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Bank Market Power and SME Financing Constraints*

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Abstract. Some studies find that market power is associated with credit availability (*information hypothesis*); others find that less competitive banking markets lead to more credit rationing (*market power hypothesis*). Empirical research has relied solely on concentration as a measure of market power. The industrial organization literature, however, argues that a structural competition indicator such as the Lerner index is a superior measure. We test the information hypothesis and the market power hypothesis using these two alternative measures of market power and find that they generally give conflicting results. However, we also offer evidence suggesting that both views can be reconciled.

JEL Classification: G21, L11

1. Introduction

The potential impact of financial market structure on access to external finance and economic growth has garnered considerable interest recently among researchers as well as policymakers (e.g., Rajan and Zingales, 1998; Boot and Thakor, 2000; Berger et al., 2004). A particularly interesting dimension of financial market structure is the competitiveness of the banking industry. The traditional *market power* view has been that less competitive banking markets are associated with less credit availability and a higher price for credit. However, an alternative view has emerged over the past decade that argues that the impact of competition on credit may be

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related to the level of asymmetric information in the market (Dell'Ariccia and Marquez, 2005). In particular, this *information hypothesis* argues that competitive banking markets can weaken relationship-building by depriving banks of the incentive to invest in soft information. Therefore, less competitive markets may be associated with more credit availability (Petersen and Rajan, 1995).

The issue of bank competition and credit availability may matter most for small and mid-sized enterprises (SMEs) for two reasons. First, SMEs are more vulnerable to information problems. Second, SMEs are much more bank-dependent than large enterprises. Despite the policy relevance of this issue, empirical interest in this topic is relatively recent and existing papers find different and conflicting results. We add to this empirical literature in several ways. Our study is the first to employ a structural competition indicator in a firm-level analysis of market power and firm financing constraints. Previous firm-level studies have relied exclusively on concentration measures to proxy for market power. We are aware of one other study by Claessens and Laeven, (2005) that indirectly examined financing constraints using a different measure of structural competition, the Panzar and Rosse H statistic. This study focuses on the link between banking competition and industrial growth using data on a large cross section of countries. The main finding is that greater foreign bank presence and fewer activity restrictions in the banking sector leads to a more competitive banking system. However, the authors also examine the link between concentration and competitiveness. They find no evidence that concentrated banking systems are less competitive. Instead, in contrast to much of the traditional industrial organization theory, they find evidence to the contrary. Thus, they conclude that contestability is more important than structure in determining competition. As in Claessens and Laeven (2005), our study suggests that changes such as deregulation and technical innovation have made defining financial markets and services more problematic and may have rendered concentration as an indicator of market power less valuable.

The industrial organization literature, however, has argued theoretically and empirically that the Lerner index and other structural competition measures are superior to concentration as measures of market power (see, *inter alia*, Connor and Peterson, 1992; Aghion, 1996; Borenstein and Bushnell, 1999; Dell'Ariccia, 2001). In addition, relatively recent empirical work in banking has found that the HHI as a measure of market power lacks consistency and robustness (Berger, 1995; Rhoades, 1995; Hannan, 1997). This research argues that we should emphasize in our analysis the use of the Lerner index as the more appropriate measure of market power in testing the link between competition and credit availability.

A secondary objective of our paper is to compare the results obtained using the Lerner Index versus using the HHI. A finding that the Lerner index produces different results than the HHI would suggest that past research that has relied exclusively on the HHI, often because of data limitations, may be problematic. We pursue this issue further by investigating why these measures might produce

different results. On the theoretical side we appeal to prior research in the industrial organization literature. On the empirical side we conduct our own investigation based on factors identified in the theoretical literature to see whether conflicting results in our analysis and elsewhere in the literature can be reconciled.

We also contribute to the literature on competition and credit availability by utilizing a particularly rich data set on Spanish SMEs, which contains extensive information about both borrowing firms and the banks from which they obtain financing. Spain is a particularly good laboratory to investigate this issue; it has a banking-oriented financial system with a large fraction of bank-dependent SMEs. Moreover, relationship lending may be relatively more important in Spain than other developed countries such as the U.K. and the U.S. because some methods of transactions lending that exist in the U.K. and the U.S. are not available in Spain. Thus, the information hypothesis may have greater explanatory power for lending behaviour in Spain where fewer alternatives to relationship lending exist.[1]

We conduct our analysis by using two different basic models of credit availability. Our first set of tests employs an empirical model that uses dependence on trade credit as the measure of firm financing constraints. These trade credit tests are based on one of the most common approaches found in the literature on bank credit (e.g., Petersen and Rajan 1995). The assumption in these tests is that trade credit is an SME's most expensive form of external debt (Petersen and Rajan, 1995; de Mello, 2004; and Fisher, 2005). Recent research, however, has cast some doubt on this assumption and the reliability of trade credit as a measure of firm financing constraints (e.g., Miwa and Ramseyer, 2005; Giannetti et al., 2009). Thus, in addition to our trade credit tests we also employ a disequilibrium model that identifies financially constrained and financially unconstrained firms.

By way of preview, we find that when the Lerner index is used as the measure of market power in both our trade credit dependence model and our disequilibrium

[1] Two important transactions-based lending technologies that exist in the U.K. and the U.S., but not in Spain, are small business credit scoring and asset-based lending. Of course, if the choice of lending technology is endogenous then the existence of more lending technologies in the U.K. and the U.S. may not affect tests of market power and credit availability in these countries. For example, banks in the U.K. and the U.S. might employ relationship lending in markets where they have more market power (as predicted by the information hypothesis), and employ one of these alternative transactions technologies in markets where they lack market power. However, research suggests that the choice of lending technologies may not be entirely endogenous. Small business credit scoring appears to be limited to very small business loans and may dominate all other lending technologies for loans in this size category (under about $100,000) for those banks that offer it because of its very low cost (e.g., DeYoung et al. 2007). The use of asset-based lending, which involves intense monitoring of accounts receivable and inventory, is limited to high risk borrowers (Carey, Post and Sharpe (1998), Udell (2004)). Thus, in the U.K. and the U.S. banks might employ small business credit scoring or asset-based lending for certain types of borrowers (instead of relationship lending) regardless of whether they have local market power. For these types of borrowers we would not find any association between market power and credit availability.

model, market power is negatively related to credit availability. However, we also find that results using the Lerner index are not consistent with results using concentration. Finally, when we use the disequilibrium model to investigate these differences we find that these conflicting results can be reconciled (as predicted by theory) by controlling for bank contestability, demand elasticity and information production. This suggests that researchers and policymakers need to be very careful in drawing strong conclusions about market power and credit availability based on analyses that rely exclusively on concentration as a measure of market power without introducing other necessary controls to disentangle, *inter alia*, the market power effects and the information production effects.

Our paper proceeds as follows. In the next section we briefly review two strands of the relevant literature. First, we look at the literature on measuring market power. We note that this literature on balance argues that the Lerner index and other structural competition measures are superior to concentration measures on both theoretical and empirical grounds. This literature also offers a theoretical reconciliation of the two measures. Second we briefly look at the literature on bank competition and information production in bank lending. In Section 3 we discuss our methodology and data. In Section 4 we present our results from our main trade credit dependence and disequilibrium models. We also use the disequilibrium model to empirically explore how our Lerner index results and our HHI result – and the market power hypothesis and the information hypothesis – can be reconciled. The paper ends with a summary of the main conclusions in Section 5.

2. Related Literature

2.1 MEASURING MARKET POWER

Empirical studies of the structure-conduct-performance hypothesis in banking most often use measures of concentration such as the Herfindahl-Hirschman Index (HHI) to proxy for market power (e.g., Hannan and Berger, 1991). Regarding the studies that employ concentration, Black and Strahan (2002) find that deregulation of US banking restrictions "reduced the negative effect of concentration" on the entry of entrepreneurs. Similarly, Beck et al. (2004) analyze whether the impact of bank competition is complicated by activity restrictions and government involvement in the bank sector. In particular, they show that the negative relationship between bank concentration and access to firm finance is mitigated in countries with more efficient legal systems, less corruption, higher levels of financial, economic and institutional development, and a larger presence of foreign banks. This negative effect of bank concentration on funding access is exacerbated, however, in countries with more restrictions on bank activities, higher government interference in the

banking system, and a higher share of government-owned banks. These results suggest that in concentrated banking systems it is possible to reverse the adverse affects of concentration on access to finance by removing restrictions on bank activities. Other papers have also cast doubt on the consistency and robustness of concentration as an indicator of market power in banking (Berger, 1995; Rhoades, 1995; Hannan, 1997). In our analysis we employ the Lerner index – a direct measure of market power based on estimations of marginal cost pricing – as an alternative to the HHI. We are the first paper in the literature on firm financing constraints to use the Lerner index and compare it to concentration measures. The Lerner index has been extensively used in the context of the so-called New Empirical Industrial Organization (NEIO) perspective where researchers have estimated the parameters of a firm's behavioral equation to directly obtain measures of marginal cost such as the Lerner Index (Schmalensee, 1989). As we discuss below, theoretical arguments indicate that the Lerner index is a preferable measure because it is more inclusive in capturing the factors that drive market power.

The Lerner index (L) is defined as the spread between prices (P) and marginal costs (C'), divided by prices $L = (P - C')/P$. The Industrial Organization literature provides a theoretical link between the HHI and the Lerner index through the equality $L = (P - C')/P = HHI\alpha/\varepsilon$, where α is a conjecture parameter showing contestability and the response of industry output to changes in firm output, and ε is the industry price elasticity of demand.[2] It is apparent from this equation that the HHI is not the only determinant of the Lerner index. As a consequence the HHI will only yield similar results to the Lerner index if the analysis using the HHI controls for the elasticity of demand and for variations in market contestability (see Connor and Peterson, 1992; and Borenstein and Bushnell, 1999). Of particular concern in studies of credit availability is the fact that changes in the banking industry driven by consolidation and liberalization have likely affected the stability of the conjecture and elasticity parameters casting doubt on the reliability of HHI as a dynamic measure of competition in this type of study.[3]

Along these lines Aghion et al. (1996) point out that the "Lerner Index has several advantages over indicators such as market share or the HHI" since it is a measure that tests differences between prices and marginal costs and does not depend so critically on geographic and product market definitions. Kim and Knittel (2006) review the existing empirical literature on measures of market power and conclude

[2] Numerous studies have examined the link between concentration and the HHI beginning with Saving (1970) and Cowling and Waterson (1976).

[3] Although the SCP hypothesis of a positive relationship between concentration and profits can be derived from oligopoly theory under specific assumptions in a Cournot setting, it is not robust to alternative assumptions (Lau, 1982). Furthermore, some empirical studies have rejected the hypothesis of Cournot conduct in the banking industry (Berg and Kim, 1994).

that only the lack of reliable marginal cost data have induced policy-makers to use the HHI as a measure of market power which has been shown to be only weakly correlated with deviations from perfectly competitive pricing. Dell'Ariccia (2001) also provides theoretical evidence on the source of these differences between the HHI and the Lerner index in banking studies. In particular, contestability patterns such as "heterogeneous patterns of entry" in different regional markets (i.e. branch openings that could increase or decrease contestability) may, at least partially, explain why the use of concentration measures yield different results than the Lerner index. Other studies of the banking industry have also shown that marginal cost measures such as the Lerner index are often uncorrelated with the HHI and that the HHI often produces spurious results (e.g., Shaffer 1993, Ribon and Yosha 1999).

Despite the preference for the Lerner index in the industrial organization literature, empiricists need to be concerned about potential bias over the business cycle caused by changes in risk and other factors. Silvestre (1993) analyses these problems and shows that, on the one hand, marginal costs are strongly procyclical, but, on the other hand, prices are countercyclical or only mildly procyclical. Overall, these biases tend to make the Lerner index significantly countercyclical.

These theoretical and empirical predictions suggest that the reliability of concentration as a measure of market power is quite dependent on the use of appropriate controls for market contestability and demand elasticity.

2.2 BANK COMPETITION AND INFORMATION PRODUCTION

In the 1990s researchers began to examine a potentially comprehensive explanation for how banks and other financial institutions might mitigate information problems in SME lending. This approach has focused on "lending technologies" rather than on individual elements of the commercial loan contract. A lending technology can be defined as a combination of screening mechanisms, contract elements, and monitoring strategies (Berger and Udell, 2006). Most of the attention in this strand of the literature has focused on one specific lending technology, "relationship lending" as first formally modelled in Petersen and Rajan (1995). Relationship lending is primarily based on proprietary soft information about the SME gathered over time "through multiple interactions with the borrower, often through the provision of multiple financial services" (Boot 2000). Soft information can include assessments of a SME's future prospects compiled from past interactions with its suppliers, customers, competitors, or neighboring businesses (Petersen and Rajan, 1994; Berger and Udell, 1995; Mester et al., 1998; Degryse and van Cayseele, 2000). The balance of the empirical evidence suggests that the strength of the bank-borrower relationship is positively related to credit availability and negatively related

to loan interest rates and collateral requirements (e.g., Petersen and Rajan, 1994, 1995).[4]

A key unresolved issue associated with relationship lending is the effect of market power on the feasibility of this lending technology. Hyytinen and Toivanen (2004), argue that most theoretical models of the banking firm show that a bank's *raison d'etre* is to collect and analyze information. They also show that a bank's rents stem from industrial organization-type sources such as a small number of competitors, product differentiation, and/or price discrimination – all sources of market power. Petersen and Rajan (1995) (PR) provide an explicit theoretical link between information production and market power in their theoretical model of relationship lending.[5] They show that when loan markets are competitive commercial lenders have less incentive to invest in relationship building. This is the essence of the *information hypothesis*[6], which contradicts the traditional *market power hypothesis* that argues that competition promotes credit availability. This theoretical motivation for relationship lending also suggests that empirical investigation of credit availability needs to account (through the choice of appropriate variables) for information production as well as market power, something currently absent in the literature. Thus, we not only contribute to the empirical literature by considering alternatives to concentration as a measure of market power, but we also explicitly control for information production. As it turns out, controlling for information production is critical in reconciling conflicting results driven by the choice of market power measure (i.e., the Lerner index vs. the HHI) and in reconciling the market power hypothesis and the information hypothesis.

The extant empirical literature on market power and credit availability reflects a variety of different approaches. Many empirical papers have used dependence

[4] There is now very large literature on relationship lending much of which addresses the specific issue of the association between the strength of the bank-borrower relationship and credit availability and price. No less than four survey articles and studies have been published that are substantially or entirely devoted to the subject of relationship lending (Berger and Udell, 1998; Boot, 2000; Ongena and Smith, 2000). Collectively these surveys contain a comprehensive assessment of the evidence linking relationship strength and credit availability – both pro and con.

[5] Another theoretical model suggests that the impact of competition involves a trade-off between the borrower's incentive problem and higher monitoring effort and that when the second effect dominates it is optimal for banks to have some market power (Caminal and Matutes, 2002). There is also a model that includes both the informational effects associated with the incentive to acquire private information along with the traditional (i.e., SCP) effects that work to restrict the supply of credit. This model shows that the net effect depends on the cost of information acquisition (de Mello, 2004). Thus, the issue is ultimately empirical.

[6] An alternative theoretical model suggests that competitive markets may be conducive to relationship building (Boot and Thakor, 2000). There is also theoretical work that suggests that increased competition in loan markets is associated with more credit availability for "informationally captured" firms and is associated with a decrease in quality of informed banks' loan portfolios (i.e., a "flight to captivity") (Dell'Ariccia and Marquez, 2005).

on trade credit as a proxy for credit availability. A key virtue of using trade credit dependence is data availability. Trade credit dependence can be calculated in studies that rely on cross sectional data – as long as the data include firm financial statements (e.g., studies that rely on the Federal Reserve Board's Survey of Small Business Finance). The implicit assumption in these papers is that trade credit is one of the most expensive forms of external finance. Some papers, for example, found support for the information hypotheses by showing a positive correlation between the level of competition and dependence on trade credit (Petersen and Rajan, 1995; de Mello, 2004).

Other papers have also found support for the information hypothesis using alternative measures of credit availability. Using U.S. Internal Revenue Service data on small firms, Zarutskie (2003) finds that higher concentration increases the probability of receiving a bank loan. Using cross-country data, Cetorelli and Gambera (2001) and Bonaccorsi di Patti and Dell'Ariccia (2004) found that higher concentration is associated with growth in industrial sectors that are more dependent on external finance. Montoriol (2006) found a positive correlation between concentration and credit conditions in an analysis of the impact of regional concentration on lending conditions in Spanish banking.

However, several other analyses have either found no evidence for the information hypothesis or found support for the *market power* hypothesis. Jayaratne and Wolken (1999) and Berger et al. (2005) do not find any association between concentration and dependence on trade credit. Elsas (2005) documents that Hausbank status is positively correlated to better access to information and that the likelihood of observing a Hausbank relationship is positively related to competition in the market, at least for low and intermediate levels of concentration. Degryse and Ongena (2008) show that more concentrated markets are associated with significantly larger spreads in both deposit markets and loan markets. In particular, competition lowers spreads and may also spur banks to tie customers in relationships that may encompass more fee-related products and cross-selling. Scott and Dunkelberg (2005) find that entrepreneurs' perception of the quality of service and credit availability is positively related to competition (although loan rates were not).[7]

3. Market Structure and Firm Financing Constraints: Methodology and Data

In this section we first present our trade credit dependence model, which mirrors the standard approach in the literature including different panel data techniques that aim to control for the likely endogeneity problems that may affect trade credit

[7] Some studies report indirect evidence against the information hypothesis. Ongena and Smith (2001) find evidence inconsistent with the "lock-in" element of bank relationships.

dependence models. Then we present our alternative disequilibrium model approach which avoids the recent criticisms of trade credit as a measure of firm financial constraints. We conclude the section with a discussion of our data.

3.1 THE TRADE CREDIT DEPENNDENCE MODEL

The most common empirical approach in analyzing the impact of market power on credit availability is to test the following model using cross sectional data such as data from the Survey of Small Business Finance:

$$Y_i = \beta X_i + \varepsilon_i \tag{1}$$

where X_i is a set of explanatory variables that include market power, firm controls, environmental controls and possibly bank controls. As we have noted above, quite often the key dependent variable is dependence on trade credit. Like much of the literature in this area, we also employ trade credit as our dependent variable in our first set of tests. However, we are not limited to cross sectional data. Thus, we can employ panel data techniques in our regression analysis.

As in other empirical studies on bank competition and/or firm financing constraints there is a potential endogeneity problem with some of the regressors such as firm inefficiency or profitability. To address this problem, we use a panel instrumental variable estimation methodology by Arellano and Bond (1991) where the estimated equation is expressed in first-differences. This Arellano-Bond estimator is called the *difference-estimator* and uses a set of instruments based on a combination of strictly lagged exogenous variables (the environmental and regional controls) and the lagged values of the potential endogenous variables. The specification is estimated by using two-stage least squares with a consistent variance-covariance matrix. It is not, however, a "dynamic" technique because the lagged dependent variable does not appear as a regressor in the main equation:

$$y_{i,t} - y_{i,t-1} = \beta'(X_{i,t} - X_{i,t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}) \tag{2}$$

where y is the financing constraint variable, X is a set of explanatory variables representing bank market power (HHI and Lerner index), other bank market conditions (average bank size, bank credit risk[8], number of bank branches, bank profitability, bank inefficiency) firm characteristics (firm inefficiency, firm profitability, firm size) and environmental regional control factors (GDP, taxation, percentage urban population and number of bankruptcies/total number of SMEs in the region), and ε is the error term. The subscripts i and t represent the firm and time period, respectively.

[8] We control for credit risk, as well as GDP, in order to address the business cycle effects that may affect the evolution of the Lerner index.

A second issue is the possibility that lagged values of the financing constraints variables might affect, at least partially, the current values of borrowing constraints. In this case, a "dynamic" specication with lagged dependent variables as regressors can address these feedback effects. So we also employ an alternative dynamic panel methodology that relies on the Generalized-Method of Moments (GMM) estimator replaced by Arellano and Bover (1995) and Blundell and Bond (1998) and refined by Blundell et al. (2000). This GMM estimator is called the *system-estimator* since it combines, in a system, the regression in differences with the regression in levels. The instruments for the equation in differences are again the lagged exogenous variables (the environmental and regional controls) and the lagged values of the potential endogenous variables. The instruments for the equation in levels are the lagged differences of the corresponding variables. These are appropriate instruments under the following additional assumption: although there may be correlation between the levels of the right-hand side variables, there is no correlation between the differences of these variables and the firm-specific effect.

The system-estimator is appropriate to estimate the following specification:

$$y_{i,t} - y_{i,t-1} = (\alpha - 1)\, y_{i,t-1} + \beta' X_{i,t} + \eta_i + \varepsilon_{i,t} \tag{3}$$

where y, X and ε, are defined as in equation (1) and η_i is an unobserved firm-specific effect. Equation (3) can be rewritten as:

$$y_{i,t} = \alpha y_{i,t-1} + \beta' X_{i,t} + \eta_i + \varepsilon_{i,t} \tag{4}$$

The firm-specific effect is eliminated by taking first-differences in equation (3) so that:

$$y_{i,t} - y_{i,t-1} = \alpha(y_{i,t-1} - y_{i,t-2}) + \beta'(X_{i,t} - X_{i,t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}) \tag{5}$$

All variables are expressed in logs, so that the differences can be interpreted as growth rates. The use of appropriate instruments is necessary to deal with the likely endogeneity of the explanatory variables, and also to deal with the fact that the new error term $(\varepsilon_{i,t} - \varepsilon_{i,t-1})$ is correlated with the lagged dependent variable $(y_{i,t-1} - y_{i,t-2})$. It has been shown (Blundell and Bond, 1998) both in Monte Carlo studies and empirically, that the use of the selected instruments produces considerable efficiency gains and avoidance of finite sample bias. Such a situation may arise especially when the time series are relatively persistent in any dimension, as it is the case for a number of variables in our data which vary across regions but only slightly across firms (as, for example, regional GDP). Thus, although the difference-estimator solves the problem of the potential presence of unobserved individual effects, this estimator may have potential statistical shortcomings compared to the system-estimator when the dependent variable and the explanatory variables are to some degree persistent over time. Therefore, the choice between the two methods to deal with endogeneity is non-trivial since financing constraints and

their determinants may very likely offer very different degrees of variation across time and across firms.

In order to assess the appropriateness of our instrumental variables approaches we conduct a Durbin-Wu-Hausman (DWH) test. The DHW is an F-test for overidentifying restrictions in each of the regressions (Davidson and McKinnon, 1993, pp. 237–242). In particular, the instruments are appropriate when the DHW rejects the null hypothesis that the instruments have no effect on the estimates of the regression coefficients. If the p-value of the DHW test is below 10%, the null hypothesis is rejected and the instrumental variables are accepted.[9]

We will compare the two alternative methodologies – the difference-estimator (without lagged dependent variables) and the system-estimator (with lagged dependent variables) – to assess whether feedback effects significantly alter the relationship between financing constraints and the set of regressors.

3.2 THE DISEQUILIBRIUM MODEL

Although dependence on trade credit has been widely used in the literature as a measure of firm financial constraints (Petersen and Rajan, 1995; de Mello, 2004; and Berger et al., 2005, Fisher, 2005), some recent research challenges the critical assumption in these papers that trade credit is extremely expensive. One paper finds that in the U.S. most trade credit is "cheaper than bank credit" (Giannetti et al., 2009). Another paper argues that it is difficult to reconcile the ubiquitous nature of trade credit with it being a relatively expensive source of credit (Miwa and Ramseyer, 2005).

In light of this new research on trade credit we also analyze the relationship between market power and firm financial constraints using an alternative approach to measuring financial constraints. Specifically, we employ a disequilibrium model based on Maddala (1983) that consists of two reduced-form equations, a loan demand equation, a loan availability (supply) equation, and a transaction equation. In this model, the realized loan quantity will be the minimum of the desired level of bank loans and the supply made available to the firm by banks.

The loan demand equation ($Bank\,loans^{d}_{it}$), the loan supply equation ($Bank\,loans^{s}_{it}$), and the transaction equation ($Bank\,loans_{it}$) of firm i in period t are:

$$\begin{aligned} Bank\,loans^{d}_{it} = {} & \beta^{d}_{0} + \beta^{d}_{1} Sales_{it} + \beta^{d}_{2} Cash\,flow_{it} \\ & + \beta^{d}_{3} Loan\,interest\,spread_{it} + \beta^{d}_{4} \log GDP_{it} + u^{d}_{it} \end{aligned} \tag{6}$$

[9] Similar significance levels are considered elsewhere in the literature (i.e. Cetorelli and Gambera, 2001).

$$Bank\ loans^{s}_{it} = \beta^{d}_{0} + \beta^{s}_{1}\ Tangible\ assets_{it} + \beta^{s}_{2}\ Bank\ market\ power + \beta^{s}_{3}\ Default\ risk_{it} + \beta^{s}_{4}\ Loan\ interest\ spread_{it} + \beta^{s}_{5} \log GDP_{it} + u^{s}_{it} \quad (7)$$

$$Bank\ loans_{it} = Min\left(Bank\ loans^{d}_{it},\ Bank\ loans^{s}_{it}\right) \quad (8)$$

The specification of loan demand and supply follows the reduced-form equations in the theoretical specifications in Maddala and Nelson (1974) and Ito and Ueda (1981) and the empirical implementations in Ogawa and Suzuki (2000), Atanasova and Wilson (2004) and Shikimi (2005). The key identification problem in the disequilibrium model involves attributing the observed changes in firm financing to the underlying movements in the loan demand and loan supply functions, by imposing a priori exclusion restrictions. In our case, while the interest spread on bank loans (*Loan interest spread*, computed as the difference between the loan interest rate and the interbank interest rate[10,11]) and *logGDP* enter both the demand and the supply equation, we assume that firm activity (*Sales*) and internal funding sources (*Cash flow*) only affect the demand for bank loans (6). The *Sales* variable is included because when an expansion in the firm's activity will call forth an increase in its demand for bank loans to support the corresponding increases in fixed assets, accounts receivables and inventory, and the *Cash flow* variable because it proxies the internal funds that may be used in lieu of external bank financing.

Other variables are instead taken to affect only the availability of credit (7): the firm's collateralizable assets (*Tangible assets*); the banks' market power in the area where the firm operates (*Banks' market power*), which is either the HHI or the Lerner index; and the firm's default risk (*Default* risk), as measured by the coverage ratio of operating profits over interest paid. *Tangible Assets* controls for the likelihood that, other things equal, banks will likely be willing to lend more to firms with more collateral (as predicted by Besanko and Thakor, 1987). The *Banks' market power* indicator shows to what extent our posited measures of bank competition may alter the supply curve. *Default risk* measures the extent to which a firm's risk profile may affect the supply of bank loans, relying on a metric commonly used by bankers to assess credit quality.

All level variables in (6) and (7) are expressed in terms of ratios (of total assets) to reduce heteroscedasticity. As a consequence, the size (scale) effect of "total assets" in the demand function above is estimated as part of the constant term since the

[10] The loan interest rate is computed as a ratio of loan expenses and bank loans outstanding. We implicitly assume that the year-end loan balance is roughly equal to the weighted average balance during the year.

[11] Since interest rates are central in this model, loan prices were alternatively measured in levels instead of the spread over the short-term prime rate. The results were robust to this alternative specification.

constant term is estimated as a coefficient of the reciprocal of total assets.[12] Both demand and supply equations contain *log(GDP)* to control for macroeconomic conditions across the regional markets where the SMEs operate.[13]

The simultaneous equations system shown in (6), (7) and (8) is estimated as a switching regression model using a full information maximum likelihood (FIML) routine (Maddala and Nelson, 1974). The FIML routine employed also incorporates fixed effects to account for unobservable firm-level differences. Based upon the estimates of this system it is possible to compute the probability that loan demand exceeds credit availability, as shown in Gersovitz (1980) and, therefore, to classify the sample into constrained and unconstrained firms. A firm is defined as financially constrained in year t if the probability that the desired amount of bank credit in year t exceeds the maximum amount of credit available in the same year is greater than 0.5. We also experiment with a lower cut-off threshold of 0.4 and a higher cut-off threshold of 0.6 in order to control for the effect of estimation errors. The results were not qualitatively different. Following Gersovitz (1980), the probability that a firm will face a financial constraint in year is derived as follows:

$$\Pr\left(loan_{it}^{d} > loan_{it}^{s}\right) = \Pr\left(X_{it}^{d}\beta^{d} + u_{it}^{d} > X_{it}^{s}\beta^{s} + u_{it}^{s}\right) = \Phi\left(\frac{X_{it}^{d}\beta^{d} - X_{it}^{s}\beta^{s}}{\sigma}\right) \tag{9}$$

where X_{it}^{d} and X_{it}^{s} denote the variables that determine a firm's loan demand and the maximum amount of credit available to firms, respectively. The error terms are assumed to be distributed normally, $\sigma^2 = \text{var}(u_{it}^{d} - u_{it}^{s})$, and $\Phi(.)$ is a standard normal distribution function. Since $E(loan_{it}^{d}) = X_{it}^{d}\beta^{d}$ and $E(loan_{it}^{s}) = X_{it}^{s}\beta^{s}$, $\Pr(loan_{it}^{d} > loan_{it}^{s}) > 0.5$, if and only if $E(loan_{it}^{d}) > E(loan_{it}^{s})$.

3.3 DATA

The data set contains firm-level information from the Bureau-Van-Dijk Amadeus database. Our sample consists of annual data on 30,897 Spanish SMEs for the period 1994–2002. The panel is balanced with 278,073 panel data observations. We consider firms with less than 50 employees to be small and firms between 50 and 250 employees to be medium-sized. 75.71% of the firms are small (23,394), while 24.29% (7,503) are medium-sized. We define the 17 administrative regions of Spain

[12] The constant term is them estimated as the parameter for "1/total assets" and, therefore, the estimated value of the coefficient of the estimated constant term or reciprocal of total assets is considerably large.

[13] Since some of the variables are computed from regional data, errors are clustered by region since these variables would be equal or very similar across firms in the same region.

as the relevant markets for firms[14]. Consistent with our market definition, the set of variables that describe the banking conditions have been computed as weighted averages of the values of these variables for the banks operating in these regions (using bank branches as the weighting factor). As a result, some of the variables may be similar across firms in the same region during certain periods. Consequently, in all the estimations, the errors are clustered at the regional level. These bank market variables have been computed from an auxiliary sample of individual bank balance sheet and income statement data that represent more than 90% of total bank assets in Spain.[15] Using deposits as the weighting factor produced virtually the same variables (the correlation with the variables computed using branches as a weighting factor is 0.98).

There are four different sets of variables: (i) bank market power; (ii) other bank market characteristics; (iii) firm characteristics; and (iv) environmental regional control variables. The main definitions of the variables are shown –in order of appearance- in Table I while the summary statistics over time are shown in Table II.

4. Results

4.1 RESULTS: THE TRADE CREDIT MODEL

Table III shows the results for our trade credit model tests under both alternative methodologies: the single-equation difference estimator approach and the system-estimator dynamic panel approach. The dependent variable here is "trade credit/total liabilities". We consider the regressions that use concentration to measure market power as our benchmark comparison with other empirical studies. However, unlike the extant literature, we also run our regressions using the Lerner index as an alternative measure of market power. The values of the F-test indicate a high overall statistical significance for these equations and the DHW test indicates that the instruments are appropriate since the p-values are below 10%, rejecting the null hypothesis that the instruments do not improve the estimation outcome.

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[14] This regional breakdown offers a wide range of variability in firm financing constraints and bank competition levels. For more detailed summary statistics by region (as well as by sector and firm size), see a previous working paper version of the paper: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=910226#PaperDownload

[15] The bank sample consists of 38 commercial banks and the 46 savings banks operating in Spain. Balance sheet and income statement information were provided by the Spanish Commercial Banks Association (AEB) and the Spanish Savings Bank Confederation (CECA). Our environmental control variables are also computed on a regional basis in order to control for other regional factors that may affect credit availability (Source: Spanish Statistical Office, INE).

Table I. Definitions of the main variables employed in the empirical tests

Bank market power	
HHI bank deposits	Herfindahl-Hirschman concentration index (HHI) in the deposit markets. This index is computed as the sum of the squared market shares of each one of the banks operating in a given region.
Lerner index	Ratio "(price of total assets – marginal costs of total assets)/price". The price of total assets is directly computed from the bank-level auxiliary data as the average ratio of "bank revenue/total assets" for the banks operating in a given region using the distribution of branches of banks in the different regions as the weighting factor. Marginal costs are estimated from a translog cost function with a single output (total assets) and three inputs (deposits, labor and physical capital) using two stage least squares and bank fixed effects.
Other bank market characteristics	
Average bank size	Log of the ratio between the total assets of banks operating in a given region and the number of bank institutions in that region. Some previous studies of the relationship between bank size and SME financing argue that large banks are at a disadvantage in lending to informationally opaque small businesses, because of their organizational diseconomies in providing relationship lending and because "soft" information may be difficult to transmit within large organizations and may create agency problems (Berger and Udell 2002). However, Berger et al. (2007) do not find evidence that larger banks make disproportionately fewer small business loans. They argue that large banks tend to adjust to the competitive conditions in local markets, and may also be able to do so via their internal capital markets: as they operate in various regional markets, large banks may transfer liquidity from one region to another This advantage may compensate their organizational disadvantages in processing soft information.
Bank credit risk	Average ratio of "loan losses to total loans" in a given region. This variable controls for differences across regions in the propensity of banks to supply credit to borrowers of different risk and differences in credit supply related to the ex post performance of their loan portfolios.
Number of bank branches	This proxies the physical bank infrastructure in the region where a firm operates. Lending constraints are expected to be lower in those regions where bank services are more widespread. Studies such as Jayaratne and Wolken (1999) have shown that branching deregulation, and the subsequent increase of bank branches in regional markets in the US resulted in lower financing constraints for SMEs.
Bank profitability	Measured as the return on assets (ROA), it is typically used as a control variable to capture any link between bank performance and the local supply of credit.
Bank inefficiency	This is the average ratio "operating expenses/gross income" in a given region. More inefficient bank markets may lead to an inferior allocation of resources and higher financing constraints (Schiantarelli, 1995; Hubbard, 1998).
Firm characteristics	
Trade credit/total liabilities	It reflects dependence on trade credit and assumes that trade credit is the most expensive source of SME financing based on the practice of offering high discounts for early payment (e.g., Petersen and Rajan 1995, de Mello 2004).

(*Continued*)

Table I. (Continued)

Trade credit/tangible assets	An alternative measure of trade credit dependence. Tangible assets may support more external financing because tangibility mitigates contractibility problems (Almeida and Campello, 2004). We control for the possibility that firms may differ in their tangible/intangible assets mix for technological reasons (and, thus, their ability to get more secured financing), by examining the amount of trade credit per euro of tangible capital.
Firm inefficiency	Ratio of firm operating costs to income, is included to control for the potential effects of differences in firm cost management. Firms that exhibit higher operating inefficiency may rely more frequently on trade credit and other expensive sources of funding (Petersen and Rajan, 1995). Similarly, operating inefficiency as an input into bank credit scoring models may affect loan supply (Becchetti and Sierra, 2003).
Firm profitability	Ratio of profit before taxes over total assets is employed as a measure of performance. It also controls for observable firm quality.
Firm size	Log of total assets. Cross-country studies of financing choices have found different financing patterns for small and large firms, in the use of long-term financing and trade credit (e.g., Demirgüç-Kunt and Maksimovic, 2001). Large firms may benefit from internal capital markets and may face less financing constraints.
Sales	Total sales during the year.
Cash flow	Net income plus depreciation plus changes in deferred taxes.
Tangible assets	Fixed assets on firm's balance sheet (thousand of euros). This is considered as proxy of collateral.
Loan interest spread	This spread is defined as the difference between loan interest rates and interbank rates. The loan interest rate is computed as a ratio of loan expenses and bank loans outstanding. We implicitly assume that the year-end loan balance is roughly equal to the weighted average balance during the year.
Default risk	This risk variable is defined as the ratio of operating profits to interest paid. A proxy for operating risk showing how many times interest paid are covered by operating profits.
Environmental regional control variables	
GDP	Real regional gross domestic product, accounts for differences in the economic development across the regions where SMEs are located.
Taxation	Taxes scaled by earnings before interest and taxes, reflects differences in taxation across regions that may affect performance and observable firm quality and influence access to external financing.
Percentage urban population	Ratio "population in areas with more than 10,000 inhabitants in the region/total population in the region". It captures any differences in urban versus rural markets.
Number of bankruptcies/total number of SMEs in the region	Ratio of total bankruptcies over the total number of SMEs in the region where the firms operate, proxies for firm financial stability across regions.

Our analysis will mainly focus on the coefficients of our two alternative measures of market power: our concentration measure, the HHI of bank deposits, and our structural competition indicator, the Lerner index. Table III shows that the coefficients of the HHI and the Lerner index are both statistically significant but have opposite signs. In particular, when the HHI is used, market power appears to be associated with less stringent financial constraints (i.e., less dependence on

Table II. Variable Means over Time (1994–2002)

	1994	1995	1996	1997	1998	1999	2000	2001	2002	PERIOD
Bank market power										
HHI bank deposits	0.12083	0.11733	0.11701	0.11356	0.10437	0.09645	0.08936	0.08314	0.07772	0.10220
Lerner index	0.2102	0.2304	0.2403	0.2419	0.2412	0.2517	0.2532	0.2637	0.2641	0.2488
Other bank market characteristics										
Average bank size	8.0247	8.0928	8.3265	8.4085	8.4985	8.5123	8.6985	8.7158	8.8236	8.4215
Bank credit risk	0.03352	0.02545	0.01059	0.00625	0.00232	0.00051	0.000223	0.00013	0.000114	0.00879
Number of bank branches	3348	3450	3544	3590	3664	3702	3700	3687	3657	3594
Bank profitability	0.00927	0.01125	0.01363	0.01819	0.02543	0.0182	0.0253	0.0331	0.0288	0.02035
Bank inefficiency	0.71256	0.71053	0.70552	0.70523	0.6944	0.62015	0.6253	0.61002	0.56823	0.66133
Firm characteristics										
Trade credit/total liabilities	0.34166	0.34326	0.34234	0.35104	0.3498	0.34754	0.35155	0.34383	0.34530	0.34626
Trade credit/tangible assets	0.42586	0.43988	0.42824	0.44007	0.41583	0.41055	0.44201	0.43218	0.43020	0.43322
Firm inefficiency	0.86954	0.85442	0.82546	0.85517	0.83102	0.7858	0.8337	0.8882	0.81483	0.83979
Firm profitability	0.0711	0.07656	0.07286	0.07116	0.07601	0.078	0.07135	0.06584	0.05432	0.07080
Firm size	13.73	13.78	13.84	13.93	14.03	14.12	14.23	14.29	14.33	14.03
Sales	14241,2	14987,3	13976,5	16294.8	18321.4	19443.2	19672.0	19882.1	19773.1	18324.6
Cash flow	1353.1	1461.6	1392.4	1677.9	1822.5	1901.3	1906.5	1998.2	2136.6	1846.2
Tangible assets	1237.3	1343.6	1299.0	1492.2	1508.4	1512.3	1584.4	1602.2	1533.8	1451.1
Loan interest spread	0.0152	0.0155	0.0144	0.0142	0.0139	0.0132	0.0126	0.0119	0.0120	0.0131
Default risk	3.14	3.84	3.04	5.42	5.23	4.30	4.56	5.01	4.43	4.12
Environmental regional control variables										
GDP	41811	43643	44964	46400	48099	54074	52520	54016	55437	48996
Taxation	0.21814	0.2152	0.2183	0.2163	0.2258	0.2352	0.1925	0.1935	0.2025	0.21305
Percentage urban population	0.51252	0.52685	0.53713	0.53208	0.5412	0.5518	0.562	0.5727	0.5834	0.54663
Number of bankruptcies/total number of SMEs in the region	0.042	0.031	0.016	0.027	0.029	0.019	0.016	0.022	0.025	0.024

Table III. SME Financing Constraints: Trade Credit Regression (I)
The dependent variable is the ratio of trade credit to total liabilities, taken as a measure of financial constraints. Coefficients marked with 1, 2 and 3 asterisks are significantly different from zero at the 10, 5 and 1 percent level, respectively, and p-values are reported in parenthesis below the respective coefficients. The errors are clustered at the regional level.

	Instrumental Variables		*GMM-system estimator*	
	(I)	*(II)*	*(III)*	*(IV)*
Constant	−5.0163***(0.000)	−5.3140***(0.000)	−5.0094***(0.000)	−5.3915***(0.000)
Lagged dependent variable	–	–	−1.7720***(0.000)	−1.1741***(0.000)
Bank market power				
HHI bank deposits	−0.19483**(0.019)	–	−24.53423***(0.000)	–
Lerner index	–	0.03800***(0.002)	–	0.07194***(0.000)
Other bank market characteristics				
Average bank size	−0.229655***(0.000)	−0.08952***(0.000)	−0.29851***(0.000)	−0.06552***(0.000)
Bank credit risk	−5.16237***(0.000)	−7.6893***(0.000)	−8.1593***(0.000)	−27.1427***(0.000)
Number of bank branches	−0.07033***(0.000)	−0.07702***(0.000)	−0.0037***(0.000)	−0.00566***(0.000)
Bank profitability	−0.9830***(0.000)	−1.5456**(0.030)	−4.2174***(0.000)	−3.0704**(0.013)
Bank inefficiency	0.00582***(0.000)	0.01266***(0.000)	0.04012***(0.000)	0.04575***(0.008)
Firm characteristics				
Firm inefficiency	−0.04569(0.338)	−0.0426(0.566)	−0.02599(0.172)	0.0581**(0.041)
Firm profitability	0.01786(0.880)	0.03086(0.888)	0.0934(0.326)	−0.06622*(0.050)
Firm size	0.13152***(0.000)	0.05671***(0.000)	0.12027***(0.000)	0.38701***(0.000)
Environmental regional control variables				
GDP	−0.60E-06***(0.000)	−0.81E-06***(0.000)	−0.35E-05***(0.000)	−0.25E-05***(0.000)
Taxation	−0.00021(0.959)	0.00044*(0.069)	−0.00014(0.681)	0.00022**(0.017)
Percentage urban population	2.4579***(0.000)	2.54061***(0.000)	2.8454***(0.000)	9.9948***(0.000)
Number of bankruptcies/total number of SMEs in the region	0.04518***(0.000)	0.04574***(0.000)	0.04415***(0.000)	0.06332***(0.000)
F-statistic	0.009	0.011	0.015	0.014
Durbin-Wu-Hausman test (p-value)[a]	0.016	0.040	0.036	0.029
Observations	278.073	278.073	278.073	278.073
Number of firms	30.897	30.897	30.897	30.897

[a]The Durbin-Wu-Hausman statistic tests the null that the use of instrumental variables does not change the estimation outcome.

trade credit); and, when the Lerner index is used, market power appears to be associated with more stringent financial constraints (more dependence on trade credit).

Other bank market characteristics are also found to affect firm borrowing constraints significantly. Of particular interest is the result that average bank size is negatively and significantly related to firm borrowing constraints. This evidence is consistent with Berger et al. (2007) and the view that large banks are not necessarily disadvantaged in providing loans to small business since they may benefit from internal capital markets and may have a superior ability to adapt to local market competitive conditions.

Table IV shows the results of the dynamic panel estimations when "trade credit/tangible assets" is used as an alternative measure of financing constraints. The results are consistent with those in Table III, indicating that our results are robust to this alternative specification of borrower financial constraints. That is, the results in Table IV confirm that higher market power measured by the Lerner index is negatively related to credit availability and higher market power measured by the HHI of bank deposits is positively related to credit availability.

A concern in our analysis is the consistency of our two alternative competition measures. Focusing first on concentration, we considered various alternatives to the HHI of bank deposits, the one (CR1), three (CR3) and five (CR5) (largest) bank concentration ratios, respectively. Only the CR3 measure was negatively and significantly related to the financing constraint variables (as was the HHI of bank deposits). The HHI of bank loans and of bank total assets were also used as alternative concentration measures and only the former provided statistically significant results in line with those of the HHI of bank deposits. The apparent inconsistency of the concentration measures casts further doubt on the accuracy of concentration as a measure of market power.

It is also possible that the relationship between market power indicators and financing constraints is non-linear, as suggested in theoretical contributions such as Anand and Galetovic (2006) and in recent empirical studies such as Elsas (2005) or Degryse and Ongena (2007). As a robustness check, the linear relationships specified in equations (1) to (4) were changed to quadratic specifications and estimated using non-linear least squares with bank fixed effects. The statistical significance and sign of the HHI and the Lerner index in the equations did not vary.

We also estimate the so-called H-statistic of Panzar and Rosse (1987), defined as the elasticity of total revenues to changes in factor prices. We employed panel data (fixed effects) techniques as in Claessens and Laeven (2005). H is a structural measure of market structure. The log of total revenues is regressed against the log of the three input prices (labour, deposits and physical capital) previously employed to estimate marginal costs. Besides, the log of total assets (controlling for size), the log

Table IV. SME Financing Constraints: Trade Credit Regression (II)
The dependent variable is the ratio of trade credit to tangible assets, taken as a measure of financial constraints. Coefficients marked with 1, 2 and 3 asterisks are significantly different from zero at the 10, 5 and 1 percent level, respectively, and p-values are reported in parenthesis below the respective coefficients. The errors are clustered at the regional level.

	Instrumental Variables		*GMM-system estimator*	
	(I)	*(II)*	*(III)*	*(IV)*
Constant	−5.0253***(0.000)	−4.8951***(0.000)	−5.0222***(0.000)	−4.92271***(0.000)
Lagged dependent variable	–	–	−0.13260**(0.049)	−0.17225*(0.060)
Bank market power				
HHI bank deposits	−13.7480***(0.000)	–	−20.1118***(0.000)	–
Lerner index	–	0.12466***(0.000)	–	0.18344**(0.043)
Other bank market characteristics				
Average bank size	−0.27684***(0.000)	−0.34195***(0.000)	−0.26025***(0.000)	−0.14241***(0.000)
Bank credit risk	−4.8702***(0.000)	−20.2040***(0.000)	−27.5780***(0.000)	−3.7136**(0.042)
Number of bank branches	−0.05778***(0.000)	−0.00284***(0.000)	−0.01163**(0.040)	−0.00197***(0.000)
Bank profitability	−3.26679*(0.063)	−2.69694**(0.043)	−5.6328***(0.002)	−0.45399(0.622)
Bank inefficiency	0.01820***(0.000)	0.07791***(0.000)	0.07291***(0.001)	0.0742***(0.004)
Firm characteristics				
Firm inefficiency	0.03001***(0.000)	0.041760***(0.00)	0.03588***(0.001)	0.09741***(0.000)
Firm profitability	−0.65546(0.425)	−0.44176(0.618)	−0.99631(0.129)	−0.40102(0.548)
Firm size	0.23960***(0.000)	0.59746***(0.000)	0.31850***(0.000)	0.59311***(0.000)
Environmental regional control variables				
GDP	0.23E-05**(0.032)	0.69E-05*(0.062)	−0.74E-05*(0.085)	−0.16E-05**(0.029)
Taxation	0.00301(0.764)	0.00632(0.707)	0.00014(0.913)	−0.0077(0.240)
Percentage urban population	−15.7462**(0.011)	5.52944**(0.019)	3.3755**(0.024)	19.6507***(0.001)
Number of bankruptcies/total number of SMEs in the region	0.06579***(0.000)	0.04082***(0.000)	0.03224***(0.000)	0.02079***(0.000)
F-statistic	0.016	0.017	0.020	0.021
Durbin-Wu-Hausman test (p-value)[a]	0.087	0.045	0.029	0.091
Observations	278.073	278.073	278.073	278.073
Number of firms	30.897	30.879	30.897	30.897

[a]The Durbin-Wu-Hausman statistic tests the null that the use of instrumental variables does not change the estimation outcome.

of loan losses over total assets (controlling for loan quality), the log of equity to total assets (controlling for solvency) and the log of deposits and other funding over total liabilities (controlling for liabilities diversification) are included in the equation as control factors. H is the sum of the elasticities of total revenues to input prices obtained from the coefficients of these three estimated parameters in the equation. H can be negative (input costs falling and revenue rising) suggesting strong monopoly power. Alternatively, if $H = 1.0$, then all changes in input prices are passed on to output prices, suggesting perfect competition. When H is positive but less than 1.0, monopolistic competition holds. The main results suggest that monopolistic competition holds since both $H = 1$ and $H = 0$ hypotheses are rejected. The overall value for the whole period was 0.46. Yearly OLS estimates of the H-statistic were also estimated and correlated with the Lerner and HHI. The correlation with the Lerner index was 0.81 while the correlation with the HHI was -0.48. This result shows again the apparent inconsistency of the HHI measure with other structural measures of market competition.

4.2 RESULTS: THE DISEQUILIBRIUM MODEL

The estimated parameters of the disequilibrium model are shown in Table V. All of the exogeneous variables in both the demand and supply equations have the expected signs. The hypotheses of the overall significance of the equations can not be rejected according to the log-likelihood values. Table V shows the two alternative specifications for the disequilibrium model, one where the HHI is the measure of market power in the supply equation and another one where the Lerner index is the indicator of market power. Other than the indicators of market power, the differences in the coefficients of the parameters of the demand and supply equations between these two specifications are not statistically significant. The indicators of market power that are significant in the both alternative regressions, however, exhibit a different sign – positive in the case of the HHI (suggesting higher credit availability with market power) and negative in the case of the Lerner index (suggesting lower credit availability with market power).

Using the estimations of the FIML disequilibrium model we compute the probability that a given firm is financially constrained. We find that 33.90% of firms in the sample were financially constrained during the period when we us Lerner index. As shown in the Appendix, these values remain very stable over time. Interestingly, the probability of being constrained varies considerably across regions and across sectors. There were no statistically significant differences between small and medium sized firms.[16] When we use the HHI the percentage of financially

[16] In light of these regional and sector differences we re-ran all of the regressions in Tables II and III by sector and region and size (not shown). The results were generally consistent with the earlier

Table V. Estimated parameters of the disequilibrium model

This table reports estimates of a switching regression model. The estimation method is full information maximum likelihood (FIML) with fixed effects. Coefficients marked with 1, 2 and 3 asterisks are significantly different from zero at the 10, 5 and 1 percent level, respectively, and p-values are reported in parenthesis below the respective coefficients. The errors are clustered at the regional level.

	(I)		(II)		p-values for coefficients differences
	Coefficient	Std. Error	Coefficient	Std. Error	
Demand for bank loans					
Sales/total assets(t−1)	0.6329***(0.000)	0.01	0.6509***(0.000)	0.01	0.01
Cash-flow/total assets(t−1))	−2.0344***(0.000)	0.07	−2.2918***(0.000)	0.08	0.01
Loan interest spread	−1.5129***(0.000)	0.05	−1.4678***(0.000)	0.04	0.01
Log(GDP)	0.0192*(0.063)	0.12	0.0232**(0.018)	0.11	0.01
Supply of bank loans					
Tangible fixed assets/total assets(t−1)	2.3983***(0.000)	0.01	2.4367***(0.000)	0.01	0.01
Banks' market power (HHI)	0.0219**(0.028)	0.01	–	–	–
Banks' market power (Lerner index)	–	–	−0.9812***(0.002)	0.01	–
Loan interest spread	1.0267***(0.000)	0.04	1.0234***(0.000)	0.05	0.01
Default risk	0.0001(0.772)	0.01	0.0001(0.831)	0.01	0.01
Log(GDP)	−0.0826***(0.09)	0.10	−0.0886**(0.014)	0.09	0.01
Reciprocal of total assets in the loan demand equation	338326.2***(0.000)	1145.3	340228.0***(0.000)	1156.15	0.01
Reciprocal of total assets in the loan supply equation	214326.6***(0.000)	2102.0	211297.2***(0.000)	2170.12	0.01
S.D. of the disturbance in demand equation	1.5166***(0.000)	0.01	1.5322***(0.000)	0.01	0.01
S.D. of the disturbance in supply equation	0.4986***(0.000)	0.01	0.4688***(0.000)	0.01	0.01
Correlation coefficient between both disturbances	0.6658***(0.000)	0.08	0.6749***(0.000)	0.07	0.01
Log likelihood	159621		158955		
Coincidence in the classification of firms as constrained	88.2%				
Observations	278.073		278.073		
Number of firms	30.897		30.897		

constrained firms was very similar (32.82%). However, as shown at the bottom of Table V, both specifications (using the Lerner index and the HHI) only coincide by 88% in terms of the firms that are labelled as financially constrained.

4.3 THE 'INFORMATION' AND 'MARKET POWER' EFFECTS: ANOTHER LOOK AT THE IMPACT OF BANK COMPETITION ON FIRM FINANCING CONSTRAINTS

The results of our trade credit dependence model and the disequilibrium model tests suggest that, at a minimum, the findings in studies of firm financing constraints that rely exclusively on concentration as a measure of market power may not hold for alternative indicators of market power. Focusing on the disequilibrium model, for instance, our results reveal that the classification of firms as constrained or unconstrained is sensitive to the choice of market power indicator in the supply equation. We now extend our analysis and explore alternative explanations for these differences using alternative specifications of the disequilibrium model of firm financing constraints. In particular, two additional specifications are considered that are motivated by the theoretical link between the Lerner index and the HHI that we discussed in Section 2.1:

(i) Given that the HHI is only one of the determinants of the Lerner index, our first specification corrects the HHI, dividing it by the elasticity of demand, as suggested by Connor and Peterson (1992) and Borenstein and Bushnell (1999). As a proxy for the elasticity of demand, we use an estimate of the parameter of the "loan interest spread" in the different regional markets where each bank operates.

(ii) The correspondence between the bank HHI and the bank Lerner index, as well as the relationship between these indicators and firm financing constraints has been shown to depend on the evolution of market contestability and on bank investment in information production. We therefore consider a second specification where the HHI and the Lerner index interact with indicators of market contestability and bank investment in information production. The main source of contestability in banking markets is likely the heterogeneous patterns of entry by new competitors (Dell'Ariccia, 2001). A common feature of information production in the banking industry is that it necessitates sunk investments. In line with this logic (and in line with Petersen and Rajan, 1994; and Hyytinen and Toivanen, 2004), we use the increase in the number of branches to proxy for bank investment in information production. This second specification thus considers in the same regression the bank market power indicator itself, the bank market power indicator interacting with the increase in the number of bank branches in the region where the firm

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regressions and are generally consistent across regions, sectors and across small and medium-sized firms, although the HHI is not statistically significant in some sectors.

operates, and the bank market power indicator interacting with the entrance of new bank competitors in the region where the firm operates. This second specification also incorporates two additional controls: firm size (log of total assets) and sectoral dependence on external finance.[17] These variables control for the extent to which the Lerner index and the HHI may vary with firm size and sectoral dependence on external finance, as in Rajan and Zingales (1998), Cetorelli and Gambera (2001) and Claessens and Laeven (2005). Controlling for all these factors we may also address endogeneity since one could argue that market power simply adjusts to certain bank conditions related to these contestability and information production factors.

The results of these alternative specifications are shown in Table VI. In the first specification, we find that by correcting the HHI for demand elasticity (the first specification), we obtain results similar to those obtained using the Lerner index. This suggests that an increase in market power reduces the availability of bank loans. The second specification allows us to distinguish between the role of market power and the role of information production. In particular, when the HHI and its interaction with contestability and information production are considered, they are all significant. The HHI exhibits a negative and significant sign showing again the *market power* effect while the variables showing the interaction of the HHI with the number of new branches and with the entrance of new competitors exhibit a positive and significant sign showing the effects of contestability and information production, respectively. Similar results are obtained when we employ the Lerner index as our measure of market power. However, while the interaction of concentration with firm sectoral external dependence is positively and significantly related to the availability of bank loans – suggesting higher credit availability for more dependent sectors, as in Cetorelli and Gambera (2001) – these effects cannot be observed when the Lerner index is used as the measure of market power.

Importantly, by disentangling the effects of demand elasticity, contestability and information production our classification of firms by financing constraints becomes much more consistent across alternative specifications of market power (i.e., the Lerner index vs. the HHI): our overlap improves from 88% to 97%.

Overall, these results suggest that the *information hypothesis* and the *market power* hypothesis can be reconciled as long as the HHI is corrected to reflect factors

[17] As in Rajan and Zingales (1998), we are interested in the amount of desired investment that cannot be financed through internal cash flows generated by the same business. We use the Rajan-Zingales proxy for external dependence. In particular, sectoral dependence on external finance is measured as the weighted average of the ratio "capital expenditures minus cash flow from operations divided by capital expenditures" for the firms belonging to a given sector and in a given region, using firm's total assets as the weighting factor.

Table VI. Estimated parameters of the disequilibrium model. Alternative specifications for the concentration index

This table reports estimates of a switching regression model. The estimation method is full information maximum likelihood (FIML) with fixed effects. Coefficients marked with 1, 2 and 3 asterisks are significantly different from zero at the 10, 5 and 1 percent level, respectively, and p-values are reported in parenthesis below the respective coefficients. The errors are clustered at the regional level.

	(I)		(II)		(III)	
	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
Demand for bank loans						
Sales/total assets(t−1)	0.6063***(0.000)	0.01	0.6340***(0.000)	0.01	0.5442***(0.000)	0.01
Cash-flow/total assets(t−1)	−2.1478***(0.000)	0.08	−2.1937***(0.000)	0.07	−2.1665***(0.000)	0.07
Loan interest spread	−1.5725***(0.000)	0.06	−1.5039***(0.000)	0.05	−1.4123***(0.000)	0.05
Log(GDP)	0.0183*(0.059)	0.11	0.0211**(0.037)	0.10	0.0226***(0.009)	0.11
Supply of bank loans						
Tangible fixed assets/total assets(t−1)	2.2105***(0.000)	0.01	2.1232***(0.000)	0.01	2.3244***(0.000)	0.01
Banks' market power (HHI/€)	−0.0121***(0.000)	0.01	–	–	–	–
Banks' market power (HHI)	–	–	−0.0102**(0.034)	0.01	–	–
HHI Increase in the number of bank branches*	–	–	0.0342**(0.043)	0.01	–	–
HHI Entrance of new competitors in the bank market*	–	–	0.0563**(0.019)	0.01	–	–
HHI sectoral external financial dependence*	–	–	0.0342**(0.015)	0.01	–	–
HHI firm size*	–	–	0.0131(0.121)	0.01	–	–
Banks' market power (Lerner index)	–	–	–	–	−0.8585**(0.001)	0.01
Lerner index Increase in the number of bank branches*	–	–	–	–	0.0226***(0.003)	0.01
Lerner index Entrance of new competitors in the bank market*	–	–	–	–	0.0263**(0.042)	0.01
Lerner index sectoral external financial dependence*	–	–	–	–	0.0062(0.104)	0.01
Lerner index firm size*	–	–	–	–	0.0091(0.121)	0.01
Loan interest spread	1.2755***(0.000)	0.05	−1.3244***(0.000)	0.05	1.0644***(0.000)	0.05
Default risk	0.0001(0.901)	0.01	0.0001(0.973)	0.01	0.0001(0.775)	0.01
Log(GDP)	−0.0807***(0.08)	0.09	−0.0873**(0.010)	0.10	−0.0832**(0.011)	0.10
Reciprocal of total assets in the loan demand equation	339321.6***(0.000)	1293.7	351622.5***(0.000)	1156.15	324451.3***(0.000)	1202.31
Reciprocal of total assets in the loan supply equation	218765.6***(0.000)	2336.5	205443.8***(0.000)	2170.12	225660.6***(0.000)	2014.15
S.D. of the disturbance in demand equation	1.6023***(0.000)	0.01	1.6004***(0.000)	0.01	1.6226***(0.000)	0.01
S.D. of the disturbance in supply equation	0.5039***(0.000)	0.01	0.5243***(0.000)	0.01	0.5128***(0.000)	0.01
Correlation coefficient between both disturbances	0.6425***(0.000)	0.08	0.6228***(0.000)	0.07	0.6119***(0.000)	0.08
Log likelihood	152342		178955		16122.8	
Percentage of borrowing constraints firms	33.1%		33.9%		33.9%	
Coincidence in the classification of firms as constrained (relative to the Lerner index specification)	97.5%		98.1%		100.0%	
Observations	278.073		278.073		278.073	
Number of firms	30.897		30.897		30.897	

that can drive a wedge between concentration and price-cost margin estimations – in particular, demand elasticity, market contestability and investment in information production.

5. Conclusions

The relationship between bank competition and firm financing has been studied in the context of two main competing hypotheses. The *market power* view holds that concentrated banking markets are associated with less credit availability and a higher price for credit. An alternative view, the *information hypothesis* argues that competitive banking markets can weaken relationship-building by depriving banks of the incentive to produce soft information (Petersen and Rajan 1995). Therefore, according to the information hypothesis, higher bank market power reduces firm financing constraints.

This study offers new evidence on the relationship between bank market competition and firm financing constraints and the extent to which tests of this relationship may be sensitive to the choice of the measure of market power. Notably, we find evidence of this sensitivity in the Spanish economy where SMEs are heavily dependent on banks for their financing. In particular, we find in our initial set of tests that the HHI and the Lerner index produce opposite results: on the one hand, the use of the Lerner index indicates that market power is associated with higher financial constraints, and, on the other hand, the use of HHI indicates that market power is associated with lower financial constraints. This lack of robustness is of concern because the extant empirical literature on market power and firm financing constraints has relied exclusively on the HHI and other concentration measures, mostly due to data constraints, i.e., a lack of panel data. It is of further concern because the theoretical and empirical work in the industrial organization literature argues that the Lerner index and other structural measures of competition are superior to concentration as measures of market power.

Finally, we show that our initial conflicting results using alternative market power measures, and the main two views in the literature (the *market power* hypothesis and the *information hypothesis*) can be reconciled when we control for demand elasticity, banking market contestability and bank investment in information. In particular, we find that bank market power increases firm financing constraints supporting the *market power* hypothesis and we find that contestability and information production attenuate this effect supporting the information hypothesis.

Appendix. Regional and Sector Breakdown

B1. SAMPLE COMPOSITION BY REGION AN SECTOR

Region	Firms	Observations
ANDALUSIA	1.830	16.470
ARAGON	1.810	16.290
ASTURIAS	905	8.145
BALEARIC ISLANDS	781	7.029
CANARY ISLANDS	259	2.331
CANTABRIA	173	1.557
CASTILE LA MANCHA	1.750	15.750
CASTILE AND LEÓN	963	8.667
CATALONIA	8.767	78.903
COMUNIDAD VALENCIANA	3.640	32.760
EXTREMADURA	648	5.832
GALICIA	1.800	16.200
MADRID	3.660	32.940
MURCIA	756	6.804
NAVARRA	838	7.542
BASQUE COUNTRY	1.816	16.344
RIOJA	501	4.509
Sector	Firms	Regions
MANUFACTURES OF FOOD PRODUCTS AND BEVERAGES	2583	23247
MANUFACTURES OF TEXTILES AND DRESSING	1917	17253
MANUFACTURES OF WOOD, PAPER, PRINTING AND RECORDED MEDIA PRODUCTS	1564	14076
MANUFACTURES OF CHEMICAL, PLASTIC, MINERAL AND METAL PRODUCTS	3296	29664
MANUFACTURES OF MACHINERY AND EQUIPMENT AND TRASNSPORT VEHICLES	1947	17523
MANUFACTURES OF FURNITURE AND RECYCLING	513	4617
ELECTRICITY, GAS AND WATER SUPPLY	78	702
CONSTRUCTION	4428	39852
SALE, MAINTENANCE AND REPAIR OF MOTOR VEHICLES	1339	12051
WHOLESALE TRADE AND COMISSION TRADE	6439	57951
HOTELS AND RESTAURANTS	2484	22356
TRANSPORT SERVICES	1272	11448
REAL STATE ACTIVITIES	2236	20124
RENTING OF MACHINERY AND EQUIPMENT	112	1008
COMPUTER AND RELATED ACTIVITIES	203	1827
OTHER RETAIL TRADE PRODUCTS AND SERVICES	471	4239
OTHER	15	135
TOTAL	**30.897**	**278.073**

B2. PERCENTAGE OF FINANCIALLY CONSTRAINED FIRMS

Time	%
Entire period (1994–2002)	33,90
1994	34,62
1995	31,88
1996	34,22
1997	32,30
1998	34,25
1999	34,93
2000	35,16
2001	34,14
2002	33,60
Region	%
ANDALUSIA	39,23
ARAGON	38,41
ASTURIAS	39,78
BALEARIC ISLANDS	28,81
CANARY ISLANDS	39,00
CANTABRIA	39,88
CASTILE LA MANCHA	39,00
CASTILE AND LEÓN	39,65
CATALONIA	32,01
COMUNIDAD VALENCIANA	29,07
EXTREMADURA	39,66
GALICIA	39,23
MADRID	31,37
MURCIA	38,23
NAVARRA	29,59
BASQUE COUNTRY	31,21
RIOJA	32,39
Sector	%
MANUFACTURES OF FOOD PRODUCTS AND BEVERAGES	26,29
MANUFACTURES OF TEXTILES AND DRESSING	41,73
MANUFACTURES OF WOOD, PAPER, PRINTING AND RECORDED MEDIA PRODUCTS	39,00
MANUFACTURES OF CHEMICAL, PLASTIC, MINERAL AND METAL PRODUCTS	35,29
MANUFACTURES OF MACHINERY AND EQUIPMENT AND TRASNSPORT VEHICLES	25,22
MANUFACTURES OF FURNITURE AND RECYCLING	34,89
ELECTRICITY, GAS AND WATER SUPPLY	24,36
CONSTRUCTION	22,43
SALE, MAINTENANCE AND REPAIR OF MOTOR VEHICLES	41,75
WHOLESALE TRADE AND COMISSION TRADE	39,85
HOTELS AND RESTAURANTS	48,43
TRANSPORT SERVICES	21,31
REAL STATE ACTIVITIES	30,46
RENTING OF MACHINERY AND EQUIPMENT	32,14
COMPUTER AND RELATED ACTIVITIES	37,44
OTHER RETAIL TRADE PRODUCTS AND SERVICES	30,36
OTHER	33,33

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