measures, the Lerner index has gained significant traction. This index gauges a firm's market power by assessing the deviation between its price and marginal cost. Another exemplar of non-structural measures is the Panzar and Rosse (1987) H-statistic, which captures the influence of input prices on firms' revenues. Weak transmission in this regard signifies the exertion of market power. A more recent addition, proposed by Boone (2008), hinges on the notion that competitive markets disproportionately reward efficient firms. This concept translates into the elasticity of profits or market share concerning marginal costs.

Numerous studies have employed these non-structural competition metrics to delve into various aspects such as financial accessibility, funding costs, and financial stability. For instance, Hainz et al. (2013) employed the Lerner index alongside data from loans across 70 countries to deduce that enhanced competition reduces the integration of collateral in loan agreements. Casu and Girardone (2009), leveraging the Lerner index and data from European Union countries, determined that augmented monopoly power among banks doesn't necessarily correlate with decreased cost efficiency. In the Latin American context, Tabak et al. (2015) employed the H-statistic to scrutinize the competitive behavior of the Brazilian banking sector, revealing a negative correlation between the market power of Brazilian banks and their risk-taking tendencies.

Among the pertinent studies, Love and Martinez Peria (2015), Leon (2015), Ryan et al. (2014), and Alvarez and Jara (2016) stand out. Love and Martinez Peria (2015), utilizing enterprise-level data, established that diminished competition, as inferred from the Lerner index and the Boone indicator, curbs financial access. Leon (2015) conducted a comparable inquiry, encompassing not just credit line presence but also denials and discouragements. This study concurred on the negative impact of market power on financial access. Ryan et al. (2014), using the Lerner index, underscored the connection between heightened bank market power and amplified firm financing constraints across a vast SME sample in European countries. Conversely, Alvarez and Jara (2016), drawing on a sample of publicly listed firms in Latin America, found a counterintuitive outcome? augmented bank competition corresponded to more stringent financial constraints for firms.

Two studies with the most immediate relevance are Fungacova et al. (2017) and van Leuvensteijn et al. (2013). Fungacova et al. (2017) navigated a comprehensive dataset from the Euro area, indicating that competition, gauged via Lerner indices and the H-statistic, heightens credit costs. This influence, they noted, is accentuated for smaller enterprises. These conclusions, however, stand in tension with van Leuvensteijn et al. (2013), who, within a European bank context, employed the Boone indicator to reveal that augmented competition leads to reduced interest rate spreads across most loan products.

Despite these insights, these studies contend with limitations. Fungacova et al. (2017) deploy various measures, including concentration metrics, Lerner index, and H-statistic, whereas eschewing the Boone indicator. Additionally, their approximation of firm-level credit costs hinges on accounting data. Love and Martinez Peria (2015), Leon (2015), and Alvarez and Jara (2016) deploy the Boone indicator but are confined to dichotomous financial constraint indicators due to data constraints. Ryan et al. (2014) presents a continuous constraint measure but solely employs the Lerner index. Lastly, van Leuvensteijn et al. (2013) employs segment-wide interest rate averages rather than firm-specific rates and leans on banks' own data. All these studies grapple with unobserved heterogeneity, as they rely on country-level competition metrics without the inclusion of country-level fixed effects.

3 Methods and data

3.1 Empirical strategy and hypotheses testing

The main goal of this paper is to estimate the effect of bank market power on the cost of firm credit. As discussed in the introduction, the sign or magnitude of this effect is not clear ex-ante since theory suggests that countervailing forces may be at work. On the one hand, neoclassical theory predicts that banks with high market power will lend at high interest rates and extract producer rents, either through higher price–cost margins, or through systematic inefficiencies ("quiet life"). On the other hand, when asymmetric information problems are pervasive, high market power may increase incentives to building lending relationships, strengthen the quality of screening, and increase investment in information acquisition technologies

(Petersen and Rajan 1995; Hauswald and Marquez 2006; Marquez 2002). The latter should allow banks to lend at lower interest rates than otherwise would be the case. In sum, the overall effect of market power on the cost of firm credit then depends upon the relative size of these forces and becomes an empirical issue.

As noted before, a number of papers have studied empirically how competition affects the availability or cost of bank credit to nonfinancial firms with mixed results. Our contribution to this literature is in the form of a sharper empirical exercise that allows us to disentangle the aforementioned countervailing forces. This in turn is made possible only by the unique dataset we have assembled. In particular, this is one of the first papers to connect time-varying, bank-level measures of market power with directly-observed firm-level interest rates, controlling for bank and loan-level characteristics. Importantly, because of the data we use, our empirical exercise can provide estimates of the relative importance of asymmetric information, switching costs and hold-up issues in the banking industry. With this level of detail in our unit of observation, and with the inclusion of multiple types of fixed effects, we are confident that most confounding unobserved determinants of interest rates that may covary with bank's market power are accounted for.[1]

The empirical model we use is:

$$\begin{aligned} ir_{l,b,f,t} =& \mu + L_{b,t}\Psi + R_{l,b,f,t}\Theta + (L_{b,t} \times X_{l,b,f,t})\Phi + C_{l,b,f,t}\Gamma + B_{b,t}\beta \\ &+ F_{f,t}\Lambda + v_{l,b,f,t}, \end{aligned} \tag{1}$$

where: $ir_{l,b,f,t}$ is the difference between the nominal interest rate of loan l, extended by bank b to firm f in period t, and the monetary policy interest rate,[2] $L_{b,t}$ is a measure of market power by bank b in period t (i.e., the market power of the bank which granted the loan at the time it did so); $R_{l,b,f,t}$ is a set of bank-firm relationship characteristics (i.e., the relationship length between bank b and firm f at the time bank b extended the loan l); $X_{l,b,f,t}$ includes $R_{l,b,f,t}$ and some firm characteristics (i.e., firm assets); $C_{l,b,f,t}$, $B_{b,t}$, and $F_{f,t}$ are vectors of loan, bank, and firm level characteristics, respectively; and μ, $\mathbf{\Theta}$, $\mathbf{\Phi}$, $\mathbf{\Gamma}$, $\boldsymbol{\beta}$, and $\mathbf{\Lambda}$ are vectors of parameters. Our main interest is in the parameter estimate associated with bank market power, $\mathbf{\Psi}$, as well as the interactions captured by $\mathbf{\Phi}$.

Of particular interest are the interactions of market power with: (i) the length of the firm relationship with the bank granting the loan,[3] (ii) the number of distinct

[1] The greatest difficulty for finding a causal relation in this paper comes from the fact that there may be unobserved determinants of commercial loan interest rates that covary with banks' measured market power. If present, these determinants are most likely to be related to unobserved demand effects, something we control for in Sect. 4 with the inclusion of firm-fixed effects.

[2] We compute the dependent variable this way following the literature on relationship lending. Alternatively, the real interest rate on each loan was used, obtaining qualitatively identical results.

[3] The length of a credit relationship is computed as the difference between the date of loan l, and the period in which the firm-bank pair appeared for the first time in the loan-level dataset. This may imply left-censoring for the length of some relationships which may have been established before the initial date of our dataset. However, left-censoring itself does not constitute a source of estimation bias. It would be troublesome only in the case in which the longest relationships, those which are left-censored, would be biased toward banks with a particularly high (or low) level of market power. But there is no reason to believe this is the case in our dataset.

credit relationships held by the firm, and, (iii) firm size. As mentioned before, the inclusion of these interactions capturing credit market features such as credit history and switching costs is a conceptual and methodological contribution of this paper, since it is not available from the kind of firm- and bank-level datasets used by previous studies like Fungacova et al. (2017), Alvarez and Jara (2016) and van Leuvensteijn et al. (2013). We view the length of a credit relationship, for instance, as a better measure of asymmetric information for a specific bank-firm pair than other measures used in previous work.

Note that the total effect of bank market on a loan's interest rate is defined as:

$$\frac{\partial ir_{l,b,f,t}}{\partial L_{b,t}} = \Psi + X_{l,b,f,t}\mathbf{\Phi} \tag{2}$$

Equation (1) is estimated for the full sample of matched loans, under bank, firm and time (later also firm-time) fixed effects, and with standard errors clustered at the firm-bank level to capture the potential credit relationship dependent structure of errors.

3.2 Measuring bank competition

The new empirical industrial organization literature has developed and used measures of competition that are directly related to market conduct. In this section we construct estimates of a popular measure of market power—the Lerner index—for the Colombian banking industry in the 2004–2019 period. The original Lerner index developed by Lerner (1934) is a price–cost margin that captures the ability of an individual bank to charge a price above marginal cost, assuming both profit and cost efficiency. Formally the Lerner index is defined as:

$$L_{b,t} = \frac{P_{b,t} - MC_{b,t}}{P_{b,t}} \tag{3}$$

where $P_{b,t}$ and $MC_{b,t}$ are, respectively, the price charged by bank b in period t, and its marginal cost. Higher values of the Lerner index suggest higher market power. Since this paper is concerned with competition in the credit market, our price measure is the ratio of financial income (i.e., interest income, fees) to total net loans.

In obtaining estimates for bank-specific marginal costs, $MC_{b,t}$, we estimate a multi-product total operating cost (TOC) function using a parametric approach. We follow much of the empirical banking literature (Koetter et al. 2012; van Leuvensteijn et al. 2013; Tabak et al. 2012), and estimate a translog cost function, which is a second order Taylor-series approximation to an unknown cost function. In particular, our estimated TOC function is:

$$\begin{aligned}\ln C_{b,t} =& \alpha_b + \sum_{p=1}^{2} \theta_p (\ln y_{p,b,t})^2 + \sum_{p=1}^{2} \gamma_p \ln y_{p,b,t} + \sum_{i=1}^{3} \zeta_i (\ln w_{i,b,t})^2 \\ &+ \sum_{i=1}^{3} \chi_i \ln w_{i,b,t} + \kappa_{12} \ln y_{1,b,t} \ln y_{2,b,t} \\ &+ \sum_{i<k} \sum \eta_{i,k} \ln w_{i,b,t} \ln w_{k,b,t} + \sum_{i=1}^{3} \sum_{p=1}^{2} \lambda_{p,j} \ln w_{i,b,t} \ln y_{p,b,t} \\ &+ \sum_{t=1}^{T-1} \nu_t d_t + \delta \ln z_{b,t} + \varphi MnE_{b,t} + \varepsilon_{b,t}\end{aligned} \tag{4}$$

where α_b is a bank fixed effect, $y_{1,b,t}$ and $y_{2,b,t}$ are, respectively, loans and securities; $w_{1,b,t}$ is the labor unit cost or wage (personnel expenses/total assets), $w_{2,b,t}$ represents the cost of funding for the bank (interest expenses/deposits), $w_{3,b,t}$ is computed as other expenses/fixed assets, and the time dummy $d_t \in \{0, 1\}$ is intended to capture aggregate shocks. We also include a variable accounting for mergers and acquisitions of each entity. Finally, we follow (Mester 1996) and also include bank equity (as a share of total assets), $z_{b,t}$, since it can be used to fund loans and reflects different risk attitudes of banks. We impose homogeneity of degree 1 on input prices by dividing all factor prices and TOC by w_3.

Marginal costs can then be computed as the partial derivative of (4) with respect to loans:

$$MC_{b,t} = \frac{\partial C_{b,t}}{\partial y_{1,b,t}} = \left(\gamma_1 + 2\theta_1 lny_{p,b,t} + \kappa_{12} lny_{2,b,t} + \sum_{i=1}^{3} \lambda_{1,t} lnw_{i,b,t} \right) \frac{C_{b,t}}{y_{1,b,t}}.$$

We estimate equation (4) using a quarterly dataset of 13 banks over the period 2004q1-2019q4. These 13 banks represented over 92.5% of total commercial loans in 2019. A complete description of the variable definitions and data sources, as well as the results from the estimation of Eq. (4) are presented in Appendix B.

Table 1 presents some descriptive statistics about our sample of banks. It is worth noting that for the average and median bank in Colombia, commercial (business) loans represent around 51%–54% of their loan portfolios, over ten percentage points more than what they represent for US banks (44% in 2016). This is particularly important for our subsequent exercise in which we estimate the impact of bank market power on the cost of business loans. Also worth noting is the fact that Colombian bank's equity to asset ratio is, on average, very similar to that of US banks today (11.7%).[4]

Equipped with estimates of marginal costs, we are in a position to compute Lerner indices, which are depicted in Fig. 1 below. The plots include the unweighted averages (blue line), as well as the median (red) and individual bank-level indices (right panel). Both measures of bank market power suggest the same broad temporal

[4] Additional descriptive statistics such as means by market power quartiles are presented.

Table 1 Bank-level descriptive statistics

	Mean	Stand. Dev.	25%	50%	75%	Skew.	Kurt.
Total cost/Total assets	6.81	1.91	5.34	6.65	8.08	0.59	0.42
Loans/Total assets	61.13	12.36	54.81	64.11	70.01	−0.89	0.42
Securities/Total assets	22.85	10.95	14.41	19.80	30.02	0.85	0.07
Personnel expenses/Total assets	1.73	0.78	1.22	1.55	2.14	1.30	3.07
Interest expenses/Deposits	5.31	1.69	4.20	4.98	6.25	1.14	2.29
Other expenses/Fixed assets	37.04	33.38	19.39	28.27	43.51	5.84	58.18
Lerner index	0.56	0.08	0.52	0.55	0.62	−0.41	1.41
Adjusted Lerner index	0.50	0.11	0.44	0.49	0.57	0.13	0.48
Equity/Total assets	11.63	3.55	9.01	11.32	13.29	0.88	0.79
ROA (%)	2.39	1.35	1.51	2.37	3.29	−0.06	0.87
Leverage (%)	8.38	2.75	6.53	7.83	10.10	0.63	0.08
Output price (%)	17.99	5.86	13.66	16.81	21.10	1.58	6.20
Commercial loans/Net loans	54.07	19.57	40.53	51.10	70.66	0.12	−0.81
Housing loans/Net loans	31.04	17.49	18.95	28.21	42.47	0.60	−0.08
Consumption loans/Net loans	11.35	13.67	0.19	6.86	18.57	1.68	3.12

[a]Jarque-Bera tests were also applied resulting in non-normality of all variables

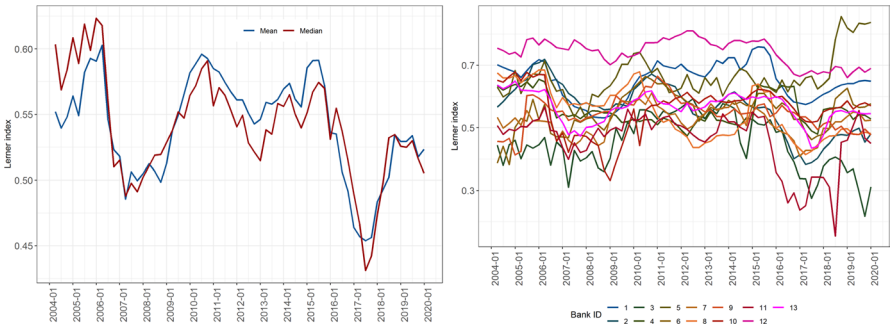


Fig. 1 Lerner index for Colombian banks

patterns: Market power decreased between 2004 and 2019, an opposite behavior to that of bank concentration which shows a secular trend toward higher industry concentration (see Fig. 2). However, substantial variation is observed in between these two years. Interestingly, bank market power increased sharply during 2008–2011, in the wake and aftermath of the global financial crisis. This is consistent with the data provided by Clerides et al. (2015) where bank market power increased worldwide during this period, and with available evidence from other countries and industries that price markups are mostly countercyclical (Wilson and Reynolds 2005).

Table 2 presents pairwise correlations between (unweighted) average market power and concentration measures. Interestingly, the correlations between market power and the concentration measures are negative and statistically significant at 1%

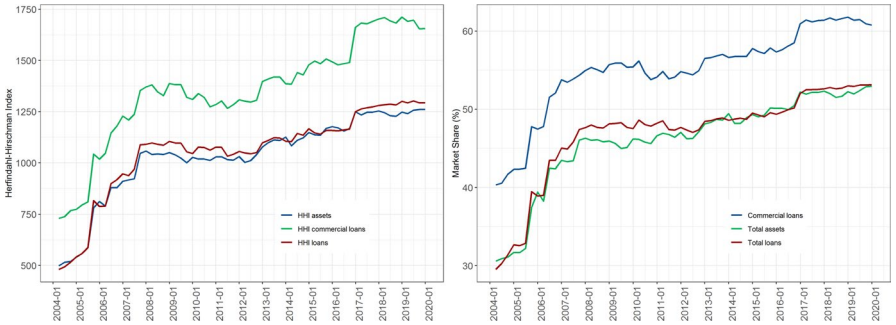


Fig. 2 Bank concentration in Colombia

Table 2 Bank Market Power and Concentration Correlation Matrix

	Lerner	Top-3 loans	HHI loans
Lerner	1.00		
Top-3 loans	− 0.50***	1.00	
HHI loans	− 0.50***	0.99***	1.00

***Denotes statistical significance at the 1% level

significance. This is consistent with previous evidence that highlights the potential divergence between market power and concentration measures and cautions against the use of concentration as a proxy for bank competition (Fernandez et al. 2005).

3.3 Firm and loan-level data

As mentioned in Sect. 3.2, the key to our empirical strategy is the use of a unique dataset that merges the bank-level data discussed above, with firm, and loan-level data from the Colombian corporate credit market.

Our most comprehensive data source is the "Formato 341" (341 form) from Colombia's financial supervisor (Superintendencia Financiera de Colombia) which contains loan-level data on the universe of loans granted by banks. From this source we obtain a total of 3,662,063 loans; a full set of descriptive statistics is presented in Table 3. The median-sized loan in this dataset is of USD53, 908, while the maximum loan size if USD253.2 million.[5] Half loans—49%— are floating rate and about 70% do post collateral. The average loan maturity is 1.5 years, but 25% of the loans in our dataset are very short term (one quarter); and 75% of them have maturity of less than 2 years.

With this dataset we are also able to measure the length of a credit relationship, which is on average 5.6 years. The length of the credit relationship is a key variable in this study. Measuring this variable adequately is challenging, as we do not know

[5] All figures here and in what follows are expressed in USD at 2020 current exchange rates.

Table 3 Loan-level descriptive statistics

	Mean	Stand. Dev.	25%	50%	75%	Skew.	Kurt.
Interest rate spread (%)	9.37	6.32	4.85	7.27	11.56	1.19	0.44
Ln loan amount	21.02	22.58	18.30	19.43	20.55	33.86	2388.4
Loan's maturity (Years)	1.46	2.72	0.25	1.00	2.00	9.49	121.4
Fixed interest rate (%)	0.49	0.50	0.00	1.00	1.00	0.03	2.00
Collateral	0.29	0.46	0.00	0.00	1.00	0.90	1.19
Previous delinquency to bank	0.18	0.39	0.00	0.00	1.00	0.08	1.10
Number of previous relationships	4.93	3.00	3.00	4.00	7.00	1.00	1.11
Length of the banking relationship	5.64	4.84	1.76	4.58	8.39	1.18	2.46

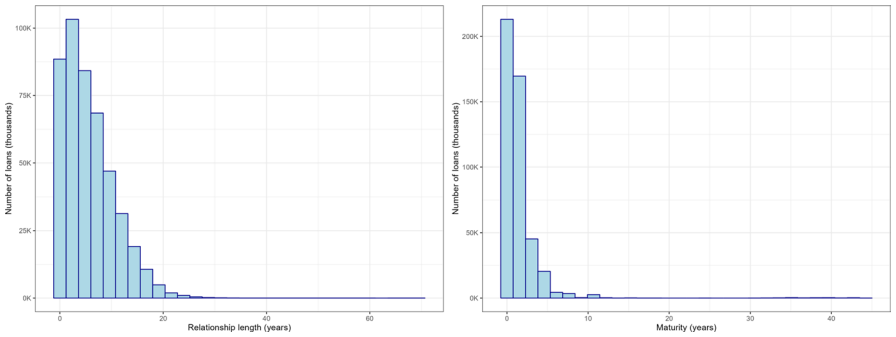


Fig. 3 Relationship length and maturity histograms

the exact date at which each firm obtained its first loan with a given bank. We infer the relationship's length by observing the first date for which a credit record is registered for a given firm with a given bank. While individual credit registry data in Colombia begins in 1994, there are some loans in our data set which were granted in the 1960 s and 1970 s. However, we have not way of knowing whether the firms to which these loans were granted had obtained loans before with those banks. And, in general, the length of the relationship variable may have left-censoring. However, we argue that the potential left-censoring is not an issue for our results (see Appendix D).

Figure 3 depict histograms for the variables relationship length and loan maturity, respectively. As shown in Fig. 1, while most credit relationships are of less than twenty years, we can track a few number of relationships of more than 40 years. Meanwhile, the duration (maturity) of most loans is lower than eight years. Hence, relationship lengths are longer than loan maturities in most cases. This fact allows us to perform robustness trimming our data set to test whether potential left-censoring affects our main results. As shown in the results section, findings with trimming (model estimated for a sub-sample stating in 2012 rather than in 2004) are qualitatively identical to those obtained using the full data set, allowing us to conclude

Table 4 Firm-Level Descriptive Statistics

	Mean	Stand. Dev.	25%	50%	75%	Skew.	Kurt.
Ln (Assets in billions)	−2.99	−1.32	−5.51	−4.55	−3.49	3.40	7.30
ROA (%)	10.46	14.40	0.28	2.08	5.70	9.65	24.1
Leverage (%)	314	211	83	149	264	2.75	15.02

that left-censoring does not affect our results (See Appendix D). Finally, from this loan-level data, it can be seen that the typical firm is usually current in its financial obligations (median of current delinquencies is zero) and only 18% of firms has ever been delinquent on a loan (average of "previous delinquencies to a bank" is 0.18).

A final source of data is a firm-level dataset collected from the Superintendencia de Sociedades, the government agency that supervises general business activity. From this source we obtain *matched* data from 52,639 non-financial firms, for a total of 400,090 observations (7.6 observations per firm on average). As shown in Table 4, median firm size in this dataset, as measured by assets, stands at 2.6 million of 2020 US dollars, while the median firm leverage ratio stands at 1.5.

Despite the large collection of variables used in our estimations, any concern of multicollinearity is ruled out when looking at barely significant correlations between the variables employed in the regressions (see Appendix C).

4 Results

4.1 Baseline results

This paper is dedicated to the examination of the impact of fluctuations in bank market power, as quantified by the Lerner index, on loan costs. The Lerner index, an instrument of significant prominence within the realm of economic discourse, stands as a pivotal metric for gauging market power and boasts a robust historical and theoretical foundation, have been comprehensively scrutinized in the academic canon. Eminent scholars, including Lerner (1934), Landes and Posner (1981), Elzinga and Mills (2011),Giocoli (2012), and Shaffer and Spierdijk (2017), have contributed significantly to the elucidation of its conceptual and empirical underpinnings.

Fundamentally, the Lerner index assumes a central role in the assessment of a firm's market positioning, achieved by contrasting the prevailing market output price with the firm's marginal production costs. This juxtaposition rests upon the bedrock of marginal-cost pricing, a concept intrinsically linked to the "social optimum attained under conditions of perfect competition," as meticulously articulated by Lerner (1934). The presence of a positive Lerner index typically signifies the exercise of market power, potentially entailing repercussions for the welfare of consumers, as their interests may be compromised.

Table 5 Bank market power and firm finance: Lerner index

Variables	(1) Spread	(2) Spread	(3) Spread	(4) Spread	(5) Spread	(6) Spread	(7) Spread	(8) Spread
Lerner	3.212***	3.145***	18.422***	17.576***	12.683***	17.300***	35.358***	7.749***
	(0.143)	(0.143)	(0.518)	(1.008)	(2.066)	(4.058)	(1.185)	(1.363)
Bank-Firm relationship								
Length relationship		0.031***	0.414***	0.460***	0.366***	0.442**	0.783***	0.518***
		(0.002)	(0.013)	(0.025)	(0.049)	(0.178)	(0.029)	(0.034)
Number relations		−0.119***	0.046**	−0.001	0.025	−0.044	−0.042	n.a
		(0.004)	(0.023)	(0.041)	(0.054)	(0.072)	(0.045)	n.a
Interactions								
Lerner × Length relationship			−0.682***	−0.742***	−0.625***	−0.758**	−1.226***	−0.890***
			(0.023)	(0.044)	(0.088)	(0.316)	(0.051)	(0.060)
Lerner ×Number relations			−0.294***	−0.153**	−0.232**	−0.110	−0.045	0.208**
			(0.040)	(0.070)	(0.090)	(0.125)	(0.078)	(0.090)
Loan level								
Ln Loan Amount	−1.003***	−0.995***	−0.991***	−0.890***	−0.885***	−0.841***	−0.776***	−0.759***
	(0.005)	(0.005)	(0.005)	(0.012)	(0.041)	(0.110)	(0.013)	(0.017)
Loan's Maturity	0.048***	0.044***	0.045***	0.034***	0.023**	0.007	0.027***	−0.016***
	(0.004)	(0.004)	(0.004)	(0.003)	(0.011)	(0.040)	(0.005)	(0.006)
Collateral	−0.940***	−0.933***	−0.911***	−1.354***	−1.460***	−1.487***	−1.432***	−1.338***
	(0.022)	(0.022)	(0.022)	(0.029)	(0.127)	(0.334)	(0.031)	(0.042)
Fixed Interest Rate	0.584***	0.566***	0.557***	0.477***	0.503***	0.384	0.274***	0.552***
	(0.020)	(0.020)	(0.020)	(0.026)	(0.076)	(0.261)	(0.024)	(0.040)
Bank level								
Bank's Ln(Assets)	0.482***	0.364***	0.360***	0.520***	0.424***	1.647	1.090***	2.698***
	(0.016)	(0.016)	(0.016)	(0.030)	(0.114)	(1.946)	(0.121)	(0.177)

Table 5 (continued)

Variables	(1) Spread	(2) Spread	(3) Spread	(4) Spread	(5) Spread	(6) Spread	(7) Spread	(8) Spread
Bank's Roa	−0.408***	−0.383***	−0.413***	−0.442***	−0.269***	0.211	0.173***	0.149***
	(0.013)	(0.013)	(0.013)	(0.018)	(0.094)	(0.127)	(0.018)	(0.031)
Bank's Leverage	−0.334***	−0.314***	−0.322***	−0.305***	−0.188***	−0.147	−0.417***	−0.148***
	(0.006)	(0.006)	(0.006)	(0.009)	(0.043)	(0.126)	(0.015)	(0.018)
Non-performing loans	0.795***	0.802***	0.801***	0.549***	0.374***	0.388**	0.545***	0.267***
	(0.035)	(0.035)	(0.035)	(0.043)	(0.055)	(0.163)	(0.044)	(0.090)
Firm level								
Ln(Assets)	0.284***	0.345***	−0.939***	−0.961***	−0.980***	−1.139***	−2.750***	n.a
	(0.008)	(0.008)	(0.046)	(0.093)	(0.248)	(0.360)	(0.109)	n.a
Lerner *times* Ln(Assets)			2.278***	2.124***	1.779***	2.042**	4.705***	0.647***
			(0.080)	(0.155)	(0.434)	(0.706)	(0.182)	(0.208)
Constant	5.804***	7.598***	−0.794**					
	(0.206)	(0.211)	(0.352)					
Observations	400,090	400,090	400,090	394,630	394,630	394,630	373,936	198,439
R-squared	0.127	0.131	0.133	0.269	0.304	0.319	0.438	0.622
Firm fixed effects	✗	✗	✗	✓	✓	✓	✓	✓
Time fixed effects	✗	✗	✗	✗	✓	✓	✓	✓
Bank fixed effects	✗	✗	✗	✗	✗	✓	✓	✓
Firm-Bank fixed effects	✗	✗	✗	✗	✗	✗	✓	✗
Firm-Time fixed effects	✗	✗	✗	✗	✗	✗	✗	✓

Robust standard errors in parentheses. n.a refers to non-available coefficients due to perfect collinearity

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

In this study, our primary focus lies in assessing the ramifications of fluctuations in bank market power, quantified by the Lerner index, on the cost associated with obtaining a loan. Employing rigorous statistical techniques, we present the estimation results in Table 5, where each column corresponds to a distinct model specification.[6] To ensure robustness, all models incorporate clustered standard errors, thereby mitigating the potential influence of heteroscedasticity-related issues. The initial column serves as our baseline model, devoid of fixed effects and interactions with the Lerner index. Subsequent columns introduce various fixed effects and interactions to the baseline model, denoted by a checkmark in the corresponding box.

Although numerical results may exhibit variability across model specifications, the signs of coefficients and their statistical significance remain remarkably consistent. Notably, coefficients pertaining to loan, firm, and bank characteristics generally demonstrate statistical significance and align with anticipated directions. For instance, interest rates are predictably higher for fixed-rate loans, attributed to the inflation and heightened market risk borne by banks in such loan categories. According to the baseline model, fixed-rate loans command an approximately 58 basis point premium over their floating-rate counterparts. Furthermore, collateralized loans exhibit lower costs compared to uncollateralized ones, with the baseline model indicating an average interest rate reduction of 0.94 percentage points for collateralized loans.

As expected, interest rates increase with loan maturity, and larger loans command lower interest rates. However, bank size exhibits a positive relationship with interest rates across model specifications, signifying that larger bank, on average, charge higher interest rates to their clientele. A conceivable rationale for the premium evident in the case of larger banks lies in the hypothesis that they deliver a heightened standard of service quality. This enhanced service quality may manifest across multiple facets, encompassing the caliber of their personnel, the extensive reach of their branch network, and the overall stability inherent in their institutional framework. It is essential to acknowledge that investigating this alternative hypothesis falls beyond the scope of this paper. However, it merits consideration as a potentially valuable avenue for further research in related domains. The effect of bank profitability, however, varies among model specifications. Banks with a higher proportion of nonperforming loans tend to levy higher interest rates, while banks with greater leverage extend relatively lower interest rates to firms.

Notably, the most intriguing findings emerge when considering the direct impact of increased bank market power on loan interest rates. In the baseline model, an incremental 0.1 unit rise in the Lerner index corresponds to a 32 basis point increase in loan interest rates, holding all else constant. Importantly, this effect represents the total estimated consequence of heightened market power on credit costs for nonfinancial firms in Colombia within this initial model, which lacks interactions between the Lerner index and other variables. In the second model (column 2), the introduction of "Length of relationship" and "Number relations" variables to the

[6] In order to check for the potential effect of left-censoring of the relationship-length variable we include estimation results using a shorter period (2012–2019) in Appendix D. Main results do not vary with the trimming of the data which confirms our hypothesis that left-censoring is not an issue in our data.

baseline model reveals notable insights. While this specification does not include interactions or fixed effects, it highlights the direct effects of credit relationship length (positive) and the number of relationships (negative) on credit costs. Specifically, a lengthier credit relationship corresponds to higher credit costs, whereas a greater number of relationships is associated with lower credit costs. These findings persist across various model specifications, underscoring the presence of lock-in and switching costs, along with the perceived benefits of diversifying lending relationships.

Furthermore, the inclusion of interactions between the Lerner index, credit relationship length, number of relationships, and business size in Model 3 yields compelling outcomes. While the direct effect of market power intensifies substantially, a counteracting negative effect emerges through the interaction of the Lerner index with credit relationship length. This key observation signifies that the influence of bank market power on credit costs varies significantly based on the duration of the credit relationship. Specifically, while heightened market power directly escalates average credit costs, firms engaged in longer credit relationships experience a diminished impact from increases in the Lerner index. Moreover, for sufficiently extended credit relationships, this effect even becomes negative, reflecting the pivotal role of relationship lending and the advantages perceived by firms in maintaining such long-term affiliations.

Similar patterns of results are observed across subsequent model specifications presented in columns 4 to 8, with variations arising primarily from the inclusion of specific fixed effects designed to account for unobservable shocks, such as demand-related fluctuations. Notably, the number of relationships and its interaction with the Lerner index exhibit limited relevance across most specifications. Therefore, in computing the total effect of market power on credit costs, our primary focus centers on the direct effect and the interaction between the Lerner index and credit relationship length.

To visually depict our main findings, Fig. 4 provides a graphical representation of the six models, highlighting both the direct effect and the interaction effect of interest. Additionally, 95% confidence intervals are depicted. Across all six panels, it is evident that the total impact of heightened bank market power exhibits a negative correlation with credit relationship length, with some specifications indicating a transition to a negative effect after approximately six years of the relationship, while others suggest a critical inflection point at around ten years of the relationship.

Table 6 shows results for the same model specifications but using instead the Adjusted Lerner index as the measure for bank market power. In the computation of the traditional Lerner index full profit and cost efficiency is assumed. To deal with the fact that bank inefficiencies in these two-dimensions may be biasing our market power estimates, we perform the simple adjustment to the Lerner index suggested by Koetter et al. (2012). Their adjusted Lerner index is found as:

$$AdjL_{bt} = \frac{\pi_{bt} + TOC_{bt} - MC_{bt}Q_{bt}}{\pi_{bt} + TOC_{bt}} \tag{5}$$

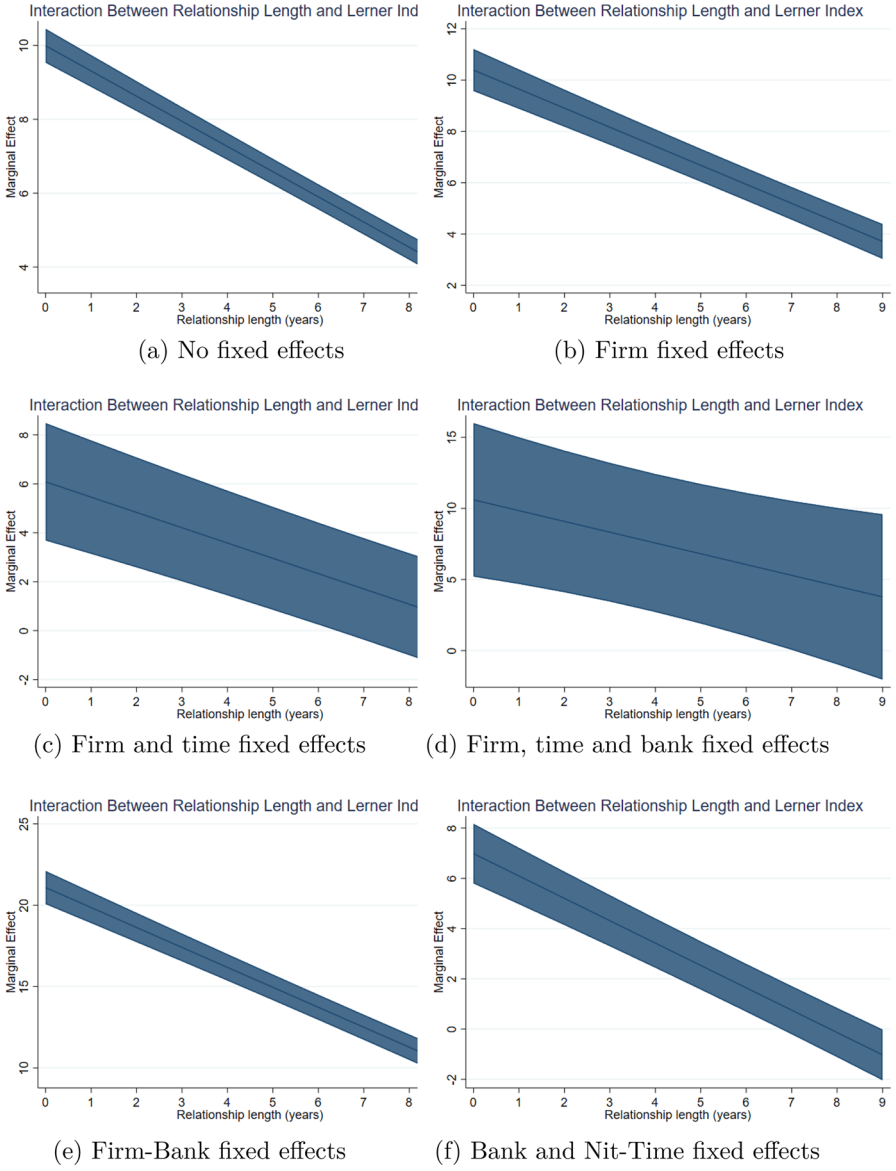


Fig. 4 Heterogeneous Effects of Bank Market Power. The figures plot marginal effects obtained using the coefficients from column 3 to 8 in Table 1

where π_{bt} stands for predicted profits, TOC_{bt} is predicted TOC and Q_{bt} is total output. In our measures, we use actual figures for profits, output and cost, instead of predicted ones. Results are qualitatively identical to those described above. However, interestingly, the total effect of increasing bank market power on the cost of credit

Table 6 Bank market power and firm finance: adjusted lerner index

Variables	(1) Spread	(2) Spread	(3) Spread	(4) Spread	(5) Spread	(6) Spread	(7) Spread	(8) Spread
Adj. Lerner	2.303***	2.509***	6.181***	6.794***	3.289*	7.100*	23.571***	3.065***
	(0.132)	(0.132)	(0.409)	(0.835)	(1.856)	(3.452)	(1.029)	(1.138)
Bank-firm relationship								
Length relationship		0.034***	0.318***	0.343***	0.237***	0.293**	0.683***	0.319***
		(0.002)	(0.009)	(0.018)	(0.035)	(0.100)	(0.023)	(0.024)
Number relations		−0.121***	−0.063***	−0.047	−0.032	−0.041	−0.014	n.a
		(0.004)	(0.016)	(0.032)	(0.041)	(0.062)	(0.035)	n.a
Interactions								
Lerner × Length Relationship			−0.566***	−0.593***	−0.439***	−0.554**	−1.235***	−0.601***
			(0.017)	(0.034)	(0.070)	(0.198)	(0.043)	(0.046)
Lerner × Number Relations			−0.119***	−0.083	−0.147*	−0.129	−0.107	0.085
			(0.031)	(0.057)	(0.074)	(0.124)	(0.066)	(0.072)
Loan level								
Ln loan amount	−1.008***	−1.001***	−0.997***	−0.894***	−0.890***	−0.839***	−0.773***	−0.760***
	(0.005)	(0.005)	(0.005)	(0.012)	(0.039)	(0.109)	(0.013)	(0.017)
Loan's maturity	0.038***	0.035***	0.039***	0.029***	0.016	0.009	0.030***	−0.017***
	(0.004)	(0.004)	(0.004)	(0.003)	(0.011)	(0.041)	(0.005)	(0.006)
Collateral	−0.908***	−0.900***	−0.882***	−1.333***	−1.435***	−1.491***	−1.440***	−1.331***
	(0.022)	(0.022)	(0.022)	(0.029)	(0.127)	(0.334)	(0.031)	(0.042)
Fixed interest rate	0.564***	0.544***	0.548***	0.470***	0.497***	0.400	0.286***	0.560***
	(0.020)	(0.020)	(0.020)	(0.026)	(0.076)	(0.260)	(0.024)	(0.040)
Bank level								
Bank's Ln(Assets)	0.529***	0.406***	0.418***	0.572***	0.463***	2.051	1.627***	3.125***
	(0.016)	(0.016)	(0.016)	(0.030)	(0.111)	(1.835)	(0.121)	(0.178)

Table 6 (continued)

Variables	(1) Spread	(2) Spread	(3) Spread	(4) Spread	(5) Spread	(6) Spread	(7) Spread	(8) Spread
Bank's Roa	−0.100***	−0.061***	−0.073***	−0.158***	0.069	0.445***	0.316***	0.413***
	(0.014)	(0.014)	(0.014)	(0.020)	(0.096)	(0.133)	(0.021)	(0.036)
Bank's leverage	−0.352***	−0.330***	−0.345***	−0.325***	−0.177***	−0.163	−0.506***	−0.160***
	(0.006)	(0.006)	(0.006)	(0.009)	(0.042)	(0.106)	(0.015)	(0.018)
Non-performing loans	0.780***	0.786***	0.779***	0.537***	0.363***	0.375*	0.533***	0.252***
	(0.035)	(0.035)	(0.035)	(0.043)	(0.056)	(0.175)	(0.044)	(0.090)
Firm level								
Ln(Assets)	0.301***	0.360***	−0.183***	−0.262***	−0.420**	−0.549*	−1.728***	n.a
	(0.008)	(0.008)	(0.032)	(0.075)	(0.204)	(0.285)	(0.088)	n.a
Lerner × Ln(Assets)			1.096***	1.049***	0.878**	1.104*	3.221***	0.847***
			(0.063)	(0.128)	(0.397)	(0.610)	(0.155)	(0.170)
Constant	7.643***	9.497***	5.239***					
	(0.199)	(0.204)	(0.282)					
Observations	400,090	400,090	400,090	394,630	394,630	394,630	373,936	198,439
R-squared	0.127	0.130	0.132	0.268	0.305	0.318	0.436	0.622
Firm fixed effects	✗	✗	✗	✓	✓	✓	✓	✓
Time fixed effects	✗	✗	✗	✗	✓	✓	✓	✓
Bank fixed effects	✗	✗	✗	✗	✗	✓	✓	✓
Firm-bank fixed effects	✗	✗	✗	✗	✗	✗	✓	✗
Firm-Time Fixed Effects	✗	✗	✗	✗	✗	✗	✗	✓

Robust standard errors in parentheses. n.a refers to non-available coefficients due to perfect collinearity

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

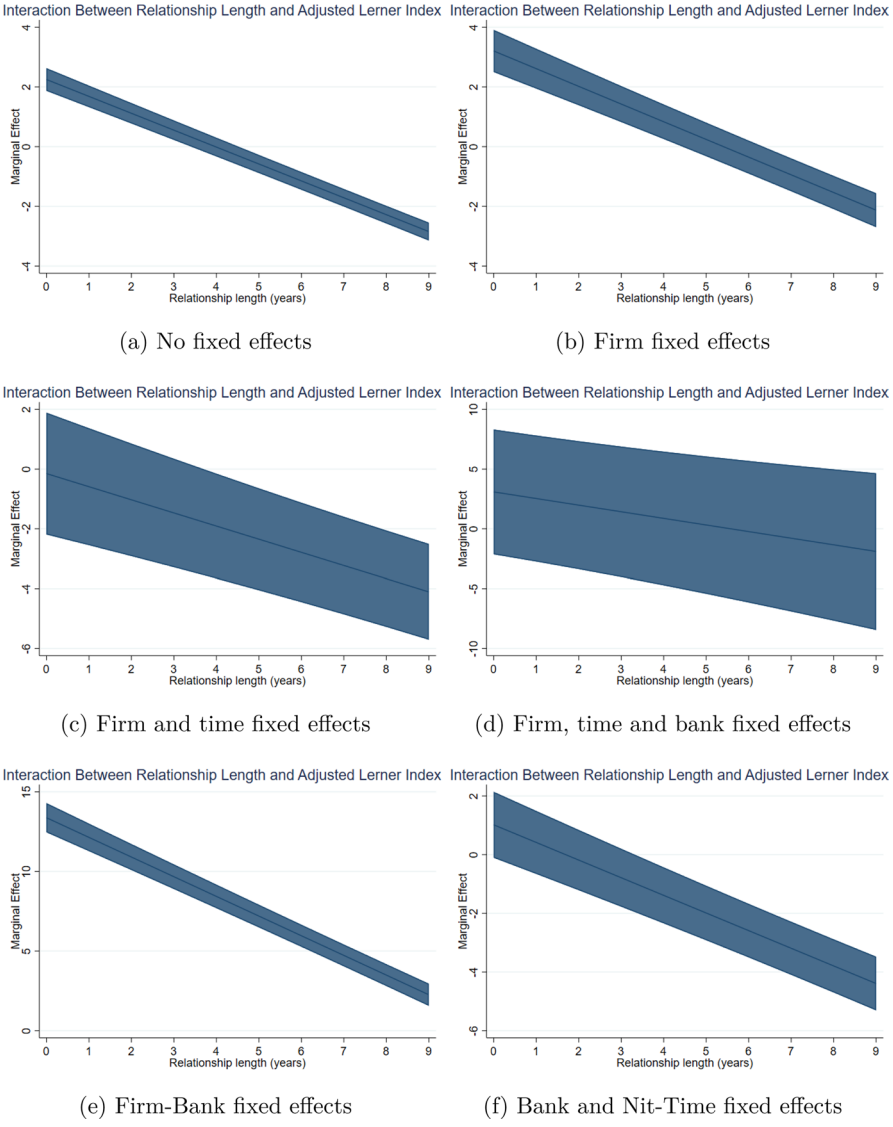


Fig. 5 Heterogeneous Effects of Bank Market Power. The figures plot marginal effects obtained using the coefficients from column 3 to 8 in Table 2

becomes negative even faster than when using the Lerner index. This can be seen easier when looking at the panels of Fig. 5.

Our analysis has demonstrated a positive correlation between elevated bank market power and increased credit costs for firms operating in Colombia. Consequently, implementing strategic policy measures aimed at fostering greater market competition has the potential to mitigate the burden of credit costs borne by Colombian enterprises.

Financial regulation in Colombia has historically prioritized the preservation of financial stability, a commendable policy objective. However, it is arguable that the regulatory environment may have erred on the side of stringency, inadvertently fostering a subdued level of competition within the banking sector. This propensity toward strictness is notably evident in the country's universal banking laws and the restrictions placed on banks regarding their exposure to exchange rate risks. Consequently, these regulatory measures have exhibited a tendency to bolster market concentration through a surge in mergers and acquisitions, while concurrently deterring foreign banks from establishing a presence in Colombia.

One specific illustration of these regulatory constraints relates to limitations on banks' exchange rate exposure. These constraints encompass norms that inhibit the acquisition of foreign currency funding for the purpose of lending in Colombian pesos. Consequently, such regulations may impose barriers to the entry of foreign banks, which might otherwise source funding in foreign currency from their parent entities abroad. This restriction potentially hinders the introduction of foreign banks into the Colombian market, which could contribute to increased competition and diversification of financial services, thus promoting a more dynamic and robust banking sector.

Colombian financial regulation further extends its impact by restricting a range of off-balance sheet operations, notably including the stringent limitations imposed on exchange rate derivatives. This constraint not only curtails the scope for effective hedging strategies but also diminishes the accessibility of credit for businesses. Additionally, the regulatory landscape in Colombia imposes rigorous conditions for the emergence and expansion of new fintech firms, thereby circumscribing the potential competitive forces they could introduce to the banking sector. To stimulate greater competition within the country's banking industry, comprehensive reforms across these dimensions warrant consideration and implementation

5 Concluding remarks

Within this study, we undertake a comprehensive exploration into the influence of bank market power on the financial outlay for firms, employing an intricate amalgamation of bank-specific, firm-specific, and loan-level data. Our investigation brings to light a discernible pattern: banks endowed with higher market power tend to impose higher average interest rates on their loan products. However, this pattern is notably intricate, contingent upon the distinctive attributes of both banks and firms, and of paramount importance, the duration of credit relationships.

While the direct consequence of heightened bank market power translates into elevated credit costs perceived by nonfinancial entities, the extent of this influence exhibits intricate dynamics rooted in the temporal span of credit engagements. Notably, the protracted nature of credit associations mitigates the magnitude of the overall impact. Remarkably, over extended credit relationships, the aggregate effect of burgeoning bank market power on the credit cost assumes a negative trajectory. This finding underlines the substantial value that relationship-based lending imparts to

nonfinancial enterprises. Despite the recognized drawbacks of relationship lending, including lock-in and switching costs as spotlighted by the extant literature, our estimations reveal its salutary impact ? a reduction in loan expenses amidst an elevation in bank market power. Consequently, entities stand to gain from fostering enduring associations, especially in emerging economies like Colombia. This perspective is particularly pertinent given the pronounced trend toward heightened market power and market concentration within Colombia in recent decades.

The implications of our findings are demonstrably pertinent to policymaking. For example, they signify that regulatory efforts might be optimally directed at curbing the market power of a select few dominant banks positioned at the apex of the market power distribution. Correspondingly, our insights suggest that mechanisms enhancing information exchange and diminishing switching costs within credit markets represent efficacious strategies for counteracting the rent-extractive tendencies associated with high market power banks.

It is worth emphasizing that our use of a unique and exclusive dataset has engendered a host of conceptual and methodological innovations, amplifying the persuasiveness of our results as indicative of causal relationships. Moreover, such distinctive datasets could serve dual purposes: not only facilitating the identification of collusion instances but also affording insights into entry and expansion episodes. These insights are pivotal for a nuanced comprehension of how the distribution of market power exerts ramifications on credit access, a dimension of relevance within economies marked by underdeveloped credit markets.

Our study underscores critical policy implications in the realm of bank market power and its impact on the cost of firm finance. Firstly, regulatory oversight must focus keenly on mitigating the undue dominance of select banks, thus nurturing a competitive banking landscape that safeguards borrowers' interests. This entails vigilant monitoring and intervention against anticompetitive behavior to curtail excessive market concentration.

Furthermore, fostering transparency and information-sharing mechanisms within the banking sector is pivotal. By reducing information asymmetry, borrowers are better equipped to negotiate terms, countering the adverse effects of heightened market power. Alongside this, policymakers should prioritize the reduction of switching costs, enabling borrowers to explore alternative financing avenues, thereby injecting a healthy dose of competition into the market. Equally important is the cultivation of enduring relationships between banks and firms, particularly in economies with developing credit markets. Such relationships, despite potential drawbacks, demonstrate their worth by tempering the rise in loan costs amidst escalating bank market power. In parallel, initiatives that promote diversification within the banking sector and enhance financial literacy among borrowers can amplify the positive impact on borrowers' financial well-being. Lastly, a flexible and dynamic regulatory framework, responsive to changing market conditions, remains imperative for timely and effective interventions that counteract the adverse implications of heightened market power.

Table 7 M &A in the Colombian Banking Industry 2004–2019

Mergers and Acquisitions	New Entrants
Banco Sudameris acquires Banco Tequendama (2005)	Bancamia (2008)
Davivienda acquires Banco Superior (2004)	Banco WWB (2010)
BBVA acquires Banco Granahorrar (2005)	Bancoomeva (2011)
Banco Colmena merges with Banco Caja Social (2005)	Banco Finandina (2011)
Banco Conavi merges with Bancolombia (2005)	Banco Falabella (2011)
Banco Union Colombiano merges with Banco de Occidente (2006)	Banco Pichincha (2011)
Banco de Bogota acquires Megabanco (2006)	Banco Cooperativo Coopcentral (2013)
Davivienda acquires Bancafe-Granbanco (2006)	Banco Santander de Negocios (2013)
Scotiabank acquires controlling ownership of Colpatria (2011)	Banco Mundo Mujer (2014)
Banco Corpbanca acquires Helm Bank (2013)	Multibank (2014)
Banco Sudameris merges with GNB Colombia (2014)	Mibanco (2014)
	Serfinanza (2018)

Appendix A: Mergers and acquisitions in the Colombian banking system

See Table 7.

Appendix B: Data sources, variable definitions and TOC estimation

Bank-level data

All of our bank-specific measures come from the financial supervisor in Colombia, Superintendencia Financiera. In particular, we access the excel workbooks provided by SuperFinanciera under the link https://www.superfinanciera.gov.co/publicacion/60776 ("Estados Financieros - Moneda total - COLGAAP"). These spreadsheets contain both balance sheet and income statement accounts. Our variable definitions are as follows:

- Total bank assets: is taken as account number 100000 ("Activo").
- Fixed assets: is taken as account number 180000 ("Propiedades y equipos").
- Total bank investments: is taken as account number 130000 ("Inversiones").
- Equity: is taken as account number 300000 ("Patrimonio").
- Total bank net loans: is taken as account number 140000 ("Cartera de creditos y operaciones de leasing financiero") which records net commercial, consumer, housing, and microcredit loans; and we exclude net financial leasing loans by subtracting account numbers for gross commercial, consumer, housing, and microcredit leasing loans (141183 to 141198; 141983 to 141998; 143283 to 143298; 143383 to 143398; 143683 to 143698; 144183 to 144198; 144283 to 144298; 144283 to 144498; 144583 to 144598; 145083 to 145098; 145983

Table 8 TOC Translog Function Estimates

Dependent variable: ln(*operatingcost*)	Coefficient	*t*-value	$P > \|t\|$
ln_loans	0.826	7.61	0.000
ln_loans_sq	0.078	7.88	0.000
ln_invest	0.763	8.171	0.000
ln_invest_sq	0.052	4.47	0.000
ln_input_price	1.403	12.06	0.000
ln_input_price_sq	0.071	3.92	0.000
ln_input_price2	−0.811	−7.14	0.000
ln_input_price_sq	0.069	4.79	0.000
ln_loans_invest	−0.178	−10.00	0.000
ln_loans_input	0.029	1.87	0.062
ln_loans_input2	0.039	2.52	0.012
ln_invest_input	−0.146	−7.97	0.000
ln_invest_input2	0.112	7.05	0.000
ln_input1_input2	−0.138	−4.69	0.000
ln_eqty_asset	−0.089	−3.20	0.001
merge_acquisition	0.047	5.88	0.000
Bank fixed-effects	Yes		
Time fixed-effects	Yes		
Bank-level clustered std errors	Yes		
R2 (overall)	0.972		
Number of panels (banks)	13		
Observations	897		

to 145998; 146083 to 146098; 146283 to 146298; 146383 to 146398; 146583 to 146598; 146683-146698; 146783 to 146798; 146883 to 146898; 146983 to 146998; 147083 to 147098) and adding accounts for commercial, consumer, housing, and microcredit leasing provisions (149109, 149114, 149119, 149124, 149149, 149309, 149314, 149319, 149324, 149329, 149508, 149509, 149513, 149514, 149518, 149519, 149523, 149524, 149528, 149529, 149810).

- Net Commercial loans: is the sum of account numbers 145900, 146000, 146200,146300 and 146500 to 147000 which record commercial loans under different risk categories (A to E) and using different collateral ("garantia idonea" and "otra garantia"); and exclude net commercial leasing loans by subtracting account numbers for gross commercial leasing loans (145983 to 145998; 146083 to 146098; 146283 to 146298; 146383 to 146398; 146583 to 146598; 146683-146698; 146783 to 146798; 146883 to 146898; 146983 to 146998; 147083 to 147098) and adding commercial leasing provisions (149508,149509,149513,149514,149518,149519,149523,149524,149528,149529).
- Financial Income: is the sum of the account numbers for interest income (4102000), commissions (4115000), price level restatement (411015), return on investments (410403 + 410404 + 410405 + 410409 + 410421 + 410423 +

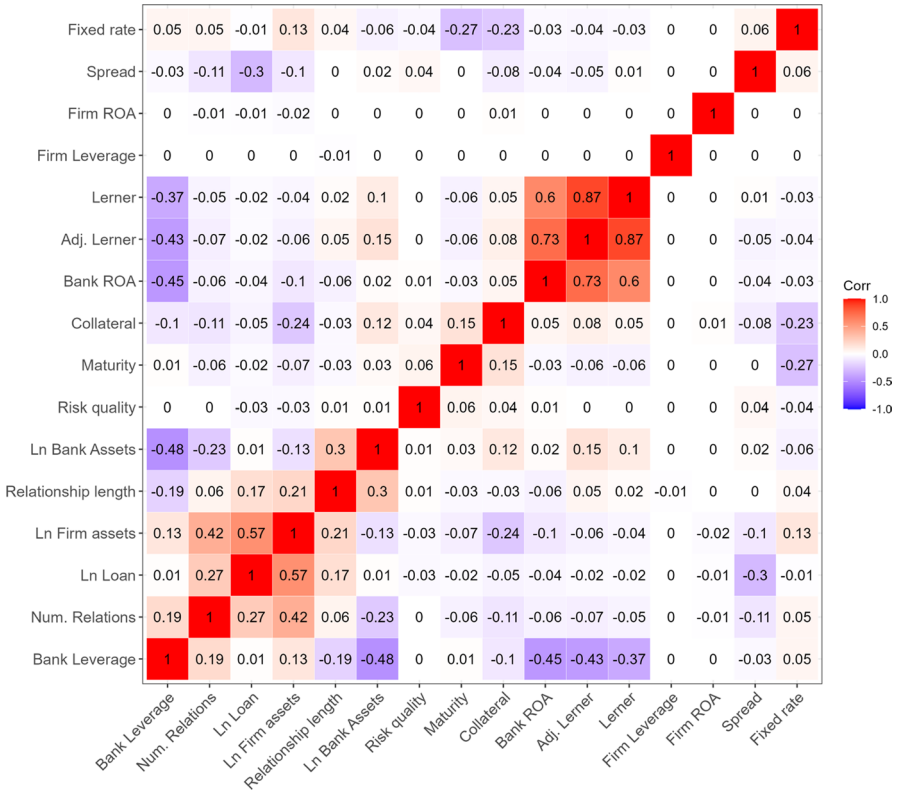


Fig. 6 Included variables correlation plot

410424 + 4123000), dividends (414000), net profit in investment sales (4116000 + 4125000 − 5116000 − 5125000) investment valuation (410700 + 410800 + 410900 + 411100 + 411200 + 411300 − 510600 − 510800 − 510900 − 511100 − 511200 − 511400), other net financial income (410400 + 411005 + 412800 + 412900 − 410403 − 410404 − 410405 − 410409 − 410421 − 410423 − 410424 − 512800 − 512900), and net changes (413500 − 513500).

TOC estimation results

See Table 8.

Table 9 Bank Market Power and Firm Finance: Lerner Index -Sample (2012-2019)

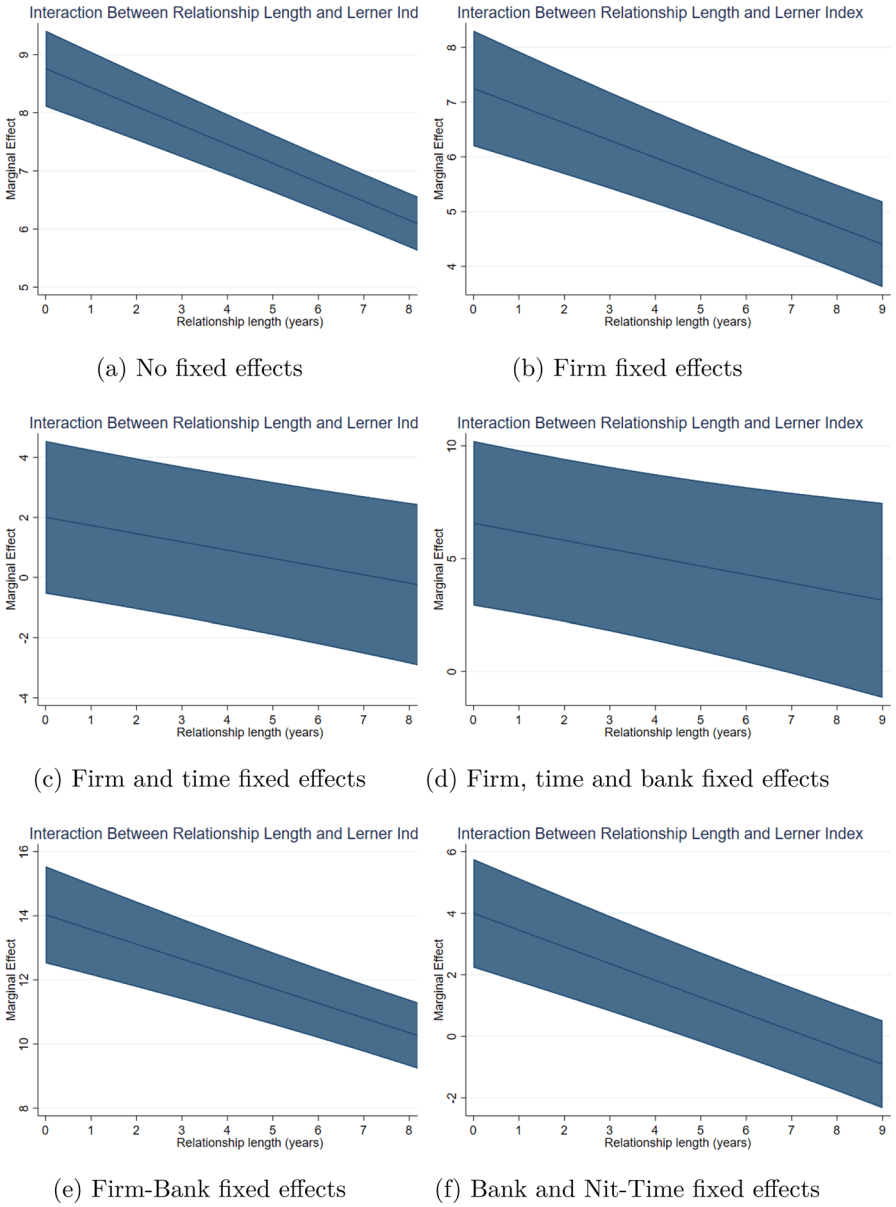
Variables	(1) Spread	(2) Spread	(3) Spread	(4) Spread	(5) Spread	(6) Spread	(7) Spread	(8) Spread
Lerner	3.955***	4.052**	20.024***	16.086***	9.905***	13.596***	29.265***	5.983***
	(0.209)	(0.209)	(0.687)	(1.275)	(2.191)	(3.188)	(1.642)	(1.934)
Bank-Firm relationship								
Length relationship		0.018***	0.200***	0.180***	0.184***	0.246**	0.140***	0.345***
		(0.003)	(0.017)	(0.029)	(0.047)	(0.100)	(0.041)	(0.041)
Number relations		−0.143***	0.212***	0.116**	0.111*	−0.035	−0.109	n.a
		(0.006)	(0.033)	(0.057)	(0.064)	(0.085)	(0.069)	n.a
Interactions								
Lerner × Length Relationship			−0.326***	−0.316***	−0.274***	−0.380**	−0.460***	−0.545***
			(0.029)	(0.050)	(0.085)	(0.164)	(0.067)	(0.072)
Lerner × Number Relations			−0.628***	−0.324***	−0.365***	−0.091	0.101	−0.001
			(0.057)	(0.095)	(0.105)	(0.139)	(0.117)	(0.136)
Loan level								
Ln Loan amount	−1.213***	−1.199***	−1.195***	−1.047***	−1.035***	−0.979***	−0.855***	−0.920***
	(0.008)	(0.008)	(0.008)	(0.022)	(0.056)	(0.176)	(0.026)	(0.034)
Loan's maturity	0.038***	0.032***	0.031***	0.017***	0.014	0.001	0.038***	−0.025***
	(0.006)	(0.006)	(0.006)	(0.005)	(0.015)	(0.046)	(0.009)	(0.010)
Collateral	−1.608***	−1.605***	−1.581***	−2.092***	−2.101***	−2.141***	−2.332***	−2.009***
	(0.033)	(0.033)	(0.033)	(0.045)	(0.116)	(0.501)	(0.053)	(0.069)
Fixed interest rate	1.026***	0.994***	0.962***	0.753***	0.803***	0.698*	0.499***	0.733***
	(0.030)	(0.030)	(0.030)	(0.038)	(0.076)	(0.360)	(0.037)	(0.063)
Bank level								
Bank's Ln(Assets)	0.038	−0.049*	−0.010	0.468***	0.549***	3.383*	3.327***	4.048***
	(0.025)	(0.026)	(0.026)	(0.043)	(0.147)	(1.665)	(0.222)	(0.320)

Table 9 (continued)

Variables	(1) Spread	(2) Spread	(3) Spread	(4) Spread	(5) Spread	(6) Spread	(7) Spread	(8) Spread
Bank's Roa	−0.761***	−0.760***	−0.787***	−0.765***	−0.465***	0.084	−0.286***	−0.018***
	(0.019)	(0.019)	(0.019)	(0.024)	(0.139)	(0.195)	(0.025)	(0.003)
Bank's Leverage	−0.278***	−0.266***	−0.272***	−0.272***	−0.255***	−0.258***	−0.457***	−0.140***
	(0.008)	(0.008)	(0.008)	(0.013)	(0.049)	(0.076)	(0.031)	(0.039)
Non-performing loans	0.866***	0.883***	0.885***	0.462***	0.509***	0.520**	0.590***	0.345**
	(0.056)	(0.056)	(0.056)	(0.068)	(0.103)	(0.193)	(0.075)	(0.163)
Firm level								
Ln(Assets)	0.657***	0.722***	−0.745***	−1.450***	−0.980***	−1.129***	−2.958***	n.a
	(0.012)	(0.013)	(0.063)	(0.140)	(0.268)	(0.345)	(0.171)	n.a
Lerner x Ln(Assets)			2.602***	2.358***	1.968***	2.189**	5.301***	0.665**
			(0.110)	(0.205)	(0.467)	(0.720)	(0.270)	(0.295)
Constant	11.809***	13.517***	4.252***					
	(0.293)	(0.300)	(0.486)					
Observations	210,097	210,097	210,097	204,937	204,937	204,937	188,293	102,225
R-squared	0.143	0.146	0.148	0.331	0.354	0.371	0.520	0.611
Firm Fixed Effects	✗	✗	✗	✓	✓	✓	✓	✓
Time Fixed Effects	✗	✗	✗	✗	✓	✓	✓	✓
Bank Fixed Effects	✗	✗	✗	✗	✗	✓	✓	✓
Firm-Bank Fixed Effects	✗	✗	✗	✗	✗	✗	✓	✗
Firm-Time Fixed Effects	✗	✗	✗	✗	✗	✗	✗	✓

Robust standard errors in parentheses. n.a refers to non-available coefficients due to perfect collinearity

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



(a) No fixed effects

(b) Firm fixed effects

(c) Firm and time fixed effects

(d) Firm, time and bank fixed effects

(e) Firm-Bank fixed effects

(f) Bank and Nit-Time fixed effects

Fig. 7 Heterogeneous Effects of Bank Market Power (2012–2019). The figures plot marginal effects obtained using the coefficients from column 3 to 8 in Table 1

Appendix C: Statistical tests

Figure 6 presents the correlation matrix plot between the variables included. Most of the variables do not present high significant correlations, ruling out concerns

about multicollinearity. The unique variables that present high correlations are not included together into the regressions (i.e. Lerner index and Adjusted Lerner index).

Appendix D: Robustness checks

We trim our dataset to the period 2012–2019 in order to investigate whether our results are affected by the potential left-censoring of the relationship-lending variable. The results are presented in Table 9 and Fig. 7 below. Results are quantitatively similar to the ones observed in the main results of the document. This result help us to confirm our prior about the absence of left-censoring in our exercise.

References

Alvarez R, Jara M (2016) Banking competition and firm-level financial constraints in Latin America. Emerg Mark Rev 28(C):89–104

Batrancea L, Rathnaswamy MK, Batrancea I (2021) A panel data analysis on determinants of economic growth in seven non-bcbs countries. J Knowl Econ 13(2):1651–1665

Batrancea L, Rathnaswamy MK, Rus M-I, Tulai H (2022) Determinants of economic growth for the last half of century: a panel data analysis on 50 countries. J Knowled Econ. https://doi.org/10.1007/s13132-022-00944-9

Batrancea LM, Balci MA, Chermezan L, Akguller O, Masca ES, Gaban L (2022) Sources of smes financing and their impact on economic growth across the European union: Insights from a panel data study spanning sixteen years. Sustainability 14(22):15318

Beck T, Demirguc-Kunt A, Maksimovic V (2004) Bank competition and access to finance: international evidence. J Money, Credit, Bank 36(3):627–48

Berger A, Hannan T (1989) The price-concentration relationship in banking. Rev Econ Stat 71(2):291–99

Boone J (2008) A new way to measure competition. Econ J 118(531):1245–1261

Cañón C, Córtes E, Guerrero R (2022) Bank competition and the price of credit: Evidence using mexican loan-level data. Int Rev Econ Financ 79:56–74

Carbo-Valverde S, Rodríguez-Fernández F, Udell G (2009) Bank market power and sme financing constraints. Review of Finance 13(2):309–340

Casu B, Girardone C (2009) Testing the relationship between competition and efficiency in banking: A panel data analysis. Econ Lett 105(1):134–137

Claessens S, Laeven L (2004) What drives bank competition? Some international evidence. J Money, Credit, Bank 36(3):563–583

Clerides S, Delis MD, Kokas S (2015) A new data set on competition in national banking markets. Finan Markets, Instit Instr 24(2–3):267–311

Elzinga KG, Mills DE (2011) The Lerner index of monopoly power: origins and uses. Am Econ Rev 101(3):558–64

Fernandez J, Maudos J, Perez F (2005) Market power in European banking sectors. J Finan Serv Res 27(2):109–137

Fungacova Z, Shamshur A, Weill L (2017) Does bank competition reduce cost of credit? Cross-country evidence from Europe. J Bank Finance 83(C):104–120

Gelos RG (2009) Banking spreads in Latin America. Econ Inq 47(4):796–814

Giocoli N (2012) Who invented the Lerner index? Luigi Amoroso, the dominant firm model, and the measurement of market power. Rev Ind Organ 41(3):181–191

Gómez-González JE, Reyes NR (2011) The number of banking relationships and the business cycle: new evidence from Colombia. Econ Syst 35(3):408–418

Greenbaum SI, Kanatas G, Venezia I (1989) Equilibrium loan pricing under the bank-client relationship. J Bank Finance 13(2):221–235

Haber S (2009) Why banks do not lend: The mexican financial system. In: Levy S, Walton M (Eds), No Growth without Equity? Inequality, interests, and competition in Mexico
Hainz C, Weill L, Godlewski C (2013) Bank competition and collateral: theory and evidence. J Financial Serv Res 44(2):131–148
Hauswald R, Marquez R (2006) Competition and strategic information acquisition in credit markets. Rev Finan Stud 19(3):967–1000
Koetter M, Kolari JW, Spierdijk L (2012) Enjoying the quiet life under deregulation? Evidence from adjusted Lerner indices for US banks. Rev Econ Stat 94(2):462–480
Kroszner RS, Strahan PE (1999) What drives deregulation? Economics and politics of the relaxation of bank branching restrictions. Q J Econ 114(4):1437–1467
Kysucky V, Norden L (2016) The benefits of relationship lending in a cross-country context: a meta-analysis. Manage Sci 62(1):90–110
Landes WM, Posner RA (1981) Market power in antitrust cases. Harv Law Rev 94(5):937–996
Leon F (2015) Does bank competition alleviate credit constraints in developing countries? J Bank Finance 57(C):130–142
Lerner AP (1934) The concept of monopoly and the measurement of monopoly power. Rev Econ Stud 1(3):157–175
Love I, Martinez Peria M (2015) How bank competition affects firms' access to finance. World Bank Econ Rev 29(3):413–448
Love I, Martinez-Peria MS (2015) How bank competition affects firms' access to Finance. World Bank Econ Rev 29(3):413–448
Marquez R (2002) Competition, adverse selection, and information dispersion in the banking industry. Rev Financial Stud 15(3):901–926
Menkhoff L, Suwanaporn C (2007) On the rationale of bank lending in pre-crisis Thailand. Appl Econ 39(9):1077–1089
Mester LJ (1996) A study of bank efficiency taking into account risk-preferences. J Bank Finance 20(6):1025–1045
Neumark D, Sharpe S (1992) Market structure and the nature of price rigidity: evidence from the market for consumer deposits. Q J Econ 107(2):657–680
Ornelas JRH, da Silva MS, Van Doornik BFN (2022) Informational switching costs, bank competition, and the cost of finance. J Bank Finance 138:106408
Panzar JC, Rosse JN (1987) Testing for monopoly equilibrium. J Ind Econ 35(4):443–56
Petersen MA, Rajan R (1995) The effect of credit market competition on lending relationships. Q J Econ 110(2):407–443
Ryan RM, O'Toole CM, McCann F (2014) Does bank market power affect SME financing constraints? J Bank Finance 49(C):495–505
Shaffer S, Spierdijk L (2017) Market power: competition among measures. 9
Sharpe SA (1990) Asymmetric information, bank lending, and implicit contracts: a stylized model of customer relationships. J Financ 45(4):1069–1087
Smirlock M (1985) Evidence on the (non) relationship between concentration and profitability in banking. J Money, Credit, Bank 17(1):69–83
Tabak BM, Fazio DM, Cajueiro DO (2012) The relationship between banking market competition and risk-taking: do size and capitalization matter? J Bank Finance 36(12):3366–3381
Tabak BM, Gomes GM, da Silva Medeiros M (2015) The impact of market power at bank level in risk-taking: the Brazilian case. Int Rev Financ Anal 40(C):154–165
van Leuvensteijn M, Sorensen CK, Bikker JA, van Rixtel AA (2013) Impact of bank competition on the interest rate pass-through in the euro area. Appl Econ 45(11):1359–1380
Wilson BJ, Reynolds SS (2005) Market power and price movements over the business cycle. J Ind Econ 53(2):145–174

Authors and Affiliations

Jose E. Gomez-Gonzalez[1,5] · Sebastian Sanin-Restrepo[2] · Cesar E. Tamayo[3] · Oscar M. Valencia[4]

✉ Jose E. Gomez-Gonzalez
jose.gomezgonzalez@lehman.cuny.edu

Sebastian Sanin-Restrepo
ssaninre@banrep.gov.co

Cesar E. Tamayo
ctamayot@eafit.edu.co

Oscar M. Valencia
oscarva@iadb.org

1 Department of Finance, Information Systems and Economics, City University of New York - Lehman College, Bronx, NY, USA

2 Financial Sector, Banco de la Republica, Bogotá, Colombia

3 School of Finance, Economics, and Government, Universidad Eafit, Medellín, Colombia

4 Fiscal Division, Inter-American Development Bank, Washington, DC, USA

5 Visiting Professor of the Summer School, Escuela Internacional de Ciencias Económicas y Adinistrativas, Universidad de La Sabana, Chía, Colombia