Bank Market Power and Firm Finance: Evidence from Bank and Loan Level Data*

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Abstract

We present new measures of market power for the banking industry in Colombia and estimate their effect on the cost of credit for non-financial firms. Our results suggest that bank competition increased during the 2006-2008 period–even as concentration increased–but decreased thereafter. Using a unique combination of loan, firm and bank-level datasets we are also able to show that, conditional on firm size, higher bank market power increases interest rates for firms with shorter credit relationships. This is consistent with banks investing in information acquisition when starting new relationships, and being able to cover such investments by exerting market power. We also find that, conditional on firm credit history, reducing bank market power lowers interest rates for larger firms. This suggest that size may be capturing other firm attributes such as scale effects or implicit collateral. Finally, we show that conditioning on a full set of fixed effects, especially firm-time fixed effects which isolate demand-side shocks, is essential in obtaining our results.

Keywords: Bank competition, market power, Boone, Lerner, Colombia, cost of firm finance, loan-level data.

JEL Classification Numbers: G21, D22, O16

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1 Introduction

High interest rate spreads in developing countries have concerned economists and policy-makers for a long time. This has been particularly true in Latin America, where countries have traditionally exhibited spreads well above those observed in other developing countries. In all likelihood the causes of such abnormally high intermediation margins are varied; limited enforcement of contracts, scale economies, excess risk from volatile industries (such as commodity producers), may all play a role. Nonetheless, low bank competition has often been viewed as an important determinant of high cost of credit in this region of the world (Gelos (2009), Haber (2009)).

The relationship between bank competition and the conditions under which firms can access credit is of a rather complex nature. On the one hand, basic industrial organization economics would suggest that if intermediaries can exercise market power, they will extract rents from borrowers, increasing the cost of credit and limiting access to finance. On the other hand, however, some market power may be necessary to allow intermediaries to recover the cost of information acquisition in an environment of asymmetric information (Petersen and Rajan (1995)).

Since competition is for the most part unobservable, applied economists have always relied on proxy measures to capture its behavior. Unfortunately, this means that the use of different proxies for capturing competition has resulted in a wide array of conclusions about the underlying relationship between competition and interest rate spreads.

With this paper, we make two main contributions to the extant literature on bank competition. First, we provide up-to-date measures of bank market power in a developing country (Colombia) using recently developed methods–such as the Boone profit and market share elasticity regressions–and primary sources for bank financial data. Second and most important, we provide estimates of the effect of bank market power on the conditions under which firms can obtain external finance.

Our study of the effect of bank market power on firm interest rates introduces two methodological improvements with respect to the extant literature. First, we construct and use four measures of bank market power: two Lerner indices, a profit Boone indicator and a market share Boone indicator. By constructing our own market power measures from primary sources, we aim to diminish measurement error that is sometimes attributed to large data aggregators. In using both the profit and market share Boone elasticities, we are able to detect if banks are exercising market power in either margin. Moreover, the use of these four market power indicators allows us to compare our results with most of

the recent studies of bank competition.

Second, we build a unique dataset that matches individual loans with firm and bank-level data, including market power and other bank characteristics. This allows us to overcome some of the limitations found in recent studies of this type. In particular, we can: (i) directly observe interest rates from each loan rather than derive them implicitly from accounting data, (ii) control for loan-specific characteristics such as term, size or collateral, and (iii) properly account for time-varying, unobserved firm-level heterogeneity (like demand-side shocks), and bank characteristics.

Our results suggest that bank competition was relatively low in 2004-2005, increased during 2006-2008 and has decreased systematically ever since. By most measures, bank competition today (2014) is close to its relatively low level of 2004-2005. Interestingly, the increase in bank competition during 2006-2008 occurred as the industry became more concentrated, highlighting the importance of distinguishing between concentration and competition measures. Our results also indicate that, conditional on firm size, higher bank market power increases interest rates for firms with shorter credit relationships. This is consistent with banks having to invest in information acquisition when starting new relationships, and being able to cover such investments by exerting market power through higher interest rates. We also find that, conditional on the length of a firm-bank credit relationship, reducing bank market power lowers interest rates for larger firms. This suggest that size may be capturing firm attributes that are important in the pricing of loans, such as scale effects or implicit collateral. Finally, we show that conditioning on a full set of fixed effects, especially firm-time fixed effects which isolate demand-side shocks, is essential in obtaining our results.

The reminder of the paper is organized as follows. Section 2 provides a literature review on bank competition and points to the main gaps that this paper intends to fill. Section 3 presents a brief overview of the banking system in Colombia. Section 4 presents the bank competition measures and discusses the methodological details. The fifth section details our study on the relationship between bank market power and the cost of firm finance. Section 6 concludes.

2 Related Literature

Early empirical studies of bank competition found that U.S. banks in more concentrated local markets, as measured by the Herfindahl Index, charge higher rates on SME loans and

pay lower rates on retail deposits (e.g., Berger and Hannan (1989)), and that their deposit rates are slow to respond to changes in open-market interest rates (e.g., Neumark and Sharpe (1992)). Beyond the U.S., Beck et al. (2004) argued that in a sample of 74 countries, concentration appeared to constraint access to finance, although this effect seemed to apply only to countries with low levels of economic and institutional development. The results from these studies that relied on concentration measures were quickly contested by researchers who argued empirically in favor of the efficient structure hypothesis: the idea that high concentration endogenously reflects the market share gains of efficient firms (e.g., Smirlock (1985)).

In recent years, a myriad of papers have made it clear that using concentration as a measure of competition can be misleading (see e.g., Carbo-Valverde et al. (2009)). In fact, a number of authors have shown that concentration and competition may be uncorrelated or even positively correlated (Kroszner and Strahan (1999); Claessens and Laeven (2004)). In light of these developments, more recent studies have focused on non-structural measures of competition, i.e., measures that do not rely on the link between structure and conduct to infer market power. In general, these non-structural measures extract conclusions about competitive pressure by directly observing the conduct of firms in the market.

One such measure that has attracted a lot of attention from researchers is the Lerner index. In this index, market power of a firm is identified by the divergence between the firm's price and its marginal cost. Another example of non-structural measures of competition is the Panzar and Rosse (1987) H-statistic which captures the transmission of input prices on firms' revenues; weak transmission is indicative of the exercise of market power. More recently, Boone (2008) has proposed a new measure based on the idea that efficient firms are more highly rewarded in more competitive markets. In practice, this idea is captured as the elasticity of profits or market share to marginal costs.

A number of studies have used these two measures of competition to investigate a variety of issues such as access to finance, cost of funds or financial stability. For instance, Hainz et al. (2013) use the Lerner index and data from a sample of loans from 70 countries to conclude that more competition reduces the incidence of collateral in loan contracts. Casu and Girardone (2009) use the Lerner index and a sample of European Union countries to conclude that increases in banks' monopoly power does not translate into a decrease in cost efficiency. For Latin America, Tabak et al. (2015) uses the H-statistic to examine the competitive behavior of the Brazilian banking industry; the paper finds that market power of Brazilian banks is negatively related to their risk-taking behavior.

Four papers that appear highly relevant for the current study are Love and Martinez-

Peria (2015), Leon (2015), Ryan et al. (2014) and Alvarez and Jara (2016). The first of these papers uses firm-level data from the Enterprise Surveys and conclude that low competition–as measured by the Lerner index and the Boone indicator–constraints access to finance where the latter is measured by a dummy variable that takes the value of 1 if the firm had some kind of credit line with a financial institution. Leon (2015) conducts a similar exercise but uses instead a measure of financial constraints that includes not only if the firm had a credit line or not, but also information about whether the firm was denied credit or was discouraged from applying for a loan. The results in this latter paper are also suggestive of a negative effect of market power on access to finance. Ryan et al. (2014) also finds that higher bank market power–captured by the Lerner index–tends to increase firm financing constraints in a large sample of SMEs from 20 European countries. Finally, Alvarez and Jara (2016) uses a sample of *listed* firms from six Latin American countries to investigate the relationship between bank competition–measured by the Boone indicator–and financial constraints. The paper presents evidence that higher bank competition results in more stringent financial constraints for firms.

Perhaps the two papers most closely related to ours are Fungacova et al. (2017) and van Leuvensteijn et al. (2013). Fungacova et al. (2017) uses a large dataset of firm-level data from the Euro area to conclude that competition–measured using the Lerner indices and the H-statistic–*increases* the cost of credit, and observe that the positive influence of bank competition is stronger for smaller companies. These results are somewhat in conflict with those from van Leuvensteijn et al. (2013) which uses the Boone indicator to find, also in a sample of European banks, that higher competition *reduces* interest rate spreads for most loan products.

There are a few limitations worth pointing out in these studies. To begin with, the paper by Fungacova et al. (2017) uses either concentration measures, the Lerner Index or the H-statistic. These measures may have important flaws specially when compared with the Boone indicator which is not used. Moreover, the paper can only approximate the cost of credit at the firm-level using accounting data. The papers by Love and Martinez-Peria (2015), Leon (2015) and Alvarez and Jara (2016) make use of the Boone indicator but rather than looking at interest rate spreads are forced to use a dichotomous measure of financial constraints due to data limitations. Alvarez and Jara (2016) has the additional disadvantage that only listed firms were used in the study. Ryan et al. (2014) does construct a continuous variable of financial constraints but uses only the Lerner index. Finally, while van Leuvensteijn et al. (2013) uses the market-share version of the Boone indicator and studies the impact on interest rates, the dependent variable in the main regressions comes

from the banks themselves. That is, they use segment-wide (mortgage, short-term, deposit accounts) averages of interest rates rather than the actual rates faced by individual firms. All of these studies also have to deal imperfectly with unobserved heterogeneity as they all use country-level competition measures (i.e., cannot use country level fixed effects).

3 The Banking Industry in Colombia 2004-2014[1]

The 2004-2014 period in Colombian banking was characterized by a number of legal and regulatory innovations that brought about important changes in the industry. First, as a (belated) response to the 1999 financial crisis that caused the largest macroeconomic recession in the country, a new law was introduced in 2004 ("Ley 795 de 2003") which advanced the consolidation of the regulation and supervision of the financial industry. The follow-up regulation of this law came with a decree put forth in 2005 ("decreto 4323 de 2005") in which banking and capital markets supervision–previously carried out by Superbancaria and Supervalores, respectively–was centralized into a single institution, Superfinanciera. Additional secondary regulation introduced in 2009 ("circulares externas 14 y 28 de 2009") required banks to adopt internal control systems aimed at effectively controlling risks, while in 2012 a new decree increased both liquidity and capital requirements for banks.

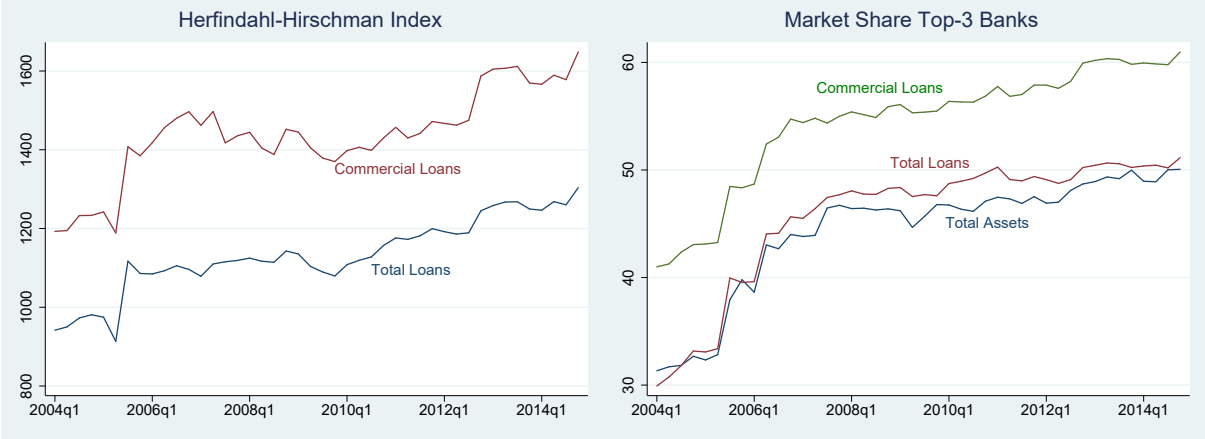
These regulatory changes helped the Colombian financial system cope with the 2007-2009 global financial crisis relatively well. Non performing loans (NPLs) reached a maximum of 4% during this period, which was significantly below the 10% experienced during the 1999 crisis. Moreover, the profitability indicators of the banking system (return over assets, ROA, and return over equity, ROE) remained relatively stable during 2007-2009.

Two main features characterize the evolution of the banking sector in Colombia during 2004-20014. First, banks that had been bailed out during the 1999 crisis and ended up in government hands were privatized. By 2008, there was only one state-owned commercial bank remaining (Banco Agrario). Instead, the government has focused its participation in the financial industry through second-tier (development) banks which service some specific sectors of the economy (e.g., Finagro which is mostly agriculture-oriented, Bancoldex which has a substantial SME component, FDN which specializes in infrastructure finance). Secondly, during 2005-2007, Colombia moved from a specialization model (where, e.g., banks were chartered with a specific purpose such as housing finance), toward a "multibank" or "universal banking" model; one in which banks are able to offer bank a wide array of

[1] A comprehensive review of the Colombian financial system history can be found in Ocampo (2015).

financial services under the same roof.[2] Although special purpose banks were in principle allowed to operate, these were mostly absorbed by larger multi-purpose banks. This brought about a marked increase in concentration within the banking industry, which is captured vividly by the evolution if the market share of the 3 largest banks, as well as by the Herfindahl-Hirschman index depicted in Figure 1. A subsequent trend toward more concentration has prevailed since, with the three largest individual banks (bank holding companies) currently controlling around 60% (70%) of the commercial loan market.

Figure 1: Bank Concentration in Colombia



A complete list of mergers and acquisitions that took place in the Colombian banking sector during this period is presented in Table 10 of Apendix 7.1, along with a list of new bank entries. Most of these new entrants are special-purpose banks such as Banco Falabella, which offers consumer credit for Flabella's retail business, and Bancoomeva which is also focused on small-scale financial services (mostly consumer credit) and has limited or null participation in the productive (commercial) credit market.

4 Measuring Bank Competition in Colombia

As discussed in section 2, the new empirical industrial organization literature has developed and used measures of competition that are directly related to market conduct. Accordingly, in this section we estimate two measures of bank-level price-cost margins–Lerner

[2]This reform push was partly inspired by a kind of consensus within academic and policymaker circles that the banking industry in Colombia could become much more efficient and profit from economies of scale (Clavijo (2000); Ferrufino (1991)) .

indices–and two measures of marginal cost elasticities–Boone indicators. The first measure and the one most widely used in our subsequent firm-level analysis (section 5) is the original Lerner index developed by Lerner (1934), which captures the ability of an individual bank to charge a price above marginal cost, assuming both profit and cost efficiency:

$$L_{bt} = \frac{P_{bt} - MC_{bt}}{P_{bt}} \tag{1}$$

where P_{bt} and MC_{bt} 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. Obtaining a measure of marginal cost requires estimating a total operating cost (TOC) function which we do below.

Our second measure of market power is the simple adjustment to the Lerner index suggested by Koetter et al. (2012). The idea is none other than to control for possible profit or cost inefficiency such that the adjusted Lerner index is found as:

$$AdjL_{bt} = \frac{\pi_{bt} + TOC_{bt} - MC_{bt}Q_{bt}}{\pi_{bt} + TOC_{bt}} \tag{2}$$

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.

Our third and fourth measures are Boone indicators that capture the elasticity of profits and market shares to changes in marginal costs. Boone (2008) shows that there is a continuous and monotonically increasing relationship between relative profit differences and the level of competition. This implies that when competition is more intense, efficient banks gain more in profits or market shares with respect of the inefficient ones. To capture this profit and market share elasticity to changes in marginal costs, we estimate the following regressions:

$$\ln \pi_{bt} = \alpha + \beta^{\pi}_{bt} \ln MC_{bt} + \vartheta_{bt} \tag{3}$$

$$\ln MS_{bt} = \alpha + \beta^{MS}_{bt} \ln MC_{bt} + \vartheta_{bt} \tag{4}$$

where estimates of β^{MS}_{bt} and β^{π}_{bt} capture bank-specific, time-varying profit and market share elasticities with respect to marginal costs. Notice that marginal cost elasticities are

expected to be negative, so larger β_{bt}^{MS} and β_{bt}^{π} (i..e., smaller $\mid \beta_{bt}^{MS} \mid$, $\mid \beta_{bt}^{\pi} \mid$) are suggestive of higher market power.

The computation of all four measures requires estimates of bank-specific marginal costs, MC_{bt}. In order to obtain these, we estimate a multi-product 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:

$$\ln C_{bt} = \alpha_b + \sum_{p=1}^{2} \theta_p (\ln y_{pbt})^2 + \sum_{p=1}^{2} \gamma_p \ln y_{pbt} + \sum_{i=1}^{3} \zeta_i (\ln w_{ibt})^2 + \sum_{i=1}^{3} \chi_i \ln w_{ibt} + \kappa_{12} \ln y_{1bt} \ln y_{2bt} + \sum_{i<k} \sum \eta_{ik} \ln w_{ibt} \ln w_{kbt} + \sum_{i=1}^{3} \sum_{p=1}^{2} \lambda_{pj} \ln w_{ibt} \ln y_{pbt} + \sum_{t=1}^{T-1} \nu_t d_t + \delta \ln z_{bt} + \varepsilon_{bt} \quad (5)$$

where α_b is a bank fixed effect, y_{1bt} and y_{2bt} are, respectively, loans and securities; w_{1bt} is the labor unit cost or wage (personnel expenses/total assets), w_{2bt} represents the cost of funding for the bank (interest expenses/deposits), w_{3bt} is computed as other expenses/fixed assets, and the time dummy $d_t \in \{0, 1\}$ is intended to capture aggregate shocks. Finally, we follow Mester (1996) and also include bank equity (as a share of total assets), z_{bt}, 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 by taking the partial derivative of (5) with respect to loans:

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

We estimate equation (5) using a quarterly dataset of 15 banks over the period 2004q1-2014q4. These 15 banks represented over 98.8% of total commercial loans in 2014. A complete description of the variable definitions and data sources, as well as the results from the estimation of equation (5) are presented in Appendix 7.2.2.

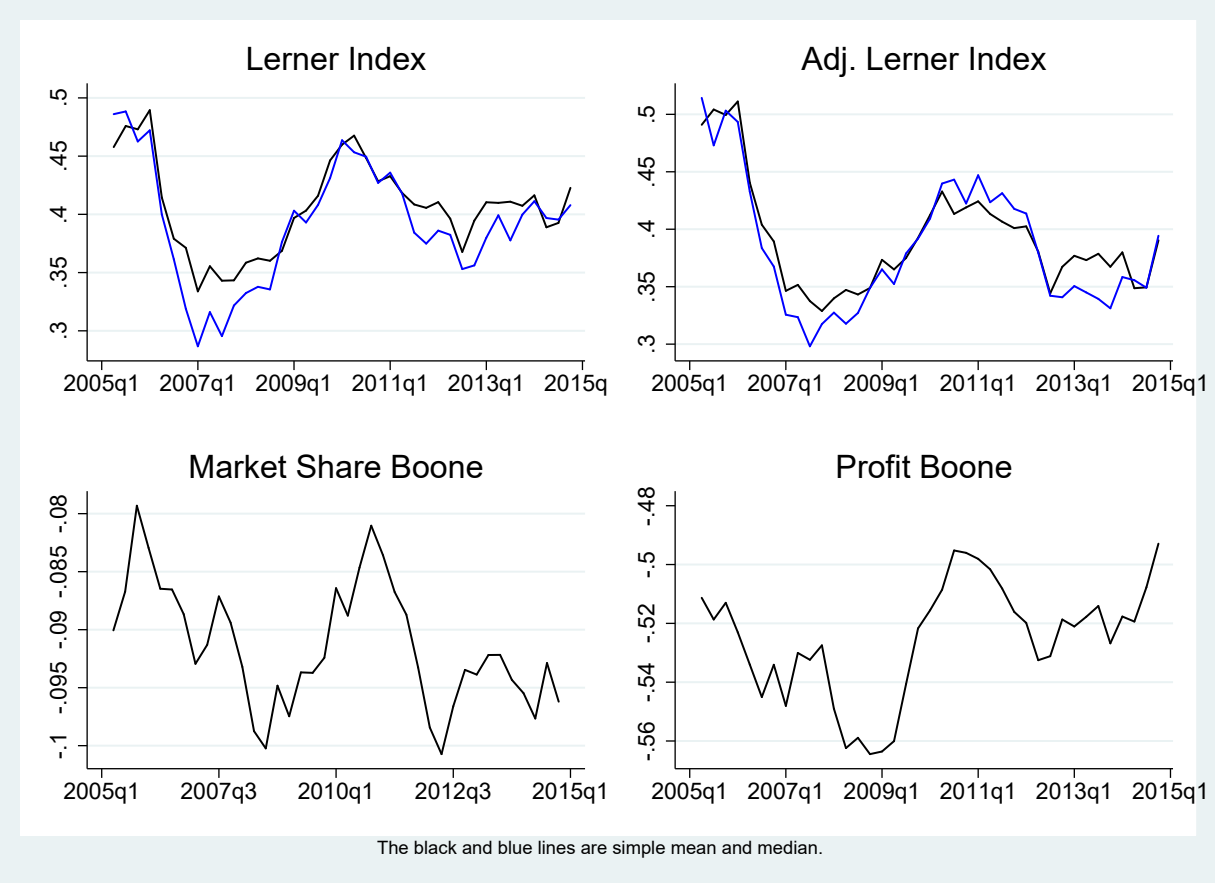
Table 7 presents some descriptive statistics about our sample of banks. It is worth noting that for the average and median bank in Colombia, commercial (business) loans represent around 53%-54% of their loan portfolios, over 10 percentage points more than what they represent for U.S. banks (44% in 2016). 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 banks in Colombia rely more heavily in equity as their equity to asset ratio stands at 14.3%, compared with 11% in recent years in the U.S. (used to be well below 10% in the U.S.).

Equipped with estimates of marginal costs, we are in a position to compute Lerner indices, and estimating equations (3) and (4). Estimating the latter two models is not straightforward, however, since we need to estimate models with coefficients that vary over time and across banks (panels). We do so by estimating the fixed-effect ANOVA model of Hsiao (2003), in which $\beta^{\pi}_{bt} = \beta^{\pi} + \beta^{\pi}_{b} + \beta^{\pi}_{t}$ and $\beta^{MS}_{bt} = \beta^{MS} + \beta^{MS}_{b} + \beta^{MS}_{t}$. This method requires that we use a balanced panel which means that our sample reduces to 11 banks.[3]

Figure 2 below depicts the estimated Lerner indices and Boone indicators. The plots include the unweighted averages (black line), as well as the median (blue) for the Lerners.[4]

Figure 2: Lerner and Boone Measures



[3]As with equation (5), we estimate the profit and market share elasticities using time fixed-effects.

[4]Given the fixed coefficient nature of the Hsiao (2003) model, the mean and the median of the Boone indicators only differ in their intercepts.

All measures of bank market power suggest the same broad temporal patterns.[5] Market power increased substantially as the system moved from specialization to universal banking during 2005-2007. Notice that this happened at the same time that concentration was intensifying (see Figure 1). Bank market power then decreased sharply in the wake of the international financial crisis of 2008-2010, which is consistent with the data provided by Clerides et al. (2015) showing that bank market power increased worldwide during this period, and with available evidence from other countries and industries that price markups (i.e., the Lerner index) are mostly countercyclical (Wilson and Reynolds (2005)). During 2011-2012 bank market power fell again, but has been increasing moderately since.

Table 1: Bank Market Power and Concentration Correlation Matrix

	Lerner	Adj. Lerner	MS Boone	Profit Boone	Top-3 loans	HHI loans
Lerner	1.00					
Adj. Lerner	0.82**	1.00				
MS Boone	0.35**	0.67**	1.00			
Profit Boone	0.58**	0.44**	0.34**	1.00		
Top-3 loans	-0.25	-0.68**	0.02	-0.77*	1.00	
HHI loans	-0.14	-0.52**	0.20	-0.66	0.87**	1.00

Note: ** denotes statistical significance at the 5% level.

Table 1 presents piece-wise correlations between (unweighted) average market power and concentration measures. Overall, correlations among our four market power are fairly high and comparable to those found in Clerides et al. (2015).[6] Interestingly, the correlations between the market power and the concentration measures are either negative or very low and not statistically significant at the 5% confidence level. 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 (Fernández et al. (2005)).

5 Bank Competition and the Cost of Credit

We now turn to the second and more important contribution of this paper: the estimation of the effect of market power on the cost of credit to non-financial firms. To do so, we

[5] Detailed behavior of the Lerner indices for banks in our sample is provided in Figure 5

[6] Clerides et al. (2015) report correlations between market share weighted averages. They report a correlation between the Lerner and Adjusted Lerner indices of 0.86, between Lerner and Profit Bone of 0.33 and between Adjusted Lerner and Profit Boone of 0.31 (they do not compute Market Share Boone indicators).

assemble a unique dataset that links loan, firm and bank-level data from separate sources. Our results suggest that once bank characteristics and unobserved firm-heterogeneity are properly accounted for, higher market power results in larger interest rates in loans extended by banks to non-financial firms.

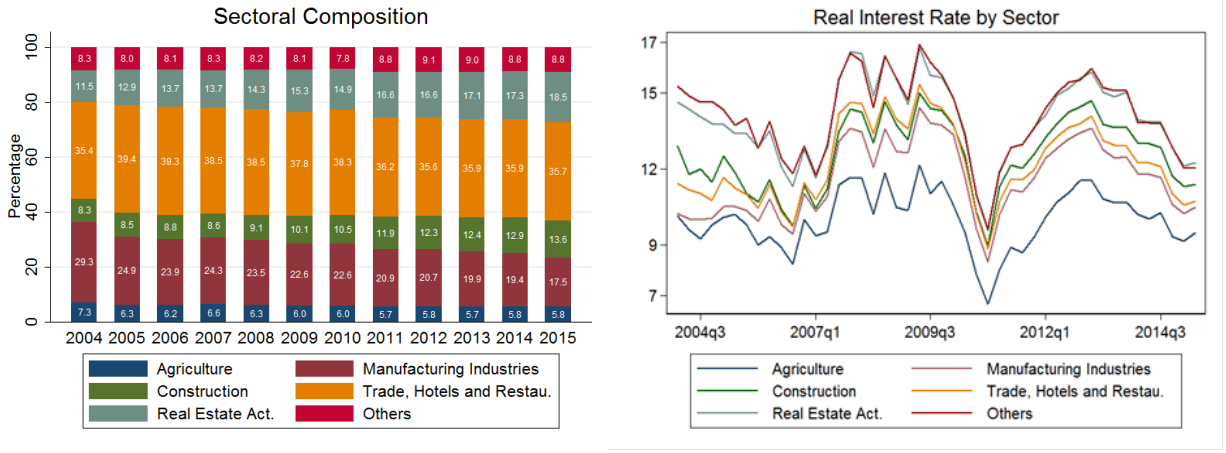
5.1 Loan and Firm Level Data

Our most comprehensive data source in the "Formato 341" (341 form) from Colombia's financial supervisor (Superintendencia Financiera) which contains loan-level data on the universe of loans granted by banks. From this source we obtain over one million loans for the 2004-2014 period, taken out by 272,801 firms. Our second data source is a government body (Superintendencia de Sociedades) that collects accounting firm-level data from 41,249 firms in Colombia. Overall, we obtain a match for 32,595 firms that appear in both datasets. Tables 7 and 8 present some descriptive statistics from the loans and firms that are included in our final sample.

From our consolidated firm-loan dataset, we observe that loans are typically short term –one quarter– even though the median length of a firm-bank relationship is about nine quarters. Also, on average firms need to collateralize about 20% of their loans, although over a half of the loans do not require collateral at all. From Table 9 it is clear that firms in our sample range from the very small (less than USD1,000 in assets) to the very large (over USD1 million in assets). Over one third of the firms in our sample are from trade, hotels and restaurants, while the fraction of manufacturing firms had been decreasing systematically to represent 19.4% in 2014. Instead, firms in the construction and real estate sectors have recently gained importance in our sample (combined they represented 30% in 2014).

Conditional on having a loan (obviously our dataset only contains firms with at least one loan), the typical firm in our dataset has two credit relationships. As Table 8 shows, the number of credit relationships increases with size, as expected, even though the differences in leverage by size are less pronounced. The left panel of Figure 3 below shows that our sample of firms is relatively well balanced across sectors of the economy, with the fraction of manufacturing firms declining over time and real estate and construction firms gaining share in recent times. The right panel of Figure 3 shows how real interest rates evolved over the period we study for loans in the main industry categories.

Figure 3: Sectoral Composition of Firms



5.2 Bank Competition and the Cost of Credit: A first pass at the data

We now turn to the estimation of the effect of bank market power on the firm's cost of credit. Our dependent variables is the real interest rate charged on each loan. In this sense, our empirical exercises is closest to that found in Fungacova et al. (2017). However, since we know the identity of the bank which granted each loan, we are able to complement our firm and loan level dataset with our previously constructed bank-level (instead of country-level) market power measures as well as with bank-specific characteristics. With this bank-firm-loan dataset at hand, we are in a position to study the impact that market power may have on the cost of accessing credit for non-financial firms. In particular, we estimate the following model:

$$ir_l = \mu + \Psi\Omega_l + X_l\boldsymbol{\omega} + Z_l\boldsymbol{\rho} + W_l\boldsymbol{\Theta} + v_l \tag{6}$$

where $\Omega_l \in \{L_{bt}, AdjL_{bt}, \beta^{\pi}_{bt}, \beta^{MS}_{bt}\}$ and t is the period in which loan l was given b is the bank which granted such loan; X_l is a vector of characteristics of loan l such as duration and collateralization; Z_l is a vector of characteristics of the firm that was granted loan l; W_l is a vector of characteristics of the bank which granted loan l; and $\boldsymbol{\omega}, \boldsymbol{\rho}$, and $\boldsymbol{\Theta}$ are vectors of parameters. Or main interest is in the parameter estimate associated with bank market power,Ψ, as well as some interactions that are introduced afterwards.

Equation (6) is estimated for the full cross-section of loans, under different sets of

time, firm and bank fixed effects (and the combinations therein), and with standard errors clustered at the firm-bank level to capture the potential credit relationship dependent structure of errors.

Table 2 presents the estimation results for the case in which $\Omega_l = L_{bt}$; that is, when the variable capturing market power is the Lerner index. A major methodological improvement in this paper is precisely the fact that we can use firm-time fixed effects (fifth column in Table 2), thereby isolating demand-side shocks. While this is our preferred/baseline specification, in what follows we also present the results excluding these firm-time fixed effects (columns 2-4) in order to illustrate the progress made by the use of loan-level instead of firm-level data.

Table 2: Bank Market Power and Firm Finance: A First Pass at the Data

	(1)	(2)	(3)	(4)
VARIABLES	Real_Interest_Rate	Real_Interest_Rate	Real_Interest_Rate	Real_Interest_Rate
Indice de Lerner	0.867***	0.638***	-0.006	0.818***
	(0.214)	(0.202)	(0.233)	(0.273)
Ln Loan Amount	-1.348***	-1.076***	-1.035***	-1.019***
	(0.008)	(0.008)	(0.010)	(0.013)
Loan's Maturity	0.082***	0.057***	0.042***	0.052***
	(0.004)	(0.004)	(0.004)	(0.006)
fixed	0.334***	0.358***	0.338***	0.292***
	(0.023)	(0.022)	(0.022)	(0.031)
Collateral	-2.466***	-3.313***	-3.547***	-3.663***
	(0.027)	(0.029)	(0.032)	(0.042)
Bank's Ln(Assets)	0.495***	0.793***	1.764***	2.378***
	(0.118)	(0.112)	(0.145)	(0.173)
Bank's Roa	-0.100***	-0.019	0.076***	0.145***
	(0.026)	(0.024)	(0.027)	(0.031)
Bank's Leverage	-0.164***	-0.159***	-0.167***	-0.185***
	(0.011)	(0.010)	(0.011)	(0.015)
>70 % Commercial Loans	-0.261***	-0.303***	-0.273***	-0.173*
	(0.071)	(0.068)	(0.073)	(0.099)
Observations	821,382	818,793	802,232	580,081
R-squared	0.364	0.473	0.590	0.726
Firm Fixed Effects	✗	✓	✓	✓
Time Fixed Effects	✓	✓	✓	✓
Bank Fixed Effects	✓	✓	✓	✓
Industry Fixed Effects	✓	✓	✓	✓
Firm-Time Fixed Effects	✗	✗	✗	✓
Firm-Bank Fixed Effects	✗	✗	✓	✓

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

These initial results show that, on average, bank market power appears to increase the cost of firm finance. The resulting estimated coefficient is small, though: In our preferred

specification, a one standard deviation increase in the Lerner index increases the cost of a given loan by 2 percentage points.

All other estimated coefficients appear to be statistically significant and of the expected sign, although some of them seem much more important than others. For instance, interest rates are lower for fixed-rate loans, but the difference is rather small (floating-rate loans are only 0.3 percentage points more expensive on average). On the other hand, posting collateral does reduce substantially the interest rate paid on a loan: the effect is close to 3.7 percentage points. As expected, loans for larger firms are cheaper while longer term loans are more expensive. Interestingly, the size and profitability of the bank making the loan increase the interest rate, even after conditioning on the bank's market power.

It is worth noticing that the results of Table 2 do not change much (except for the coefficient on bank size) with the inclusion of additional fixed effects. In what follows this will not be the case as we carry out a more detailed analysis of the relationship between bank market power and loan pricing.

5.3 Asymmetric Information and Heterogeneous Effects

The results presented in Table 2 are not be very useful in uncovering the channels by which bank market power may affect the cost of firm finance. So we now look at variables that have been used int he literature to capture the severity of asymmetric information problems as a driving force behind the impact of market power on interest rates. First we explore the interaction between bank market power and firm-size (log of assets), which has been used in several banking studies (e.g., Fungacova et al. (2017)) as a proxy for opacity. We then use what we see as a better measure of asymmetric information: our very novel data on the duration of a bank-firm relationship and its interaction with market power.

Table 3 presents the estimation results when the interaction between the Lerner index and firm size is included as an additional variable for the case of $\Omega_l = L_{bt}$. Since the coefficient of the Lerner index in our preferred specification (column 5) is now negative and the interaction is positive, the overall effect of bank market power on interest rates depends crucially on firm size. In fact, Figure 4 (left panel) shows that lower market power decreases the cost of finance for large firms, but increases it for smaller firms. This result precisely coincides with the findings of Fungacova et al. (2017). Notice the importance of conditioning on the various kinds of fixed effects: the regressions with or without firm, firm-time and firm-bank fixed effects (columns 2 and 5) show completely opposite results with respect to the Lerner index and its interaction with size.

Table 3: Bank Market Power and Firm Finance: The Role of Firm Size

VARIABLES	(1) Real_Interest_Rate	(2) Real_Interest_Rate	(3) Real_Interest_Rate	(4) Real_Interest_Rate
Indice de Lerner	10.825***	-0.504	-1.069**	-3.052***
	(0.334)	(0.401)	(0.457)	(0.766)
Ln(Assets) & Lerner	-1.129***	0.120***	0.118**	0.409***
	(0.031)	(0.041)	(0.048)	(0.081)
Ln Loan Amount	-1.237***	-1.079***	-1.036***	-1.019***
	(0.008)	(0.008)	(0.010)	(0.013)
Loan's Maturity	0.076***	0.059***	0.042***	0.052***
	(0.004)	(0.004)	(0.004)	(0.006)
fixed	0.365***	0.349***	0.339***	0.293***
	(0.023)	(0.022)	(0.022)	(0.031)
Collateral	-2.676***	-3.307***	-3.546***	-3.661***
	(0.028)	(0.029)	(0.032)	(0.042)
Bank's Ln(Assets)	0.590***	0.761***	1.760***	2.369***
	(0.120)	(0.113)	(0.145)	(0.173)
Bank's Roa	-0.108***	0.011	0.076***	0.150***
	(0.026)	(0.024)	(0.027)	(0.031)
Bank's Leverage	-0.132***	-0.154***	-0.170***	-0.195***
	(0.011)	(0.011)	(0.011)	(0.015)
>70 % Commercial Loans	-0.482***	-0.230***	-0.250***	-0.098
	(0.072)	(0.068)	(0.073)	(0.098)
Length of Relationship	0.005***	0.038***	-224,159.608	-13.574
	(0.002)	(0.002)	(1.114e+08)	(227,342.081)
Observations	821,378	818,790	802,229	580,079
R-squared	0.369	0.474	0.590	0.726
Firm Fixed Effects	✗	✓	✓	✓
Time Fixed Effects	✓	✓	✓	✓
Bank Fixed Effects	✓	✓	✓	✓
Industry Fixed Effects	✓	✓	✓	✓
Firm-Time Fixed Effects	✗	✗	✗	✓
Firm-Bank Fixed Effects	✗	✗	✓	✓

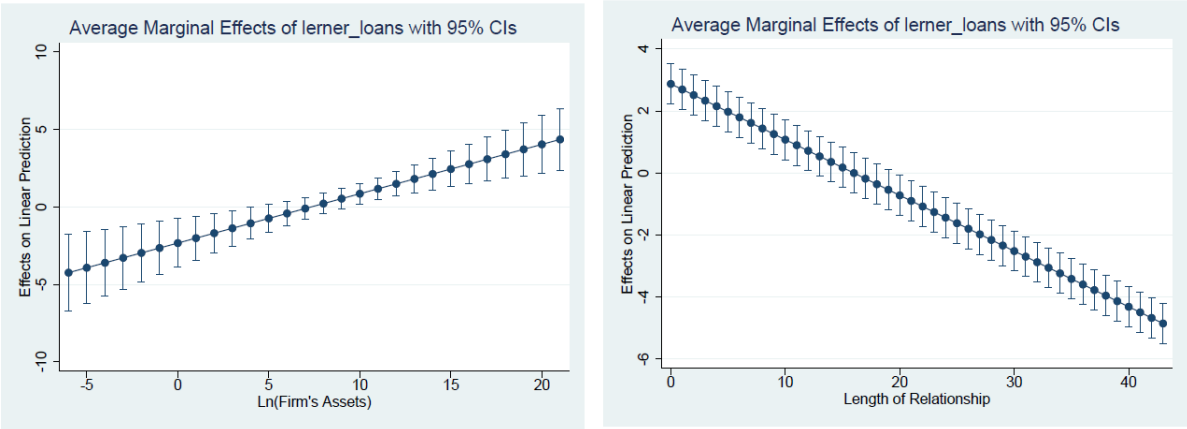
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Next, in Table 4, we present the outcome of repeating the estimations using what we regard as a more refined measure of asymmetric information: the length of a bank-firm credit relationship.[7] This variable is constructed recursively from our loan-level database and is not available from the kind of firm- and bank-level datasets used by Fungacova et al. (2017), Alvarez and Jara (2016) and van Leuvensteijn et al. (2013). The results from our preferred specification (the one most saturated with fixed effects) suggest that now the overall effect of bank market power on interest rates depends crucially on the length of the bank-firm credit relationship. In fact, higher bank market power actually increases

[7]Notice that the variable "length of relationship" in *levels* is a very slow moving firm-bank specific variable. Hence, when it is combined with firm-bank fixed effects almost perfect colinearity results and the standard errors associated with its coefficient "explode" (i.e., the coefficient becomes statistically not significant).

(decreases) the cost of financing for firms with shorter (longer) credit relationships, and the effects are not trivial: For those firms with the shortest relationships (closer to one month) higher market power can increase interest rates by as much as 2.5 percentage points.

Figure 4: Heterogeneous Effects of Bank Market Power



Note: The figures plot marginal effects obtained using the coefficients from column 5 in tables 3 and 4.

Finally we put together size and the length of the relationship in the same specification. The results are shown in Table 5. Interestingly, in our preferred specification (column 5), the Lerner index does not appear to have an effects on its own anymore: All the impact is mediated by either firm size or the length of the bank-firm relationship. Our results now present a richer account of how bank market power impacts the cost of firm financing. First, conditional on size, firms with shorter credit relationships are charged higher rates by banks with more market power. This is consistent with banks having to invest in information acquisition when starting new relationships, and being able to cover such investments by exerting market power through higher interest rates.

Table 4: Bank Market Power and Firm Finance: The Role of Credit Relationships

VARIABLES	(1) Real_Interest_Rate	(2) Real_Interest_Rate	(3) Real_Interest_Rate	(4) Real_Interest_Rate
Indice de Lerner	2.082***	2.155***	2.170***	3.132***
	(0.246)	(0.234)	(0.294)	(0.345)
Ln Loan Amount	-1.347***	-1.078***	-1.034***	-1.018***
	(0.008)	(0.008)	(0.010)	(0.013)
Loan's Maturity	0.081***	0.059***	0.042***	0.051***
	(0.004)	(0.004)	(0.004)	(0.006)
fixed	0.335***	0.346***	0.333***	0.288***
	(0.023)	(0.022)	(0.022)	(0.031)
Collateral	-2.467***	-3.305***	-3.546***	-3.662***
	(0.027)	(0.029)	(0.032)	(0.042)
Bank's Ln(Assets)	0.556***	0.832***	1.780***	2.367***
	(0.118)	(0.113)	(0.144)	(0.171)
Bank's Roa	-0.075***	0.048**	0.134***	0.202***
	(0.026)	(0.024)	(0.027)	(0.031)
Bank's Leverage	-0.192***	-0.186***	-0.215***	-0.230***
	(0.011)	(0.011)	(0.012)	(0.015)
>70 % Commercial Loans	-0.259***	-0.242***	-0.269***	-0.173*
	(0.071)	(0.068)	(0.073)	(0.099)
Length of Relationship	0.042***	0.095***	42,209.647	3.719
	(0.005)	(0.005)	(1.086e+08)	(227,794.629)
Length of Relationship & Lerner	-0.120***	-0.150***	-0.177***	-0.185***
	(0.012)	(0.011)	(0.013)	(0.017)
Observations	821,382	818,793	802,232	580,081
R-squared	0.364	0.474	0.590	0.726
Firm Fixed Effects	✗	✓	✓	✓
Time Fixed Effects	✓	✓	✓	✓
Bank Fixed Effects	✓	✓	✓	✓
Industry Fixed Effects	✓	✓	✓	✓
Firm-Time Fixed Effects	✗	✗	✗	✓
Firm-Bank Fixed Effects	✗	✗	✓	✓

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

At the other end, conditional on the length of a relationship, lowering market power reduces the rate paid by larger firms but increases it for smaller firms. In other words, after appropriately controlling for asymmetric information (through length of relationship), banks appear to price-compete for loans to larger firms. This suggests that size may be capturing other firms attributes that are important in the pricing of loans, such as scale effects –larger firms tend to take out larger loans– or collateral posting –larger firms implicitly have higher collateral may have a lower loss-given-default term in the bank's profit margin calculation.

Table 5: Bank Market Power and Firm Finance: Size and Length of Relationships

VARIABLES	(1) Real_Interest_Rate	(2) Real_Interest_Rate	(3) Real_Interest_Rate	(4) Real_Interest_Rate
Indice de Lerner	11.930***	1.010**	1.438***	0.046
	(0.359)	(0.421)	(0.497)	(0.806)
Ln(Assets) & Lerner	-1.126***	0.128***	0.080*	0.318***
	(0.031)	(0.041)	(0.048)	(0.081)
Ln Loan Amount	-1.237***	-1.079***	-1.035***	-1.018***
	(0.008)	(0.008)	(0.010)	(0.013)
Loan's Maturity	0.076***	0.059***	0.042***	0.051***
	(0.004)	(0.004)	(0.004)	(0.006)
fixed	0.364***	0.347***	0.333***	0.289***
	(0.023)	(0.022)	(0.022)	(0.031)
Collateral	-2.673***	-3.304***	-3.546***	-3.661***
	(0.028)	(0.029)	(0.032)	(0.042)
Bank's Ln(Assets)	0.644***	0.827***	1.778***	2.361***
	(0.120)	(0.113)	(0.144)	(0.171)
Bank's Roa	-0.082***	0.050**	0.134***	0.205***
	(0.026)	(0.024)	(0.027)	(0.031)
Bank's Leverage	-0.158***	-0.189***	-0.216***	-0.236***
	(0.011)	(0.011)	(0.012)	(0.015)
>70 % Commercial Loans	-0.475***	-0.218***	-0.253***	-0.114
	(0.072)	(0.068)	(0.073)	(0.097)
Length of Relationship	0.048***	0.095***	-194,278.942	-12.980
	(0.005)	(0.005)	(1.112e+08)	(227,771.049)
Length of Relationship & Lerner	-0.112***	-0.151***	-0.176***	-0.180***
	(0.012)	(0.011)	(0.013)	(0.017)
Observations	821,378	818,790	802,229	580,079
R-squared	0.369	0.474	0.590	0.726
Firm Fixed Effects	✗	✓	✓	✓
Time Fixed Effects	✓	✓	✓	✓
Bank Fixed Effects	✓	✓	✓	✓
Industry Fixed Effects	✓	✓	✓	✓
Firm-Time Fixed Effects	✗	✗	✗	✓
Firm-Bank Fixed Effects	✗	✗	✓	✓

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5.4 Other Measures of Bank Market Power

We repeat the exercises presented before with $\Omega_l = L_{bt}$ using as dependent variables the Adjusted Lerner index and the two Boone indicators. The results are shown in Appendix XX. When using the Adjusted Lerner index, the results are very similar overall. Particularly robust is the result that firms with shorter credit histories receive higher interest rates from banks with high market power.

Boone results are pending...

6 Conclusion

TBC

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Tables and Additional Figures

Table 6: Bank-Level Descriptive Statistics

	Mean	**Stand. Dev.**	**25 %**	**50%**	**75%**
Total Cost/Total Assets	10.55	4.21	7.76	9.75	11.88
Loans/Total Assets	60.23	18.02	52.44	62.07	68.97
Securities/Total Assets	22.80	17.88	13.32	19.73	32.28
Interest Expenses/Deposits	12.30	7.99	8.49	10.85	13.84
Other Expenses/Fixed Assets	18.77	25.58	1.80	8.01	23.88
Personnel Expenses/Total Assets	1.84	1.91	0.52	1.24	2.34
Equity/Total Assets	14.46	10.41	9.36	12.00	15.16
ROA (%)	2.29	2.57	1.70	2.61	3.52
Commercial Loans/Net Loans	55.67	25.83	40.33	54.86	76.53
Housing Loans/Net Loans	7.42	12.53	0.00	0.73	10.96
Consumption Loans/Net Loans	34.32	24.53	16.52	30.46	47.42

Table 7: Loan-Level Descriptive Statistics

	Mean	**S.D.**	**50 %**	**Min**	**Max**
Ln Loan Amount	10.92	2.86	11.30	-12.07	19.71
Loan's Maturity (Quarters)	2.18	2.43	1.00	1.00	46.00
Fixed Interest Rate (%)	0.20	0.40	0.00	0.00	1.00
Collateral	0.21	0.41	0.00	0.00	1.00
Previous Delinquency to Bank	0.17	0.38	0.00	0.00	1.00
Number of Delinquencies to Bank	2.11	4.85	0.00	0.00	72.00
Length of the Banking Relationship	12.16	11.00	9.00	0.00	43.00

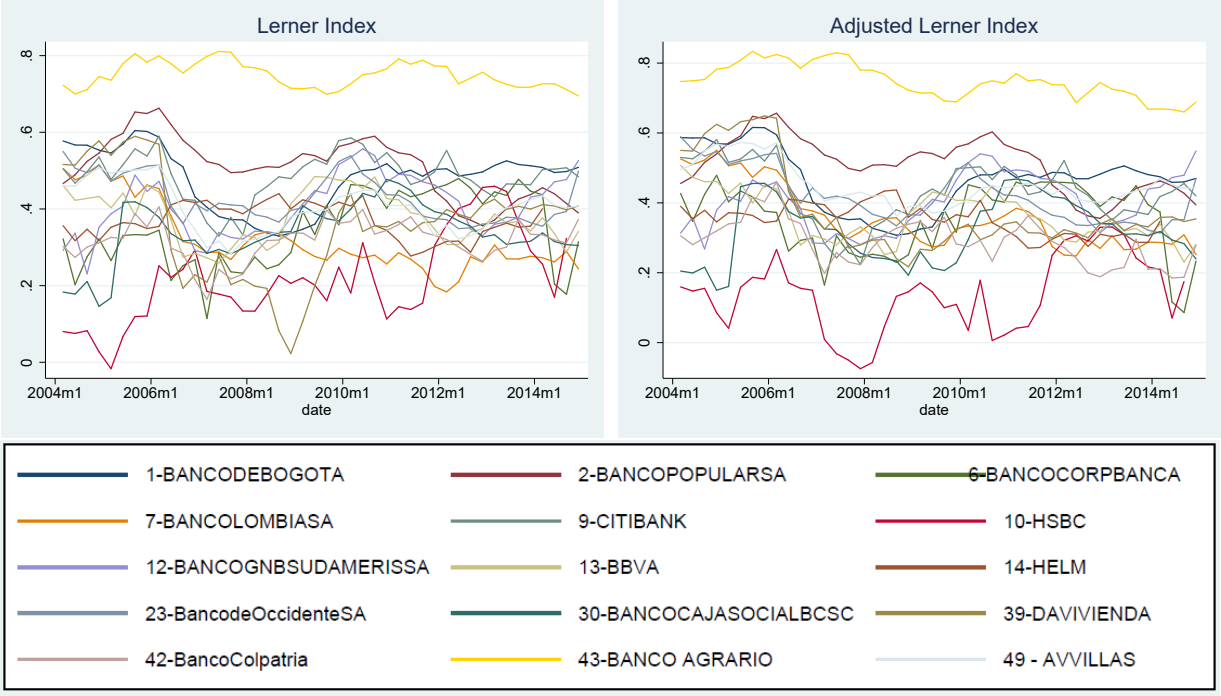
Table 8: Firm-Level Descriptive Statistics

	Mean	Stand. Dev.	Min	50%	Max
ROA (%)	5.73	10.2	-51.13	4.47	44.4
Total Liabilities/Equity	2.05	3.4	-5.67	1.07	35.02
Current Liabilities/Total Liabilities (%)	79.94	27.62	0	97.75	100
Operational Costs/Total Assets	1.44	1.23	0	1.19	8.45
Sales/Assets	1.24	1.14	0	0.97	8.11
Sales Growth (%)	1.47	46.23	-99.94	0.9	332.22
Ln(Firm's Assets)	1.13	2.09	-13.44	0.83	14.98
Amount of Banking Relationships	2.60	1.90	2.00	1.00	16.00
Payment Delay	0.14	0.35	0.00	0.00	1.00

Table 9: Firm-Level Averages by Size

	Small 50 %<	Medium >50% & 75%<	Large >75 %	Full Sample
ROA (%)	6.053	5.869	4.955	5.730
Total Liabilities/Equity	1.90	2.21	2.18	2.05
Current Liabilities/Total Liabilities (%)	83.15	77.54	75.93	79.94
Operational Costs/Total Assets	1.64	1.34	1.15	1.44
Sales/Assets	1.43	1.14	0.97	1.24
Sales Growth (%)	0.166	2.585	2.847	1.471
Number of Banking Relationships	2.077	2.645	2.898	2.600

Figure 5: Lerner Indices - Banks in the Sample



7 Apendix

7.1 Mergers and Acquisitions in the Colombian Banking System

Table 10: M&A in the Colombian Banking Industry 2004-2014

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)	

7.2 Data sources, variable definitions and TOC estimation

7.2.1 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 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 + 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).

7.2.2 TOC estimation results

Table 11: TOC Translog Function Estimates

Dependent variable: ln(*operating cost*)	**Coefficient**	***t*-value**	$P > \|t\|$
ln_loans	-0.177	-0.30	0.772
ln_loans_sq	0.118	2.79	0.015
ln_invest	0.637	1.22	0.242
ln_invest_sq	0.081	3.02	0.009
ln_input_price	1.395	2.06	0.058
ln_input_price_sq	0.061	2.99	0.010
ln_input_price2	0.677	3.97	0.001
ln_input_price_sq	0.0012	0.17	0.864
ln_loans_invest	-0.182	-3.12	0.008
ln_loans_input	-0.060	-3.97	0.001
ln_loans_input2	0.007	0.09	0.931
ln_invest_input	0.014	0.94	0.361
ln_invest_input2	-0.066	-1.25	0.236
ln_input1_input2	-0.019	-0.90	0.384
ln_eqty_ass	-0.112	-1.40	0.182
Bank fixed-effects		YES	
Time fixed-effects		YES	
Bank-level clustered std errors		YES	
R2 (overall)		0.983	
Number of panels (banks)		15	
Observations		654	