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Does Bank Competition Reduce Cost of Credit?

Cross-Country Evidence from Europe

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Abstract

Despite an expansive debate on the effects of bank competition, the impact of bank competition on the cost of credit has been studied only in a few single-country studies. We contribute to the literature by investigating the impact of bank competition on the cost of credit in a cross-country setting. We use a panel of firms from 20 European countries covering the period 2001 – 2011 to investigate this issue and consider a broad set of indicators to measure bank competition: two structural measures (Herfindahl index, and CR5), and two non-structural indicators (Lerner index, and the H-statistic). We find that bank competition increases cost of credit. We observe that this positive influence of bank competition is stronger for smaller companies. These findings accord with the information hypothesis according to which competition enhances cost of credit, because lower competition provides incentives for banks to invest in soft information. This positive impact of bank competition is however influenced by the institutional and economic framework, as well as by the crisis.

JEL Codes: G21, L11.
Keywords: bank competition, bank concentration, cost of credit.

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1. Introduction

There is an extensive debate on the effects of bank competition. While virtues of competition are obvious in most industries, greater competition in the banking industry has less certain benefits because of peculiar features of this industry. This is connected to the potentially detrimental influence of bank competition on financial stability, but also to the impact of information asymmetries which influence the relation between competition and access to credit (Berger, Klapper and Turk-Ariss, 2009; Beck, De Jonghe and Schepens, 2013; Ryan, O'Toole and McCann, 2014).

Theoretical literature provides conflicting predictions concerning the impact of competition on access to credit. The "market power hypothesis" suggests that greater bank competition contributes to relaxing financing constraints and to lower loan rates. This intuitive hypothesis is therefore in line with the general economic theory, which suggests that greater competition is associated with lower prices. However this hypothesis is challenged by the "information hypothesis" according to which greater bank competition strengthens financing obstacles and generates higher loan rates (Petersen and Rajan, 1995; Dell'Ariccia and Marquez, 2006). This hypothesis is based on the assumption that lower competition stimulates incentives for banks to invest in soft information. As a consequence, a higher level of bank competition lowers investment in banking relationships and leads to deteriorated access to credit.

A large body of empirical literature investigates how bank competition influences access to credit. The studies differ as they rely on different indicators for access to credit, the measures of competition, and the geographic scope. In a cross-country study Beck, Demirgüc-Kunt and Maksimovic (2004) investigate the impact of bank concentration on access to finance measured by survey data on the financing obstacles perceived by firms. They find a positive impact of bank concentration on financing obstacles. Love and Peria (2012) perform a similar cross-country investigation with an alternative measure for bank competition, the Lerner index, and find that competition alleviates financing obstacles. Carbo-Valverde, Rodriguez-Fernandez and Udell (2009) analyze the relation between bank competition and credit availability, measured at the firm level by the dependence on trade credit, on a sample of Spanish SMEs. They once again find that greater bank

competition is associated with lower credit constraints. Ryan, O'Toole and McCann (2014) examine the impact of bank competition measured by the Lerner index on credit constraints for a sample of firms from 20 European countries. They identify financial constraints through sensitivity of investment to the availability of internal financing. Their findings also corroborate with the fact that bank competition diminishes credit constraints. Hence, empirical literature tends to support the view that greater bank competition is associated with better access to credit in line with the market power hypothesis.

Nonetheless the investigation of the impact of bank competition on access to credit does not reveal the channels through which it takes place. Bank competition can contribute to better access to credit by relaxing lending conditions like collateral necessity (Hainz, Weill and Godlewski, 2013), but also by reducing cost of credit. We can question whether greater bank competition reduces cost of credit in line with the intuition, or if the market power hypothesis drives a counterintuitive relation between competition and price on the lending markets.

Literature does not pay much attention to the impact of bank competition on the cost of credit, with only a handful of works investigating this question. In their seminal paper, Petersen and Rajan (1995) investigate the impact of bank concentration on loan rates and find evidence supporting the information hypothesis with lower loan rates in more concentrated banking markets. In opposition, Sapienza (2002) in Italy, Kim, Kristiansen and Vale (2005) in Norway and Degryse and Ongena (2005) in Belgium provide single-country evidence concerning the impact of bank concentration on loan rates and all of them support the market power hypothesis with evidence of positive influence of bank concentration on loan rates.

Our aim in this study is to examine the impact of bank competition on the cost of credit. We advance the understanding of the effects of bank competition by contributing to the literature in two respects.

First, we provide the first cross-country analysis on the impact of bank competition on the cost of credit using micro-level data. We use a panel of firms from 20 European countries for which we have firm-level data on the cost of credit. Beck, Demirgüc-Kunt and Levine (2004) show that the institutional and economic framework influences the

impact of bank concentration on access to credit. We thus investigate if the institutional and economic environment of a country also influences the relation between competition and cost of credit. Large cross-country sample provides us with the most suitable setting to check if country characteristics influence the relation.

Second, we consider a broad set of indicators to measure bank competition. The measurement of competition is the subject of a major debate in the empirical literature in banking. Structural measures like the Herfindahl index and concentration indices are largely adopted in different reports (e.g., ECB, 2014) but they do not provide exact measures of competition as they infer the degree of competition from indirect proxies such as market share. In comparison, non-structural measures like the Lerner index or the H-statistic infer banks' conduct directly and have become increasingly popular in empirical works in banking (e.g., Maudos and Fernandez de Guevara, 2007; Turk-Ariss, 2010). Carbo-Valverde, Rodriguez-Fernandez and Udell (2009) show that the results on the link between bank competition and financing constraints can be influenced by the choice of competition measure. An analysis of the effects of bank competition must therefore consider several competition metrics to check if results are consistent across these measures. We use four competition measures in our work: two non-structural indicators (Lerner index, and the H-statistic) and two structural measures (Herfindahl index, and CR5). We can then provide a wide view of the influence of bank competition on the cost of credit.

We face two challenges in our investigation. First, the measurement of the cost of credit at the firm level is difficult due to data constraints. Data on loans can be found but they either exist only for individual countries (Degryse and Ongena, 2005) or are available exclusively for large loans (e.g., Qian and Strahan, 2007). Our question, however, is of particular interest for small companies, given the potential role of bank incentives to invest in soft information. We use accounting data to measure the cost of credit and calculate the ratio of interest expenses to total bank debt. This indicator is in fact a measure of the implicit interest rate charged by banks on the firm.[1]

Second, we cannot measure bank competition at the local level for each firm but we

[1] Carbo-Valverde, Rodriguez-Fernandez and Udell (2009) also use this indicator to measure the loan interest rate for each firm.

have to rely on aggregate measures of competition, as we require information on a battery of competition measures for a large set of European countries. Such information can only be found at the aggregate level, which explains the common use of aggregate measures of bank competition in cross-country studies on the impact of bank competition (e.g., Beck, Demirgüc-Kunt and Levine, 2004; Love and Peria, 2012; Hainz, Weill and Godlewski, 2013, Ryan, O'Toole and McCann, 2014).

This study is divided into five sections. Section 2 presents the data. Section 3 describes the measures of competition and the estimations. Section 4 displays the results. Section 5 provides concluding remarks.

2. Data

We obtain firm-level data from Amadeus, the database maintained by Bureau Van Dijk, which contains comprehensive financial information on public and private companies across Europe. In this study we focus on 20 countries of the European Union[2] for the period from 2001 to 2011. Our sample contains over 9 million firm-year observations. The annual panel is constructed by combining multiple updates of the Amadeus database. Every update contains a snapshot of currently active population of firms and up to the 10 most recent years of firms' financial data. If the firm stops providing financial statements, it gets removed from the database after four years. Therefore, using several snapshots of the database allows us to add back observations for firms that are not present in more recent updates. It eliminates the survivorship bias and extends firms' historical financial data beyond the most recent 10 years.

Most firms in Amadeus report unconsolidated financial statements, while consolidated statements are provided when available. In our dataset, we use unconsolidated financial statements to avoid double counting firms and subsidiaries or operations abroad and exclude firms that only report consolidated statements. We also exclude the financial intermediation sector and insurance industries (NACE codes 64 – 66) since they have a different balance sheet and a specific liability structure.

[2] Austria, Belgium, Bulgaria, the Czech Republic, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Lithuania, Latvia, the Netherlands, Poland, Portugal, Slovenia, Romania, Slovakia, and Spain.

The key firm-level variable is *Cost of Credit* defined as the difference between the ratio of financial expenses divided by bank debt[3] and the country nominal short-term interest rate. This is a measure of the implicit interest rate, which is in line with Carbo-Valverde, Rodriguez-Fernandez and Udell (2009).[4]

Two firm-level control variables are considered in line with the literature: *Size* defined as the log of total assets, *Tangibility* measured by the ratio of tangible fixed assets to total assets.

Country-specific variables come from different datasets. Two competition measures (Lerner index, CR5) come from Global Financial Development Database (GFDD). As the Herfindahl index is missing in this database, we collect this information from ECB's SDW database. Finally, as the H-statistic has many missing values in GFDD, we use the H-statistic estimated using the Bankscope data from Weill (2013).

One additional country-level variable comes from GFDD: *Private Credit* defined as the ratio of private credit by deposit money banks and other financial institutions to GDP. *GDP per capita* and *Inflation* are both extracted from World Development Indicators. *Rule of Law* comes from Worldwide Governance Indicators.

In line with other studies, we require that all key variables have non-missing values. All explanatory variables are truncated at 1% top and bottom. The resulting sample constitutes an unbalanced panel.

Descriptive statistics of all variables are presented in Table 1.

3. Methodology

3.1 Competition measures

Literature on industrial organization provides many indicators to measure competition which can be classified in two categories. The first category is based on the traditional industrial organization and proposes structural indicators based on the structure conduct performance (SCP) model according to which concentration is

[3] In Amadeus database, bank debt is decomposed between short-term bank debt ('loans') and long-term bank debt ('long-term debt'). We define bank debt as the sum of both components.

[4] Carbo-Valverde, Rodriguez-Fernandez and Udell (2009) define loan interest spread as the difference between the ratio of loan expenses to bank loans outstanding and the interbank interest rate.

negatively associated with competitive conduct and favors profitability. It includes the Herfindahl index and concentration ratios like CR5, the market share of the five largest firms.

The second category is based on the new empirical industrial organization. It develops non-structural measures of competition which are expected to solve problems related to the competition measures from the first category. Structural measures are constructed under assumption that competition can be inferred from indirect proxies like market structure or market shares. In opposition, non-structural measures measure conduct directly. These measures include the Lerner index, and the H-statistic based on the Rosse-Panzar model. All these measures are based on the analysis of the effective behavior of firms on the market.

Structural and non-structural measures of competition are widely used in empirical banking studies. Non-structural measures have however become increasingly used in the literature given the limitations of the structural measures.

To provide a broad perspective on the impact of bank competition on the cost of credit, we consider four measures of bank competition. Two of them are structural measures: the Herfindahl index, and the CR5. The Herfindahl index is the sum of the squares of market shares for all firms in the industry. CR5 is the 5-bank concentration ratio defined as the percentage of the market controlled by the top five banks in the market in total assets.

We further take two non-structural measures into account. The Lerner index is defined as the difference between price and marginal cost, divided by price. It measures the ability of a bank to set its price above marginal cost and provides an individual measure of market power. It equals 0 in the case of perfect competition. The H-statistic is measured using the estimation of the Rosse-Panzar model (Rosse and Panzar, 1977). It is the sum of the elasticities of total revenues to input prices. It provides information on the nature of competition at a market. It is equal to 0 in monopoly, between 0 and 1 in monopolistic competition, and 1 in perfect competition. Following former works like Claessens and Laeven (2004), we consider the H-statistic as a continuous measure of competition.

3.2 Econometric specifications

Our main interest is the relationship between competition in the banking sector and the cost of credit for a firm. We start with the estimation of the following base specification:

$$y_{ijt} = \alpha + \beta X_{ijt} + \gamma Z_{jt} + Competition_{jt} + \theta_i + \mu_t + \varepsilon_{ijt} \quad (1)$$

where y_{ijt} is the cost of bank credit for firm i in country j at time t; X is a set of firm-specific determinants (*Size, Tangibility*); Z is a set of country-level variables (*Private Credit, Rule of Law, GDP per capita, Inflation*); *Competition* stands for one of the four competition measures; θ is a firm fixed effect, μ is a time fixed effect and ε is a random error term.

To assess whether the impact of competition differs depending on the firm size we also estimate the above specification separately for micro firms (with either fewer than 10 employees or a turnover or total assets less than 2 million euros), small and medium-size firms (with either less than 250 employees or a turnover less than 50 million euros or balance sheet total less than 43 million euros) and large firms.[5]

All models are estimated with firm fixed effects, while standard errors are clustered by firm. We do not cluster by country. Even if clustering by country could be preferable in some cases (Pepper, 2002), the true standard errors could be consistently estimated when the number of clusters approaches infinity. When the number of clusters is low (less than 50) and the cluster sizes are unbalanced,[6] inference using the cluster-robust estimator may be incorrect (Nichols and Shaffer, 2007; Cameron and Miller, 2015). Both of these criteria therefore preclude us from using clustering by country.

4. Results

This section presents the results of the estimations. We first comment the main estimations and afterwards provide the results by size. We continue with results including

[5] For the detailed classification of firms by size in Europe see http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/sme-definition/index_en.htm

[6] The low number of clusters may range from less than 20 to less than 50 clusters in the balanced case and even more clusters in the unbalanced case (Cameron and Miller, 2015).

interactions before completing the analysis with results for different subperiods and with some robustness tests.

4.1 Main estimations

We perform regressions of cost of credit. Four different regressions are estimated; each of them employing different competition measure. They are reported in Table 2. It has to be noted that higher values of competition measures are associated with lower competition for all competition measures with the exception of the H-statistic.

We observe that the coefficients are significant and negative for the Herfindahl index and CR5. These findings support the view that bank concentration is negatively associated with cost of credit. We observe a similar pattern for the Lerner index, with a significant and negative coefficient. The coefficient for the H-statistic is positive but not significant. The results therefore indicate that bank competition increases cost of credit.

This finding is in line with the information hypothesis according to which competition does not undermine cost of credit.

It is of interest to point out that both structural measures and the Lerner index lead to the same conclusion, showing that the difference in results does not reflect the division between structural and non-structural measures of competition.

In analyzing the other variables, we note that firm size and tangibility of assets are significantly negative, in line with the intuition that larger firms and firms with higher tangibility of assets are more likely to have lower cost of credit. As expected, better law enforcement favors lower cost of credit, while higher inflation has a positive association with cost of credit. Interestingly, greater financial and economic development tend to enhance cost of credit.

4.2 Estimations by size

Our main estimations indicate that bank competition influences the cost of credit in line with the information hypothesis. According to this hypothesis, banks invest more in soft information when competition is lower, with such investment helping banks mitigate information problems in lending. The information hypothesis is therefore expected to concern predominantly small companies, as SMEs are in general more opaque (Berger and Udell, 1995). There is a large strand of literature showing that information asymmetries play a more significant role for SMEs, leading to the fact that investment of banks in relationship lending is of prime importance for their access to credit.

Following this hypothesis we dig deeper into the relation between bank competition and cost of credit by investigating if it differs with the size of firms. We expect to observe greater positive influence of bank competition on cost of credit for smaller companies. We reestimate our regressions by considering separately groups of firms by size: micro companies, SMEs, and large companies. The estimations by size are presented in Tables 3 and 4.

The findings clearly support the information hypothesis. For the Lerner index and the Herfindahl index, we observe that competition has a significantly negative influence on the cost of credit but only for micro companies and SMEs. The coefficient is not significant for large companies.

In the case of the H-statistic, where competition was not significant in the main estimations, the estimated coefficient is now positive and significant for micro companies but not significant for SMEs and large companies. These results reveal that we also obtain support for the information hypothesis with the H-statistic: greater competition is associated with greater cost of credit with this competition metric, but only for smaller companies. This is in line with the hypothesis that bank competition contributes to higher cost of credit for these more opaque borrowers.

We only see no difference for firms with different sizes in the findings for CR5: the coefficient is significantly negative for three size classes of firms.

To conclude, the estimations by size indicate that the positive impact of bank competition on cost of credit is likely to take place primarily for smaller firms. Therefore these results provide additional support in favour of the information hypothesis.

4.3 Interactions with country-level variables

Our main estimations indicate that greater bank competition tends to contribute to higher cost of credit, even if results differ with the competition measure. As shown by Beck, Demirgüc-Kunt and Maksimovic (2004), this influence can be either exacerbated or mitigated by the institutional and economic framework. We therefore consider three factors of this framework: financial development, economic development, and institutional development. All three factors are also taken into account by Beck, Demirgüc-Kunt and Makismovic (2004) in their analysis of the relation between bank concentration and financing obstacles.

The information hypothesis is based on the influence of bank competition on the investment in soft information of banks to gain better information on opaque borrowers. As a consequence, country-specific factors which affect information asymmetries can have impact on the relation between bank competition and cost of credit.

We expect financial development and economic development to mitigate the positive relation between bank competition and cost of credit. Our hypothesis is based on the fact that financial development and economic development can be associated with lower information asymmetries (Godlewski and Weill, 2011). The reason is that better knowledge and learning skills of bank employees in the risk analysis of loans are expected to reduce the information asymmetries before loan approval. We can reasonably assume that these skills are positively related to financial and economic development. Hence, the beneficial impact of low competition to attenuate cost of credit thanks to the information hypothesis would be lower in a country with higher financial and economic development, as such country is expected to face lower information asymmetries.

We further assume that better law enforcement mitigates the positive relation between bank competition and cost of credit. This hypothesis is based on the fact that better institutional environment makes enforcement of contracts easier and increases the

capacity of banks to screen potential borrowers, as observed by Beck, Demirgüc-Kunt and Maksimovic (2004). Better quality of institutions diminishes information asymmetries and as such mitigates the information hypothesis.

Hence we expect to observe a positive and significant interaction term between bank competition and each of the three variables for the institutional and economic framework for the three competition indicators for which greater values are associated with lower competition. Symmetrically, for the fourth one, the H-statistic, we expect a significantly negative interaction term.

As we provide the first cross-country analysis on the relation between bank competition and cost of credit, we are not aware of papers providing results to which we can compare ours. Nonetheless we can mention the findings on related papers on bank competition and access to credit. Beck, Demirgüc-Kunt and Maksimovic (2004) find that financial development does not have a significant influence on the relation between bank concentration and financing obstacles. At the same time, while they show that bank concentration has a significant and positive impact on financing obstacles, they observe that the interaction terms of bank concentration with economic development and institutional development are both significant and negative. Love and Peria (2012) analyze the influence of financial development on the relation between bank competition and access to credit. They observe significant and negative impact of the Lerner index and concentration measures on access to credit, but a positive and significant interaction term between these competition measures and financial development.

To investigate whether the impact of bank competition on cost of credit varies as a function of these factors, we interact each of these country-level variables with bank competition. Tables 5 - 7 report these estimations. Several conclusions emerge.

For financial development, we obtain the expected sign for the interaction term between bank competition and *Private Credit* only with CR5. With this indicator, the interaction term is positive and significant. However with all other four indicators, we clearly support the opposing view. The interaction term is negative and significant when bank competition is measured by the Lerner index, and the Herfindahl index. In addition, we find that the interaction term between the H-statistic and *Private Credit* is

significantly positive. All these results support the view that greater financial development strengthens the beneficial impact of low competition to attenuate cost of credit. Lower competition would contribute to lower cost of credit, and this effect is amplified by greater financial development.

How can we interpret this result? Greater financial development may provide greater incentives for banks to invest in relationship lending notably through economies of scale associated with the investment in soft information. As such the information hypothesis would be strengthened in financially more developed countries.

For the economic development (Table 6), we find evidence to support the expected hypothesis that greater GDP per capita would lower the beneficial impact of low competition on cost of credit. This conclusion is supported by the observation of a positive and significant interaction term between bank competition and *GDP per capita* when competition is measured by the Lerner index or CR5, and of a negative and significant interaction term between the H-statistic and *GDP per capita*. For the rest, the interaction term has the opposite sign when bank competition is measured with the Herfindahl index.

We find mixed results when accounting for the institutional development (Table 7). On the one hand, the results with the Lerner index, and the H-statistic, support the expected view that greater institutional development reduces the beneficial impact of low competition to weaken cost of credit. The interaction term with *Rule of Law* is positive and significant with the Lerner index, and negative and significant with the H-statistic. On the other hand, we obtain the opposing results with both structural measures of competition as the interaction term with *Rule of Law* is negative and significant with the Herfindahl index and CR5.

Based on the results described above, our investigation on how the institutional and economic framework influences the relation between competition and the cost of credit provides mixed conclusions. Financial development tends to foster the negative relation between bank competition and cost of credit, while economic development does the opposite. Institutional development does not seem to have a clear influence on this relation.

4.4 Estimations by period

We extend our analysis by examining if the crisis years that are part of our sample period can have influenced the relation between bank competition and cost of credit. To investigate the influence of the crisis, we redo our estimations by adding a dummy variable equal to one if the year is included in the period 2008 to 2011 and an interaction term between this dummy variable and the competition measure. We note several striking results.

First, the interaction term between the crisis variable and the competition is always significant. It suggests that the crisis period exerts an impact on the relation between bank competition and cost of credit.

Second, the interaction term has in all four specifications an opposite sign as the competition measure. This finding supports the view that crisis period has contributed to weaken the impact of bank competition on cost of credit. Crisis has mainly reduced the positive impact of competition on cost of credit, which was observed for the Lerner index and both structural measures. But we also observe a reduction of the impact of competition which is of the opposite result for the H-statistic.

This conclusion is of importance as it suggests that the impact of bank competition can be different in crisis times. It has major implications for policy prescriptions of our results. Indeed our results suggest that bank competition should not be fostered to lower cost of credit. However, this conclusion does not stand for crisis times.

4.5. Robustness tests

We check the robustness of our results in different ways.

First, we use an alternative measure for cost of credit in our estimations (Table 9). Using available items for a large number of companies in Amadeus database, we redefine cost of credit as interest paid divided by total bank debt. We observe similar results with one exception in the direction of greater support for the information hypothesis. Namely, the coefficients are again significant and negative for the Lerner index, the Herfindahl

index and CR5. But, while it was not significant in the main estimations, the H-statistic has now a significantly positive coefficient, meaning that greater competition enhances cost of credit. Hence these results overall corroborate with our main estimations and tend to provide additional support for the information hypothesis.

Second, we include the squared term for the competition measure in the estimations to consider possible nonlinearity in the relation between bank competition and cost of credit (Table 10). The coefficients for the squared term are significant for all four competition measures. However they do not necessarily support a nonlinear relation.

For the Lerner index, the squared term and the linear term for bank competition are both significant and negative. Hence the inclusion of a squared term does not show a nonlinear relation but rather supports the linear relation observed in the main estimations.

For CR5 and the Herfindahl index, the squared term is significantly positive while the linear term is still significantly negative. These findings suggest a possible nonlinear relation between competition measured with structural indicators and cost of credit. However the value of the coefficient for the squared term for CR5 is far lower than the one of the coefficient of the linear term, indicating that the negative impact of CR5 on cost of credit can only be reversed for values of CR5 which are not possible (given that by construction this competition measure cannot reach value higher than 1). Similarly, given the coefficients for the linear term and the squared term for the Herfindahl index, the negative relation between the Herfindahl index and cost of credit would be reversed for values of the Herfindahl index greater than 0.514, which largely exceeds the maximal value observed in our sample.

For the H-statistic, the inclusion of the squared term is of particular interest. While the linear term alone in the main estimations was not significant, it is now significantly negative and the squared term is significantly positive. It is possible to compute the threshold at which the impact of competition is no longer negative. We find that the threshold is 1.025, which exceeds the maximal value of our sample. It has to be reminded that the H-statistic equal to one means perfect competition and that such finding is very unusual in the literature on banking competition. Therefore we do not find support for a nonlinear relation between bank competition and cost of credit in our sample in the sense that a negative relation is observed for all values of the H-statistic in our sample.

However, the analysis of the H-statistic has contributed to better understanding of the non-significant coefficient observed for this competition measure in the main estimations. The closer to the unity the H-statistic is, the less bank competition contributes to the reduction of cost of credit.

Hence the analysis of the nonlinear relation between bank competition and cost of credit provides limited evidence in favor of such relation as it is only significant for two indicators.

Our main results are therefore confirmed by the robustness tests, leading to findings consistent with the "information hypothesis".

5. Conclusion

In this paper we analyze the impact of bank competition on the cost of credit using a cross-country sample of firms from 20 European countries and covering the period 2001-2011. According to the market power hypothesis, we should observe a negative relation between bank competition and cost of credit, as greater competition reduces market power of banks. On the other hand, the information hypothesis is in favor of a positive link due to the incentives of banks to invest in soft information. Whereas this question has been investigated in a few single-country studies, it has never been studied in a cross-country framework. We fill this gap and furthermore we consider four competition measures commonly used in the literature to take into account the possible differences across these measures.

Our main finding is that bank competition enhances cost of credit in line with the information hypothesis. Our baseline estimations show a positive relation between bank competition and cost of credit with the different competition measures. We find that this positive influence of bank competition is stronger for smaller companies, which also accords with the information hypothesis.

This positive impact of bank competition is however influenced by some additional characteristics. First, it is dependent on the crisis period with a weakened impact during the crisis. Second, the institutional and economic framework influences the relation between competition and cost of credit.

All in all, our findings do not support the intuitive view that bank competition contributes to a reduction of prices in line with general economic theory. Nevertheless, the banking industry is special with the presence of information asymmetries which gives incentives to invest in technologies reducing such asymmetries. As such, greater competition can shape bank behavior through lower incentives resulting in higher loan rates. We corroborate the theoretical and empirical arguments from Petersen and Rajan (1995) who conclude in favor of lower loan rates in more concentrated banking markets.

The lessons we may provide for policymakers are that procompetitive policies in the banking industry might generate detrimental effects. Our findings add to those showing the detrimental influence of bank competition on financial stability, but also on bank efficiency (Maudos and Fernandez de Guevara, 2007; Casu and Girardone, 2010).

These vices linked to greater bank competition can however be put into perspective with those from greater access to credit, as shown by Beck, Demirgüc-Kunt and Maksimovic (2004) and Ryan, O'Toole and McCann (2014). Bank competition can contribute to better access to credit by lowering financing obstacles like collateral use, even if it does not diminish cost of credit. In addition, the influence of cost of credit on access to credit is dependent on the elasticity of credit demand.

The present paper provides a first cross-country investigation of the impact of bank competition on cost of credit. The analysis can be extended in a number of ways to check the generalization of the findings on other countries and the relevance of the interpretations. This opens an avenue for further research.

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Table 1
Descriptive statistics

This table provides descriptive statistics for the main firm-level variables used in the econometric analysis. Definitions of all variables used are presented in the Appendix.

Variable	Obs	Mean	Std. Dev.	Min	Max
Firm size	11,214,493	-0.10	2.20	-4.52	8.46
Profitability	11,152,380	0.03	0.16	-1.02	0.55
Tangibility	10,459,126	0.33	0.29	0.00	0.98
Cost of credit	11,416,047	0.06	0.10	-0.05	0.50
Lerner	10,517,512	0.19	0.10	-1.61	0.43
CR5	10,943,988	81.72	9.29	56.48	100.00
H-statistic	8,858,736	0.55	0.18	-0.16	0.83
Herfindahl	11,013,526	0.08	0.06	0.02	0.40
GDP per capita	11,013,526	29,027	7,121	3,490	51,721
Inflation	11,013,526	2.36	1.35	-4.48	15.40
Rule of law	11,013,526	1.19	0.36	-0.16	1.98
Private credit	10,781,463	120.44	45.30	14.28	237.58

Table 2
Main estimations

Panel estimations with firm fixed effects. Dependent variable is the competition measure at the top of the column. *, **, *** denote an estimate significantly different from 0 at the 10%, 5% or 1% level. Definitions of all variables used are presented in the Appendix.

	Lerner	H-statistic	CR5	Herfindahl
Constant	-0.424***	-0.356***	-0.342***	-0.312***
	(0.005)	(0.006)	(0.005)	(0.004)
Size	-0.002***	-0.002***	-0.002***	-0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
Tangibility	-0.045***	-0.044***	-0.045***	-0.045***
	(0.000)	(0.000)	(0.000)	(0.000)
Private Credit	0.0001***	0.0001***	-8.00e-06*	0.0001***
	(0.000)	(0.000)	(0.000)	(0.000)
Rule of Law	-0.009***	-0.027***	-0.001	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
GDP per capita	0.00002***	0.00001***	0.00002***	0.00001***
	(0.000)	(0.000)	(0.000)	(0.000)
Inflation	0.003***	0.004***	0.003***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)
Competition	-0.015***	0.001	-0.001***	-0.099***
	(0.000)	(0.001)	(0.000)	(0.003)
R^2	0.032	0.034	0.032	0.031
N	9,402,200	8,001,815	9,762,953	9,827,991

Table 3
Estimations by size (1/2)

Panel estimations with firm fixed effects. Dependent variable is the competition measure at the top of the column. *, **, *** denote an estimate significantly different from 0 at the 10%, 5% or 1% level. Definitions of all variables used are presented in the Appendix.

	Lerner			H-statistic		
	Micro	SME	Micro	SME	Micro	SME
Constant	-0.538***	-0.377***	-0.538***	-0.377***	-0.538***	-0.377***
	(0.009)	(0.007)	(0.009)	(0.007)	(0.009)	(0.007)
Size	-0.021***	-0.004***	-0.021***	-0.004***	-0.021***	-0.004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tangibility	-0.045***	-0.047***	-0.045***	-0.047***	-0.045***	-0.047***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Private Credit	0.0002***	4.90e-07	0.0002***	4.90e-07	0.0002***	4.90e-07
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Rule of Law	-0.018***	-0.016***	-0.018***	-0.016***	-0.018***	-0.016***
	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
GDP per capita	0.00002***	0.00002***	0.00002***	0.00002***	0.00002***	0.00002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Inflation	0.005***	0.002***	0.005***	0.002***	0.005***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Competition	-0.018***	-0.014***	-0.018***	-0.014***	-0.018***	-0.014***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
R^2	0.040	0.035	0.040	0.035	0.040	0.035
N	3,919,876	4,929,972	3,919,876	4,929,972	3,919,876	4,929,972

Table 4
Estimations by size (2/2)

Panel estimations with firm fixed effects. Dependent variable is the competition measure at the top of the column. *, **, *** denote an estimate significantly different from 0 at the 10%, 5% or 1% level. Definitions of all variables used are presented in the Appendix.

	CR5			Herfindahl		
	Micro	SME	Large	Micro	SME	Large
Constant	-0.488***	-0.269***	-0.135**	-0.379***	-0.277***	-0.194***
	(0.010)	(0.007)	(0.060)	(0.008)	(0.006)	(0.055)
Size	-0.021***	-0.004***	-0.009***	-0.021***	-0.005***	-0.009***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
Tangibility	-0.045***	-0.046***	-0.060***	-0.045***	-0.046***	-0.061***
	(0.001)	(0.001)	(0.005)	(0.001)	(0.001)	(0.005)
Private Credit	0.0001***	-0.0001***	0.0002***	0.0002***	-6.82e-06	0.0002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Rule of Law	-0.014***	-0.008***	0.028***	-0.011***	-0.012***	0.006
	(0.002)	(0.001)	(0.009)	(0.002)	(0.001)	(0.008)
GDP per capita	0.00002***	0.00002***	9.15e-06***	0.00002***	0.00001***	8.86e-06***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Inflation	0.005***	0.002***	0.0001	0.005***	0.002***	0.0003
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
Competition	-0.0004***	-0.001***	-0.001***	-0.113***	-0.098***	-0.032
	(0.000)	(0.000)	(0.000)	(0.006)	(0.004)	(0.054)
R^2	0.040	0.036	0.015	0.039	0.034	0.013
N	4,059,983	5,147,297	555,673	4,088,128	5,183,189	556,674

Table 5
The Impact of Financial Development

Panel estimations with firm fixed effects. Dependent variable is the competition measure at the top of the column. *, **, *** denote an estimate significantly different from 0 at the 10%, 5% or 1% level. Definitions of all variables used are presented in the Appendix.

	Lerner	H-statistic	CR5	Herfindahl
Constant	-0.429***	-0.301***	-0.207***	-0.336***
	(0.005)	(0.006)	(0.006)	(0.005)
Size	-0.002***	-0.003***	-0.002***	-0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
Tangibility	-0.045***	-0.045***	-0.045***	-0.045***
	(0.000)	(0.000)	(0.000)	(0.000)
Private Credit	0.0001***	-0.0003***	-0.001***	0.0001***
	(0.000)	(0.000)	(0.000)	(0.000)
Rule of Law	-0.011***	-0.024***	0.003***	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
GDP per capita	0.00002***	0.00002***	0.00002***	0.00001***
	(0.000)	(0.000)	(0.000)	(0.000)
Inflation	0.003***	0.004***	0.003***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)
Competition	-0.001	-0.031***	-0.002***	-0.002
	(0.001)	(0.001)	(0.000)	(0.007)
Competition×Private Credit	-0.0002***	0.001***	0.00001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
R^2	0.032	0.036	0.032	0.031
N	9,402,200	8,001,815	9,762,953	9,827,991

Table 6
The Impact of Economic Development

Panel estimations with firm fixed effects. Dependent variable is the competition measure at the top of the column. *, **, *** denote an estimate significantly different from 0 at the 10%, 5% or 1% level. Definitions of all variables used are presented in the Appendix.

	Lerner	H-statistic	CR5	Herfindahl
Constant	-0.367***	-0.392***	-0.268***	-0.341***
	(0.005)	(0.006)	(0.007)	(0.006)
Size	-0.002***	-0.002***	-0.002***	-0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
Tangibility	-0.045***	-0.045***	-0.045***	-0.045***
	(0.000)	(0.000)	(0.000)	(0.000)
Private Credit	0.0001***	0.0001***	0.00002***	0.0001***
	(0.000)	(0.000)	(0.000)	(0.000)
Rule of Law	-0.025***	-0.022***	-0.001	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)
GDP per capita	0.00002***	0.00002***	0.00001***	0.00002***
	(0.000)	(0.000)	(0.000)	(0.000)
Inflation	0.003***	0.003***	0.003***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)
Competition	-0.147***	0.085***	-0.002***	0.051**
	(0.003)	(0.002)	(0.000)	(0.021)
Competition×GDP per capita	3.99e-06***	-2.53e-06***	3.78e-08***	-4.03e-06***
	(0.000)	(0.000)	(0.000)	(0.000)
R^2	0.032	0.035	0.032	0.031
N	9,402,200	8,001,815	9,762,953	9,827,991

Table 7
The Impact of Institutional Development

Panel estimations with firm fixed effects. Dependent variable is the competition measure at the top of the column. *, **, *** denote an estimate significantly different from 0 at the 10%, 5% or 1% level. Definitions of all variables used are presented in the Appendix.

	Lerner	H-statistic	CR5	Herfindahl
Constant	-0.405***	-0.470***	-0.404***	-0.333***
	(0.005)	(0.006)	(0.006)	(0.005)
Size	-0.002***	-0.003***	-0.002***	-0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
Tangibility	-0.045***	-0.045***	-0.045***	-0.045***
	(0.000)	(0.000)	(0.000)	(0.000)
Private Credit	0.0001***	0.0001***	-0.00003***	0.00007***
	(0.000)	(0.000)	(0.000)	(0.000)
Rule of Law	-0.018***	0.046***	0.064***	0.002*
	(0.001)	(0.001)	(0.003)	(0.001)
GDP per capita	0.00002***	0.00002***	0.00002***	0.00001***
	(0.000)	(0.000)	(0.000)	(0.000)
Inflation	0.003***	0.002***	0.003***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)
Competition	-0.056***	0.148***	0.0002***	0.011
	(0.002)	(0.002)	(0.000)	(0.010)
Competition ×Rule of Law	0.023***	-0.111***	-0.001***	-0.077***
	(0.001)	(0.002)	(0.000)	(0.006)
R^2	0.032	0.036	0.032	0.031
N	9,402,200	8,001,815	9,762,953	9,827,991

Table 8
Estimations by period

Panel estimations with firm fixed effects. Dependent variable is the competition measure at the top of the column. *, **, *** denote an estimate significantly different from 0 at the 10%, 5% or 1% level. Definitions of all variables used are presented in the Appendix.

	Lerner	H-statistic	CR5	Herfindahl
Constant	-0.370***	-0.352***	-0.266***	-0.278***
	(0.005)	(0.005)	(0.005)	(0.004)
Size	-0.003***	-0.002***	-0.002***	-0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
Tangibility	-0.045***	-0.044***	-0.045***	-0.045***
	(0.000)	(0.000)	(0.000)	(0.000)
Private Credit	0.0001***	0.0001***	-0.00004***	0.0001***
	(0.000)	(0.000)	(0.000)	(0.000)
Rule of Law	-0.014***	-0.028***	-0.004***	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
GDP per capita	0.00002***	0.00002***	0.00001***	0.0001***
	(0.000)	(0.000)	(0.000)	(0.000)
Inflation	0.003***	0.003***	0.002***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
Competition	-0.019***	0.023***	-0.001***	-0.121***
	(0.000)	(0.001)	(0.000)	(0.003)
Competition×Crisis	0.068***	-0.092***	0.001***	0.062***
	(0.001)	(0.002)	(0.000)	(0.002)
R^2	0.032	0.035	0.032	0.031
N	9,402,200	8,001,815	9,762,953	9,827,991

Table 9
Robustness check: Alternative measure of cost of credit

Panel estimations with firm fixed effects. Dependent variable is the competition measure at the top of the column. *, **, *** denote an estimate significantly different from 0 at the 10%, 5% or 1% level. Definitions of all variables used are presented in the Appendix.

	Lerner	H-statistic	CR5	Herfindahl
Constant	-0.352***	-0.459***	-0.230***	-0.305***
	(0.005)	(0.007)	(0.005)	(0.005)
Size	-0.003***	-0.002***	-0.002***	-0.003***
	(0.000)	(0.000)	(0.000)	(0.000)
Tangibility	-0.029***	-0.029***	-0.029***	-0.029***
	(0.000)	(0.000)	(0.000)	(0.000)
Private Credit	0.0003***	0.0004***	0.0002***	0.0003***
	(0.000)	(0.000)	(0.000)	(0.000)
Rule of Law	-0.030***	-0.038***	-0.016***	-0.025***
	(0.001)	(0.001)	(0.001)	(0.001)
GDP per capita	0.00002***	0.00002***	0.00001***	0.00001***
	(0.000)	(0.000)	(0.000)	(0.000)
Inflation	0.005***	0.005***	0.004***	0.005***
	(0.000)	(0.000)	(0.000)	(0.000)
Competition	-0.013***	0.005***	-0.001***	-0.069***
	(0.000)	(0.001)	(0.000)	(0.005)
R^2	0.047	0.049	0.047	0.045
N	6,975,112	5,942,377	7,328,259	7,392,692

Table 10
Robustness check: Nonlinear relation

Panel estimations with firm fixed effects. Dependent variable is the competition measure at the top of the column. *, **, *** denote an estimate significantly different from 0 at the 10%, 5% or 1% level. Definitions of all variables used are presented in the Appendix.

	Lerner	H-statistic	CR5	Herfindahl
Constant	-0.419***	-0.230***	0.077***	-0.259***
	(0.005)	(0.006)	(0.009)	(0.004)
Size	-0.002***	-0.004***	-0.001***	-0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
Tangibility	-0.045***	-0.044***	-0.045***	-0.045***
	(0.000)	(0.000)	(0.000)	(0.000)
Private Credit	0.0001***	0.0001***	0.00002***	0.0001***
	(0.000)	(0.000)	(0.000)	(0.000)
Rule of Law	-0.011***	-0.038***	0.024***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)
GDP per capita	0.00002***	0.00001***	0.00001***	0.00001***
	(0.000)	(0.000)	(0.000)	(0.000)
Inflation	0.003***	0.004***	0.003***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
Competition	-0.020***	-0.242***	-0.010***	-0.501***
	(0.001)	(0.003)	(0.000)	(0.010)
Competition squared	-0.004***	0.236***	0.0001***	0.973***
	(0.001)	(0.003)	(0.000)	(0.022)
R^2	0.032	0.036	0.033	0.031
N	9,402,200	8,001,815	9,762,953	9,827,991

Appendix

Variable	Definition
Firm size	= log(total assets). Source: Amadeus.
Tangibility	= tangible fixed assets /total assets. Source: Amadeus.
Cost of credit	= (financial expenses divided /total debt) – country nominal short-term interest rate. Source: Amadeus.
Lerner	A measure of market power in the banking market. It compares output pricing and marginal costs (that is, markup). An increase in the Lerner index indicates a deterioration of the competitive conduct of financial intermediaries. Source: Global Financial Development Database, World Bank.
CR5	Assets of five largest banks as a share of total commercial banking assets. Source: Global Financial Development Database, World Bank.
H-statistic	A measure of the degree of competition in the banking market. It measures the elasticity of banks revenues relative to input prices. H-statistics determines the nature of market structure: it is equal to 0 in monopoly, between 0 and 1 in monopolistic competition, and 1 in perfect competition. Source: Global Financial Development Database, World Bank.
Herfindahl	Defined as the sum of the squares of the market shares of all firms within the industry, where the market shares are expressed as fractions. As a general rule, an HHI below 1,000 signals low concentration, while an index above 1,800 signals high concentration. For values between 1,000 and 1,800, an industry is considered to be moderately concentrated. Source: Global Financial Development Database, World Bank.
Rule of law	Rule of law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. Source: Worldwide Governance Indicators, World Bank.
Private credit	Private credit by deposit money banks to GDP. Source: Global Financial Development Database, World Bank.