Competition and Relationship Lending: Friends or Foes?

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Abstract

Recent empirical findings by Elsas (2005) and Degryse and Ongena (2007) document a U-shaped effect of market concentration on relationship lending which cannot be easily accommodated by the investment and strategic theories of relationship lending. In this paper, we suggest that this non-monotonicity can be explained by looking at the organizational structure of local credit markets. We provide evidence that marginal increases in interbank competition are detrimental to relationship lending in markets where large and out-of-market banks are predominant. On the contrary, where relational-based lending technologies are already widely in use in the market by a large group of small mutual banks, an increase in competition may drive banks to further cultivate their extensive ties with customers.

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1   Introduction

Even if the banking industry is going global, relationship lending is still perceived as an essential feature of small business finance, not only in the European or Japanese bank-based system, but also in market-oriented systems, such as the US. The bulk of the literature focuses on the effects of exclusive bank-firm ties on lending conditions, while relatively few contributions have investigated what influences relationship lending, and particularly how credit market competition affects bank orientation (transactional versus relational lending)[1].

On the theoretical level, the effect of competition on bank orientation is ambiguous. For those who emphasize the investment nature of relationship lending it is natural to argue that competition and relational lending are die-hard foes. Market power is a necessary condition for banks to extract the informational rent generated by investing specific resources in the relationship with borrowers (Mayer, 1988; Rajan, 1992; Petersen and Rajan, 1995; Ogura, 2010). By contrast, for those who consider the strategic nature of relationship lending, competition and relational lending may be proved to be friends. Fierce competition from out-of-market banks (or in the arm's length market) may steer local banks to orientate their activities towards small, proximate and informationally opaque borrowers, boosting relational lending. In this way they can create a competitive edge that helps insulate themselves from pure price competition of outside banks (Boot and Thakor, 2000; Yafeh and Yosha, 2001; Dell'Ariccia and Marquez, 2004; Hauswald and Marquez, 2006).

The empirical evidence is mixed, with some studies finding a positive association between interbank competion and relationship lending (Petersen and Rajan, 1995; Fischer, 2000; Ogura, 2007, 2010), while others finding the opposite or no correlation between the two phenomena (Memmel *et al.*, 2007; Neuberger *et al.*, 2008). No studies, however, investigates the possibility that interbank competition has heterogeneous effects on relationship lending, depending on the structure of the local credit market. Influential steps in this direction were recently made by Elsas (2005) and Degryse and Ongena (2007), who explicitly allow for non-monotonic effects of market concentration on the likelihood of close bank-firm ties, by uncovering the existence of a U-shaped relationship. However, neither the investment nor the strategic theory of relationship lending predicts a U-shaped effect of market concentration (or competition) on the relational orientation of banks[2]. Moreover, Elsas (2005) and Degryse and Ongena (2007) fail to devise a complete explanation of why the strategic theory of relationship lending would hold for poorly concentrated market while the investment theory would hold for highly concentrated markets.

In this paper, we suggest that the non-monotonic effect of market concentration on relationship lending is not due to the degree of concentration *per se*, but to the interplay between market concentration and the type of competitors operating in the local credit market. More precisely, our research hypothesis is that what prevails between the in-

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[1]Degryse and Ongena (2008) and Strahan (2008) provides reviews of the literature on interbank competition, bank structure and lending policy

[2]On the contrary, the models developed by Dinc (2000) and Yafeh and Yosha (2001) predict that banks' investments in relationship lending reach their maximum with an intermediate number of banks and an intermediate level of competition.

vestment and the strategic theories of relationship lending depends on the organizational structure of the local banking system. When the credit market is dominated by highly hierarchical (large and functionally distant[3]) banks, market concentration favors close and extensive bank-firm ties. On the contrary, when the majority of branches belong to small, non-hierarchical local banks, it is stronger interbank competition (i.e., lower market concentration) which promotes relationship lending. The intuition for this conjecture is simple and has to do with the comparative advantages hierarchical and non-hierarchical banks can exploit when competition is tough (Berger and Udell, 2006). The former type of institution has a comparative advantage in transaction-oriented lending technologies, like financial statement lending, credit scoring or asset-based lending, due to scale economies in collecting, processing and assessing hard information, while it is disadvantaged at relationship lending due to organizational diseconomies in dealing with soft information. For opposite reasons, small institutions with few layers of management are comparatively advantaged at using subjective and non-codified information and establishing close lending relationships with information-intensive borrowers. In this view, greater interbank competition should encourage or discourage the use of relational-oriented technologies depending on the type of lending institution which predominates in the local market.

In what follows, we provide evidence for a large sample of small and medium sized Italian manufacturing firms, consistent with our hypothesis reconciling the investment and the strategic theories of relationship lending. Once we introduce in a regression model of relationship lending the interaction terms between market concentration and different measures of size, localism and distance of locally-operating bank branches, the U-shaped effect of HHI vanishes, while the non-linear effect of competition is driven by the organizational structure of the local banking system: competition and relationship lending are friends or foes according to who are the major competitors, small cooperative banks or large and distant banks.

The rest of the paper is organized as follows. In the next section, we discuss the theory laying behind the interplay of competition and organizational structure of banking systems in shaping bank-firm relationships. In Section 3, we describe our dataset, the estimation methodology and the variables. In Sections 4 and 5, we discuss the econometric results for the basic model and various robustness exercises. Finally, in Section 6 we draw some concluding remarks.

2 Bank competition, organization and orientation: background theory and evidence

2.1 How does bank competition affect bank orientation?

Interbank competition may have positive or negative influence on the relational orientation of banks according to the motives leading banks to form close relationships with borrowers.

Investing resources in a credit relationship, banks may aim at acquiring private information on the borrower and the opportunity to extract future profits from lending. In

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[3]By functional distance, we mean the distance between local branches (or subsidiaries) and the decisional centre (typically the headquarter) of their parent bank (Alessandrini *et al.*, 2005).

this case, if information acquisition is costly and takes time, harsher competition in the local credit market increases the likelihood of the borrower switching to another bank before the benefits from information production materialize, and makes lending relationships less valuable to banks and firms which are forced to write contracts that break even on a period-by-period basis (Mayer, 1988; Petersen and Rajan, 1995; Ogura, 2010). In addition, competition exacerbates the winner's curse effect, further weakening the banks' ex-ante effort to screen borrowers and build close lending relationships (Cao and Shi, 2000). Therefore, the empirical prediction of the *investment theory* of relationship lending is that extensive bank-firm ties and relational-based lending to small businesses are more frequent when the local credit market is more concentrated, regardless of the type of locally-operating banks[4].

In addition to extracting rents from borrowers, when banks and lending technologies are not homogeneous, banks may engage in relationship lending strategically. For instance, Boot and Thakor (2000) show that banks may decide to lend on a relational basis in order to create a competitive edge with respect to their rivals and insulate themselves from pure price competition. Yafeh and Yosha (2001) show that a greater competition in the arm's length market induces multi-product banks to engage more (less) in relationship lending if the number of active banks is sufficiently small (large). In addition they show that incumbent multi-product banks may strategically increase investment in relationship lending in order to reduce the demand and profits in the arm's length market and discourage the entry of a new competitor in this market. In a similar vein, Dell'Ariccia and Marquez (2004) and Hauswald and Marquez (2006) find that greater competition from out-of-market banks generates an increase in relationship lending on the part of local banks. Dell'Ariccia and Marquez (2004) develop a model in which a local lender has better information on borrowers than outside lenders, but potentially faces higher costs in extending a loan. In this framework, the informed lender has some degree of market power which allows him/her to informationally capture local borrowers. Hence, fiercer outside competition leads local lenders to reallocate more resources to the sectors most affected by adverse selection problems, leading to a *flight to captivity*. Hauswald and Marquez (2006) endogenize the production of information and stress the role of the bank-borrower distance, which reduces the quality of the creditworthiness signal. Given that banks acquire proprietary information on borrowers to soften lending competition and increase their market share, harsher competition decreases banks' incentive to generate private information, leading to reallocation of the loan portfolio towards more proximate borrowers.

The applied literature on the effects of interbank competition on bank orientation is somewhat limited and inconclusive. Empirical support for the investment theory of relationship lending is provided, for example, by Petersen and Rajan (1995), Fischer (2000) and recently by Ogura (2007, 2010). The former, using data on US small firms, found that young firms in concentrated markets receive more credit and pay lower interest rates than similar firms in competitive markets, with these differences vanishing as firms get older. In a similar vein, Ogura (2010) found that inside banks in the USA (banks hold-

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[4]A partial exception is Vesala (2005) who shows that the absolute benefits from being an inside bank have a U-shaped relationship with switching costs, considered an inverse measure of market competition. However, Vesala also shows that the relative benefits from being an inside rather than an outside bank monotonically increases with switching costs.

ing the majority of a firm's total checking account balances for more than one year) are willing to charge lower interest rates to young firms only if they operate in concentrated credit markets, thereby having the opportunity to establish an informational advantage over rivals. Such findings were broadly confirmed by Fischer (2000) for the German case, suggesting that competitive pressures in local credit markets discourage banks from acquiring costly information on opaque borrowers. More direct evidence is provided by Ogura (2007) who found that, in Japan, the number of competing banks and other measures of market competition are negatively correlated with the likelihood of lending on a relational basis which in turn increases credit availability for new firms.

By contrast, Neuberger *et al.* (2008) found only a weak or insignificant correlation between market concentration and relationship lending for Swiss small firms, while, consistent with the strategic theory of relationship lending, Memmel *et al.* (2007) found that, in Germany, competition in local credit markets is positively associated with relationship lending and that small banks are more likely to act as a relationship lender.

These studies do not allow for non-monotonic effects of market concentration on relationship lending. This possibility is analyzed by Elsas (2005) and Degryse and Ongena (2007). The former considers a sample of 122 large German firms borrowing from five major German banks, and considers a bank-firm rapport being relational on the basis of the banks' self-assessment of the *Hausbank* status. His findings indicate the existence of a U-shaped relationship between the Herfindahl-Hirschman index (HHI) of the local credit market at the registered head office of a firm (computed in terms of bank branches) and the likelihood of a relational bank-firm tie. Where the concentration of the credit market is low, the probability of a bank assuming *Hausbank* status decreases with a marginal increase in concentration. By contrast, where markets are very concentrated, a further increase in HHI raises the probability of a bank being the firm's *Hausbank*.

Degryse and Ongena (2007) build on the Elsas study, but adopt more objective measures of bank orientation, which reflect the duration and scope of the relationship, and rely on a much larger dataset of Belgian SMEs borrowing from a large national bank. Their findings confirm the U-shaped relationship between market concentration and the likelihood of bank branches engaging in relationship lending, although the vast majority of firms in their sample are located in postal zones where the correlation is negative. Moreover, the non-monotonic effect of market concentration is robust to control for the presence in the local credit market of banks with multiple contacts across other locations and for the distance of borrowers from both the lending branch and rival banks.

2.2 How does bank organization affect bank orientation?

Well received theoretical arguments indicate that bank size and organizational design influence its lending orientation and asset allocation (soft-information-based versus hard-information-based activities). The idea is that large and geographically dispersed banks are highly hierachized institutions, and that hierarchiness is associated with organizational diseconomies which place these banks at a disadvantage with respect to small, local banks in lending to information-intensive borrowers on a relational basis (Berger *et al.*, 1999; Berger and Udell, 2002; Stein, 2002). To the extent that relationship lending relies heavily on non-codified information, only available to opportunistic loan officers at the local level, the use of this lending technology entails serious communication and

agency problems across the bank organizational layers which may advise large and distant banks against it (Aghion and Tirole, 1997; Garicano, 2000; Scharfstein and Stein, 2000). On the one hand, a career-conscious loan officer anticipates that bank managers at the parent bank are unable to properly appreciate soft information he/she may gain during the relationship with borrowers and reduces his/her effort in producing it, while overinvesting in hard and verifiable information (Milbourn *et al.*, 2001). On the other hand, in order to avoid the formation of information rent and mitigate agency problems, loan officers are frequently asked to rotate within large banks and are discouraged from basing lending decisions on soft information (Hertzberg *et al.*, 2010).

Empirical evidence is broadly consistent with such theoretical predictions. A great number of studies, concerning different countries, document that big banks devote to small business lending a lower share of their resources (Berger and Udell, 1996; Sapienza, 2002; Degryse *et al.*, 2009b) and that, in turn, small firms are more likely to borrow from small banks (Berger *et al.*, 2005; Uchida *et al.*, 2008). Other studies show that functionally distant banks tend to pick up informationally transparent firms and are less prone to assist firms facing financial distress (Carter and McNulty, 2005; Mian, 2006; Alessandrini *et al.*, 2008; Canales and Nanda, 2008; Benvenuti *et al.*, 2009; Micucci and Rossi, 2009). Moreover, small firms located in markets with predominantly functionally distant banks are more likely to be credit-rationed and less inclined to introduce new technologies and products (Alessandrini *et al.*, 2009a,b).

A relatively small number of studies focus on the effect of bank size, distance and ownership structure on the lending technology. Cole *et al.* (2004) and Scott (2004) found that large banks in the USA rely heavily on hard information about firm financial statements in deciding on loan approvals, while small banks base their decisions also on soft information informally gathered through repeated face-to-face contacts with borrowers. In this vein, Frame *et al.* (2001) and Akhavein *et al.* (2005) reported that large, centralized banking organizations are more likely to use automated credit scoring technologies in small business lending, while Berger *et al.* (2005) found that small banks are better at using soft information as they lend at a lower distance and are more likely to employ personal modes of communication with their borrowers. The role of hierachical distance in influencing the importance of soft information in lending approval decisions is documented by Liberti and Mian (2009). In particular, focusing on the case-study of a large multinational bank operating in Argentina, they found that the soft-information sensitivity of credit facility is significantly lower when the credit line is approved at higher hierarchical levels, geographically distant from the office that collected information on the borrower. Finally, Angelini *et al.* (1998) and Delgado *et al.* (2007) showed that the bank lending orientation is influenced by its ownership structure, as savings and cooperative banks tend to specialize in small borrowers.

Looking directly at relationship lending, Berger *et al.* (2005) documented that credit relationships are longer-lasting and more exclusive when the lending bank is small-sized. Uchida *et al.* (2008) validated these results in the Japanese context, by showing that small banks tend to have closer ties and repeated contacts with their borrowers and lend at a shorter distance than large banks. Lastly, Angelini *et al.* (1998), Uzzi (1999) and Neuberger *et al.* (2008) found that localism and cooperative ownership is also positively associated with the relational orientation of banks due to the deeply embedded ties with the local economy, and the peer nexus between lenders and borrowers.

2.3 How do bank competition and organization intertwine?

If it is true that hierarchical and non-hierarchical banks have a comparative advantage in transactional and relational lending, respectively, then it is conceivable to expect that they will react to stronger competition by concentrating efforts and resources on their favorite lending technology. Therefore, if the local credit market is predominantly populated by hierarchical (large and distant) banks, interbank competition and relationship lending should be observed to be negatively associated. On the contrary, if the organizational structure of the local credit market is made up by non-hierarchical (small, local and cooperative banks), relationship lending should increase with competition. However, as far as we know, empirical evidence on the effects of the interplay of bank organizational structure and interbank competition in determining lending orientation is virtually lacking. Partial exceptions are Brevoort and Hannan (2004), Canales and Nanda (2008), Carbó-Valverde *et al.* (2009), Degryse *et al.* (2009a) Zarutskie (2010) who provide some useful indications consistent with the strategic use of bank orientation.

Brevoort and Hannan (2004) documented that the importance of physical proximity between banks and borrowers located in the US metropolitan areas has increased over the years 1997 to 2001, immediately after the Interstate Banking and Branching Efficiency Act was passed to remove interstate branching restrictions to banks and bank holdings and increase interbank competition (Rice and Strahan, 2009). If physical proximity entails informational proximity, Brevoort and Hannan (2004, p. 25) note, this finding is "consistent with the notion that as competition increases from lenders located outside the market, local lenders reallocate resources toward loans in which they enjoy a locational advantage".

In a similar vein, Degryse *et al.* (2009a) showed that the more rival banks are hierarchically organized and the more competitors' branches have real authority, the lower is the geographical reach of the lending branches and the greater is their orientation to physically proximate borrowers.

More in line with our empirical approach, Canales and Nanda (2008) investigate how centralized and decentralized (in terms of branch manager autonomy) banks in Mexico respond to interbank competition in local credit markets. The results they report indicate that where competition is harsher, decentralized banks tend to reallocate resources in favor of small and micro enterprises by reducing interest rates and increasing loans to this category of borrower. Similarly, Carbó-Valverde *et al.* (2009) found that when local credit markets are more contestable (i.e. the entrance of new competitors is greater) the negative impact of competition on credit availability to small businesses decreases. Finally, Zarutskie (2010) reveals that the deregulation of US banking markets has led banks to differentiate by focusing on products and technology for which they are at a competitive advantage over rivals. She found that large banks specialized in hard-information loans, such as real-estate backed loans, lowering interest rates and extending credit to more marginal borrowers. By contrast, smaller banks have reacted to deregulation by increasing the amount of unsecured commercial and personal loans, exploiting their ability to produce and use soft information, as suggested by the reduction in default on such loans.

3 Empirical setup

3.1 Data

The analysis is carried out on the eighth and ninth waves of the Survey on Manufacturing Firms ("Indagine sulle Imprese Manifatturiere") published by the Unicredit Group (formerly Capitalia). The Unicredit surveys collect a large set of information on a representative sample (stratified by firm size, industry sector and firm location) of Italian SMEs with 11–500 employees and the universe of firms with more than 500 employees over the period 1998-2003. From the original sample of 8,969 firms we exclude a number of observations for which there are missing values for relevant variables, such as location, industry and number of employees. We also control for consistency in some answers, especially concerning the number of banking relationships and the share of banking credit supplied by the main bank. Finally, we focus on SMEs, so that we drop from the sample very large firms with more than 500 employees. Thus, we end up with 4,121 observations.

Firm-level data are merged with indicators of credit market structure at the provincial level measured in the first year of the survey and calculated using Bank of Italy data on the number and geographical diffusion of bank branches[5]. Taking the province as the appropriate size of local credit markets is consistent with recent literature on the Italian banking system (Herrera and Minetti, 2007; Benfratello *et al.*, 2008; Alessandrini *et al.*, 2009b), given that, according to the Bank of Italy data, more than 90 percent of credit granted involves banks and firms located in the same province.

Finally, information on the asset size of banks was taken from Bilbank, a data set produced by the Italian Association of Bankers (ABI) collecting the balance sheets of Italian banks, while data on provincial value added and population are drawn from the National Institute of Statistics (ISTAT) database.

3.2 Empirical models and methodology

Relationship lending is a complex phenomenon, difficult to measure. In the empirical literature it has been proxied by different aspects, such as the firms' number of banks, the length and scope of the relationship, the share of loans supplied by the main bank and the lender's status of *Hausbank*.

Unlike Elsas (2005) and Degryse and Ongena (2007), our dataset is at the firm level and therefore we cannot use the *Hausbank* status as a measure of relationship lending. However, referring to the German case, Elsas (2005) showed that the bank's share of firm's total debt is significantly associated with the bank being a relationship lender, that is, with the self-assessment of the bank being a *Hausbank*, with good access to exclusive information about the firm and a good capacity to influence its management. By contrast, the duration of the bank-firm relationship is not related to the *Hausbank* status, while the number of banks seems to negatively affect the availability of information about the firm.

Therefore, in this paper we measure relationship lending by the share of banking

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[5]Italy is currently divided into 109 provinces, which are grouped into 20 administrative regions. However, since some provinces were recently constituted, we use the old classification of 95 provinces.

credit supplied to the firm by its main bank ($FINSHARE$)[6]. Moreover, as robustness, we also build a yes-or-no indicator of banks' relational orientation, $RELBANK$, that assumes the value of one if the firm obtains at least one third of bank credit from its main bank and has credit lines with no more than four banks, and the value of zero otherwise (see section 5.1)[7]. Once again, the choice of these cut-off values is based on the evidence provided by Elsas (2005) who shows that *Hausbank* borrowers maintain on average between 4 and 5 lending relationships simultaneously and that the share of total borrowers' debt financed by the *Hausbank* is 43 percent[8]. Therefore, the estimated model is:

$$
\begin{aligned}
RELATIONSHIP_{ijt} \quad = \quad & f(HHI_{jt}, HHI_{jt}^2, ORGMKTSTRC_{jt}, \\
& HHI \times ORGMKTSTRC_{jt}, FIRM_{it}, PROV_{jt}) \quad (1)
\end{aligned}
$$

where subscripts i, j and t indicate respectively the firm, the province where it is officially headquartered and the survey year; $RELATIONSHIP$ is, alternatively, $FINSHARE$ or $RELBANK$; HHI is the Herfindahl-Hirschman index; $ORGMKTSTRC$ are the market organizational structure variables; $FIRM$ and $PROV$ are firm- and provincial-level control variables.

Equation (1) is estimated either by a probit estimator, when relationship lending is measured by the dummy $RELBANK$, or by using the fractional logit estimator, when the dependent variable is $FINSHARE$. In the latter case, since the share of debt borrowed from the main bank is bounded between zero and one, the OLS linear regression is unsuitable for the $FINSHARE$ model because it cannot guarantee that the predicted values lie in the unit interval, like for binary data models. The standard solution of applying a logistic transformation to the dependent variable presents two main drawbacks. First, a linear model on the log-odds ratio could be estimated only when the dependent variables is strictly between zero and one[9]. Second, once the logistic transformation is applied, intensive computation is required to calculate $E(y|\mathbf{x})$. An alternative solution we follow in this paper, which does not require data adjustments

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[6]As a referee has noted, not only banks decide on their orientation towards relationship lending, but firms do so as well. In this vein, $FINSHARE$ might capture the firm rather than the bank orientation. While this ambiguity poses interpretation problems, broadly shared across the literature on relationship lending, in our model the problem of endogeneity is mitigated by the fact that the key independent variables are at the market level.

[7]The exact questions posed to firms in the Unicredit Survey were: (i) "Considering the bank debt equal to 100 at the end of (the last year of the survey), what was the share held by the main bank?"; (ii) "State the number of banks with which the firm had a credit relationship in (the last year of the survey)" (Capitalia, 2005).

[8]For banks which declare that they have good access to borrowers' inside information these values are 3.8, for the number of credit lines, and 44.8, for $FINSHARE$. Given the widespread practice of multiple lending across Italian firms (Detragiache *et al.*, 2000; Ongena and Smith, 2000), and the distribution of $FINSHARE$ and the number of lending banks in our specific sample (see Figure 1), we decided to be a little more conservative by slightly reducing both the cut-offs. To check the robustness of our findings, we also tried alternative, more and less restrictive, definitions of $RELBANK$, such as borrowing at least 40 (20) percent of total debt from the main bank and having credit lines with no more than 3 (5) banks, obtaining qualitatively the same results (available upon request).

[9]If $y = 1$ or $y = 0$, $log[y/(1 - y)]$ does not exist, and any procedure to adjust for the extreme values presents serious problems of approximation.

and allows for direct estimation of the conditional expectation, is the *fractional logit model* proposed by Papke and Wooldridge (1996). The fractional logit model consists in modeling the expected values of the share of the firm's debt held by the main bank as follows:

$$E(FINSHARE_i|\mathbf{X_i}) = \frac{exp(\mathbf{X_i}\hat{\beta})}{[1 + exp(\mathbf{X_i}\hat{\beta})]}$$

where $\mathbf{X_i}$ is the vector of explanatory variables, including firm-specific characteristics and banking market indicators. The parameters are estimated maximizing the Bernoulli log-likelihood function in order to get the consistent Bernoulli quasi-maximum likelihood estimator $\hat{\beta}$[10].

The dependent variables being $FINSHARE$ or $RELBANK$, for robustness we estimate equation (1) also with the simpler linear model, which, despite the limitations stated above, has the advantage of allowing for the interpretation of estimated coefficients as marginal effects.

Since our dependent variable is at the firm level, while key explanatory variables (i.e., interbank competition and organizational structure of banking systems) are at the market level, the assumption of independently distributed disturbances is not appropriate. In particular, under the more realistic assumption that the relationship lending indicator and the residual are independent across firms but are correlated across observations in the same province, the OLS standard errors can be proved to be biased downwards (Moulton, 1990; Petersen, 2009). Hence, we correct the variance-covariance matrix by clustering the standard errors at the provincial level [11].

Finally, we chose to estimate model (1) with pooled data, not exploiting the panel dimension, for two main reasons. First, the resampling rule followed in the survey provides that in each survey the panel consists of around one-third of firms from the previous wave and two-thirds of newly interviewed firms. As a consequence, estimations on an unbalanced panel would include a very large number of firms present in only one of the two waves (i.e. number of groups and number of observation would not differ so much), drastically reducing the degree of freedom of fixed effect estimations. Estimations on a balanced panel built on two waves would be run on a small number observations; in addition, as firms opt out of the panel in a non-random fashion, estimations would be biased due to the high degree of panel attrition (Nese and O'Higgins, 2007).

3.3   Variables

3.3.1   Market concentration and organisational structure variables

We use four different measures of the structure of local credit markets at the provincial level. The degree of concentration of provincial credit markets is measured by the standard Herfindhal-Hirschman index (HHI) calculated as the sum of the squared share

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[10]For applications of the fractional logit model to firm-level data see, amongst others, Hausman and Leonard (1997) and Wagner (2001).

[11]For robustness, we replicated all regressions with robust standard errors for heteroskedasticity excluding correction for cluster correlation and we found virtually identical results (they are available upon request).

of bank branches owned by each bank operating in the province[12]. Although the HHI index is not the only possible measure of market concentration, it remains the one most commonly used by both economists and antitrust regulators all around the world (Cetorelli, 1999; Cetorelli and Strahan, 2006), and its adoption allows us to directly compare our findings with the existing literature on competition and relationship banking (Elsas, 2005; Degryse and Ongena, 2007). However, the new empirical industrial organization literature has cast doubts on structural market concentration indexes as a measure of interfirm competition and suggests the use of model-based indicators, like the Lerner index or the Panzar-Rosse H statistic (Panzar and Rosse, 1987; Bresnahan, 1989), which take into account the observed firms' behavior. Therefore, for robustness we also reproduce our results using the H-statistic built at the provincial level (see Section 5.3).

The size and organizational structure of credit markets is measured by three different indicators which should capture the propensity of locally-operating banks to engage in relationship lending:

1. the functional distance of the local banking system from the local borrowers, computed as the number of branches in province weighted by the logarithm of 1 plus the kilometric distance between the province of the branch and the province where the parent bank is headquartered, over the total of branches in province ($F - DISTANCE$)[13];

2. the size structure of the local banking system, computed as the ratio of branches owned by large banks to the total, non-weighted number of branches operating in each province ($LARGE\ BANKS$), where a bank is classified as large if its total assets are more than 26 billion euros at 2003 prices[14];

3. the share of branches held by mutual banks in each province, which is a measure of the degree of localism and social embeddedness of provincial credit markets ($MUTUAL\ BANKS$).

We build banking system variables using information on the geographical distribution of branches of all the Italian banks. To partially take into consideration possible issues of reverse causality, they are calculated in the first year of each survey[15]. In 1998, there were 926 banks operating in Italy with a network of 26,301 branches; in 2001 these numbers

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[12]The index is standardized between 0 and 10 in order to have more readable coefficients.

[13]More precisely, the functional distance of the banking system from province j is reckoned as:

$$F - DISTANCE_j = \frac{\sum_{b=1}^{B_j}[Branches_{j,b} \times \ln(1 + KM_{j,z_b})]}{\sum_{b=1}^{B_j} Branches_{j,b}}$$

where B_j is the number of banks operating in province j, $Branches_{j,b}$ is the number of branches belonging to bank b in province j, and z_b is the province where the headquarter of bank b is located (Alessandrini et al., 2009b).

[14]This is the official definition of large banks adopted by the Bank of Italy. According to the Italian central banks, major banks have assets of over 60 billion euros, while medium banks have assets of between 9 and 26 billion euros. For robustness, we construct alternative measures of $LARGE\ BANKS$ including also medium banks or limiting the definition to the major banks. See Section 5.2

[15]We check the robustness of our findings taking the credit market variables in the year before the three-year period covered by each survey (results available upon request).

were 834 and 29,300, respectively. Of these branches, in 1998 (2001), 11,528 (11,951) belonged to out-of-province banks, 9,295 (11,128) to large banks and 2,800 (3,083) to mutual banks.

At the aggregate level, we expect the coefficients on the interaction terms $HHI \times F - DISTANCE$ and $HHI \times LARGE\ BANKS$ to be positive. Following the investment theory of relationship lending, the intuition is that a low interbank competition is a necessary condition to orientate large and functionally distant banks to lend on a relational basis. These types of banks have a competitive advantage in offering transactional products with respect to small, local banks, while they are at a disadvantage in relationship lending (Berger and Udell, 2002). Therefore they find it rewarding to engage in relationship lending only if market power allows them to extract additional future rents from investing resources in building extensive ties with borrowers.

However, by increasing the incidence of small mutual banks with a local vocation and comparative advantages in using soft information, it is more likely that, at the aggregate level, competition goes hand-in-hand with more relationship lending (i.e., the coefficients on the interaction terms between HHI and $MUTUAL\ BANKS$ are expected to be negative), consistently with the strategic theory of relationship lending (Dell'Ariccia and Marquez, 2004; Hauswald and Marquez, 2006).

3.3.2 Control variables

In model (1) we include a set of standard firm-specific characteristics and indicators of provincial economic development. In particular, we control for: (i) firm's age and age squared, measured by (one plus) the logarithm of the years from its inception (AGE); (ii) the number of workers employed in the firm, divided into four categories ($SIZE$); (iii) the riskiness of the firm, measured by the one-year probability of default as computed by the RiskCalc^{TM} Italy model developed by Moody's KMV ($RISK$)[16]; (iv) the efficiency of its production process, proxied by a dichotomous variable equal to one for firms which have received the international standard ISO 9000 for quality management systems ($ISO9000$); (v) the firm's degree of innovativeness, measured by a dummy variable which is equal to one for firms that made expenditures on R&D in the three-year period covered by each survey and zero otherwise ($R\&D$); (vi) the firm's degree of internationalization, measured by two dummy variables: $EXPORT$, equal to one when the firm sells part of its production abroad, and $OFFSHORE$, equal to one for firms realizing part of their production abroad.

Then we add the logarithm of the provincial real per capita value added in the first year of the survey ($VALUE\ ADDED$) as a control variable at the provincial level. Since economic and local financial development has proved to be highly correlated in Italy (Lucchetti *et al.*, 2001; Guiso *et al.*, 2004a), the introduction of $VALUE\ ADDED$ allows us to identify the true effect of the credit market structure on relationship lending. Finally, in all regressions we include wave and industry dummies to control for possible time and industry-specific effects on relationship lending.

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[16]The RiskCalc^{TM} model for one-year risk of default combines firm's financial statement ratios concerning profitability, leverage, debt coverage, growth, liquidity, activity ratios, size (Dwyer *et al.*, 2004). We thank Toni Riti of Unicredit for kindly providing us with the $RISK$ rating variable.

4   Results

4.1   Descriptive analysis

In Table 1 we report the definition and the sample statistics of the variables used in the regression analysis, while in Figure 1 we plot the kernel density of $FINSHARE$ and the sample distribution of the number of firms' banking relationships, on the basis of which we build the other dependent variable, $RELBANK$. Both the distributions are positively skewed. $FINSHARE$ (Panel (a)) has its mode in correspondence of firms collecting around one third of their total bank debt from the main bank. Only 114 firms (1.6 percent of the sample) borrow at least 90 percent of credit from the main bank, while the average (median) share of total debt funded by the main bank is 0.41 (0.35). Consistently, and in line with the standard evidence on Italy (Ongena and Smith, 2000), Panel (b) shows that multiple lending is a very frequent phenomenon in our sample, while single-bank relationships are very uncommon. Less than one percent of surveyed firms maintain an exclusive relation with a bank, eight percent of firms have credit relationships with two banks, 40 percent with no more than four banks and 42 percent with more than five banks. Finally, the dummy variable $RELBANK$ assumes the value of 1 for 32.2 percent of firms in our sample which, at the same time, collect more than one third of credit from the main bank and have contacts with no more than four banks.

The univariate relationship between market concentration and the two alternative measures of relationship lending is clearly non-monotonic. The share of credit supplied to the firm by its main bank and the likelihood of relationship lending ($RELBANK = 1$) is greater for companies headquartered in provinces where local credit markets exhibit a low or high degree of concentration (Table 2). These differences are statistically significant and, as regards the probability of observing relationship lending, also economically relevant, since $RELBANK$ is equal to 32% in highly competitive markets, decreases to 28 percent as long as concentration increases and than bounces back to 36% in more concentrated markets. By contrast, the average shares of debt with the main bank across the HHI distribution are not very dissimilar in magnitude.

Finally, in Table 3 we report correlations between the provincial values of HHI and of the organizational structure of the local banking system. As expected, the level of credit market concentration is positively correlated with the presence of out-of-market banks in the market and negatively correlated with the presence of small, mutual banks headquartered in the same province. By contrast, local market concentration is not significantly correlated with the share of large banks in the province. Although somewhat surprising, this result is driven by provinces in a single region (Sardinia) where a single local bank (Banco di Sardegna), not included in the group of large banks, opened and acquired a large number of branches during the sample period, thereby increasing HHI and decreasing $LARGE\ BANKS$.

4.2   The basic model

In Tables 4 and 5 we report regression results. In Table 4, columns 1 to 5 refer to the coefficients of the fractional logit estimates of equation (1) when the dependent variable is $FINSHARE$, while columns 6 to 10 report the average partial effects (APEs) of the

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probit estimates in which the dependent variable is the dummy $RELBANK$. Given the problems related to estimating the marginal effects in non-linear models in which interactions are included, we calculate the correct APE for the interaction terms following the procedure outlined by Ai and Norton (2003) and implemented by Norton *et al.* (2004). For robustness, in Table 5 we report the OLS coefficients of a linear regression of equation (1) when the dependent variable is, alternatively, $FINSHARE$ (columns 1-5) and $RELBANK$ (columns 6-10). This set of estimates provides results qualitatively and quantitatively similar to those presented in Table 4. Thus, in the following we will discuss separately the effects of control variables and, in greater depth, of the key banking variables, referring to the two models reported in Table 4.

4.2.1 Control variables

In all specifications, regardless of the dependent variable and econometric methodology we use, coefficients on control variables are fairly robust in sign, value and statistical significance and hence we can comment on them once and for all.

As we expected, the exclusivity of ties with the main bank significantly decreases with the size of the firm as well as with the efficiency of the production process ($ISO9000$), which could be both considered as proxy of the firm informational transparency. According to the estimates reported in column 1, for very small enterprises (employing between 11 and 20 workers) almost half (45%) of their banking credit is granted by their main bank, while this share shrinks to about 33% for medium firms employing between 260 and 500 workers. Firms whose production process is ISO 9000 certified have, all else equal, a value of $FINSHARE$ one percentage point smaller than non-certified firms. By contrast, AGE and AGE^2 are not statistically associated with the share of firm debt held by the main bank.

Consistent with the descriptive analysis of our sample, companies which invest in R&D receive a 1.4 percent smaller share of their credit from the main bank[17]. In the same way, firms that operate abroad producing ($OFFSHORE$) or selling ($EXPORT$) part of their output raise a lower share of their total debt from their main bank. The effect is somewhat larger for offshoring firms, for which the decrease in $FINSHARE$ is equal to 2.5 percentage points, than for exporting firms. A similar negative impact on the exclusiveness of the bank relationship is produced also by firm's riskiness, even if the economic effect is quite small: $FINSHARE$ for a risky firm (at the third quartile of the sample distribution of $RISK$) is 0.4% smaller than for a safe firm (at the third quartile of the sample distribution of $RISK$). These results are partially at odds with predictions of the literature on relationship lending. Theoretically, more risky, innovative and abroad-oriented companies should benefit most from close bank ties and intertemporal loan contract design. Moreover, there is evidence showing that relationship lending fosters firms' innovation adoption (Herrera and Minetti, 2007) and internationalization (De Bonis *et al.*, 2008). However, our findings are consistent with the idea that firms that either engage in R&D or are active in international markets consist predominantly of solid and transparent firms which are less interested in maintaining exclusive relationships with a single bank (Bond *et al.*, 2003; Alessandrini *et al.*, 2009a), and with the evidence that

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[17]Firms investing (not investing) in R&D have a value of $FINSHARE$ equal to 38 (42) percent, and the difference is statistically significant at the 1 percent level of confidence.

riskier firms are more likely to maintain a long-lasting and wide-ranging relationship with their bank (Degryse and Ongena, 2007) and tend to borrow from a greater number of banks (Cosci and Meliciani, 2002; Guiso and Minetti, 2004).

Finally, as expected, transactional lending is more frequent in richer provinces, where the soundness of the economic and socio-economic structure increases firms' transparency (Ferri and Messori, 2000).

4.2.2 Market concentration and organizational structure variables

As regards the variables of interest, in the first and sixth columns we estimate a simple model in which, as in Elsas (2005), the only credit market indicator is the Herfindahl-Hirschman index of local credit market concentration, added both linearly and squared to allow for possible non-monotonicity. Even after controlling for provincial real value added, we are able to replicate the U-shaped relation between HHI and the strength of bank-firm ties found by Elsas (2005) and Degryse and Ongena (2007). The coefficients on HHI and HHI^2 are jointly significant and the schedule between market concentration and relationship lending reaches a minimum at an HHI of 1.37 and 1.52 depending on measuring relationship lending by, respectively, $FINSHARE$ or $RELBANK$[18]. These figures correspond to the 60th and 75th percentile of the HHI sample distribution and in any case they are well below the threshold of 1.8 typically used by the antitrust authorities to identify concentrated markets (Cetorelli, 1999)[19]. Thus, this preliminary result is consistent with a credit market in which the strategic and the investment theory of relationship lending coexist, the former at work in competitive markets and the latter in concentrated ones.

However, this relationship tends to lose significance once we control for the organizational structure of local credit markets (columns 2 and 7). When jointly considered, the linear and quadratic terms are significant, but the U-curve has a minimum at $HHI = 0.38$ in column 2, a value below the first percentile of the provincial distribution of HHI and well below the threshold of 1 identifying competitive markets, and at $HHI = 0.02$ in column 7. This implies that the relationship between HHI and relationship lending can be considered as almost strictly positive, supporting the investment theory of relationship lending. The coefficients on $F-DISTANCE$ and $MUTUAL\ BANK$ have the expected negative and positive signs but they are generally not significant, probably because of multicollinearity. $LARGE\ BANK$ has a positive and significant coefficient. Although somewhat surprising, this finding is consistent with the idea that size *per se* is not sufficient to explain the banks' preference for lending technologies and that the profitability of lending to small, opaque borrowers on a relational base is strongly affected by the competitive, institutional and social environments in which large or small banks operate (Berger and Udell, 2006; Berger *et al.*, 2007).

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[18]Figures are computed setting all other regressors to their unconditional sample means. It is interesting to note that Degryse and Ongena (2007) find the turning point at a very concentrated market structure ($HHI = 3.7$), while the schedule between market concentration and relationship is decreasing throughout most of the sample distribution.

[19]Recall that HHI is scaled between 0 and 10, such that the reported variations correspond to the actual threshold of $HHI = 1000$ and $HHI = 1800$ identified by antitrust authorities to discriminate between competitive, moderately concentrated and concentrated markets.

The sensitivity of the effects of market concentration on relationship lending to organizational structure variables clearly indicates that the non-monotonicity of HHI might hide a different sort of heterogeneity due to the type of banks operating locally. Hence, in columns 3-5 and 8-10 we add the interaction terms between HHI and, alternatively, the three indicators of market organizational structure. On the whole, our results suggest that a marginal increase in credit market concentration can positively affect the relational orientation of banks only when the local market is populated by a sufficiently large number of branches owned by large and functionally distant banks, which are at a disadvantage in relationship lending. By contrast, the strong presence of mutual banks, which largely adopt relationship-based lending technologies, makes concentration inimical to relationship lending. These findings reconcile the investment and strategic theory of relationship lending or, rather, they indicate that close bank-firm ties tend to develop either where transaction lenders have enough market power to informationally capture their customers or where relational-based loans can be used as a competitive edge in markets patrolled by local banks.

Going into details, when we interact HHI with $F - DISTANCE$, the coefficient on the squared term of market concentration loses statistical significance in favor of the interaction term while the coefficient on $F - DISTANCE$ assumes statistical significance. The fractional logit estimates (column 3) show that in provinces where the value of $F - DISTANCE$ is above (below) 2.8, a value close to the fourth decile of its provincial distribution, the effect of market concentration on $FINSHARE$ is positive (negative). On the contrary, after interacting HHI with $MUTUAL\ BANKS$ (column 5), the marginal impact of concentration on $FINSHARE$ appears to be positive only in provinces where the market share of mutual banks is less than 7 percent, which is true in 41 out of 95 provinces over the sample period, while it proves negative as long as the degree of localism increases. The estimates of the probit model (columns 8 and 10) provide qualitatively similar findings, even if the cutoff for $MUTUAL\ BANKS$ is lowered to 5 percent, a threshold which still includes around one third of Italian provinces.

Unlike the previous results, the inclusion of the interaction between HHI and the share of large banks (columns 4 and 9) does not wipe out the statistical significance of the quadratic term of market concentration, even if the point estimates provide evidence for a differentiated impact of competition on relationship lending according to the presence of large banks. Considering the fractional logit estimates, in markets where the share of branches owned by large bank is around 15 per cent (the first quartile of the provincial distribution of $LARGE\ BANKS$) the convex curve has a minimum in correspondence of a very high value of HHI (2.16, above the 90° percentile), such that the basic relation can be considered negative. However, when we consider provinces where the market share of large banks is sufficiently high – greater than 46 percent, as in Turin or Rome (where almost one fourth of firms in our sample operate) – the relationship between concentration and relationship lending is strictly positive, since the minimum of the curve occurs for a value of HHI lower than the minimum of its sample distribution. Very similar results also hold for the probit model.

4.3 The impact of credit market structure on relationship lending

To gauge the economic impact of the credit market structure on relationship lending, Figures 2 and 3 display the relation between HHI and $FINSHARE$, in left-hand diagrams, and between HHI and $RELBANK$, in right-hand diagrams, on the basis of coefficients reported in Table 4. Besides being statistically not robust to controlling for the organizational structure of local credit markets, the U-curve in Figure 2 is also slightly convex. In other words, the economic magnitude of the average effect of HHI on relationship lending that we find is small, much more so than that reported by Degryse and Ongena (2007) for Belgium[20].

However, the negligible average impact that interbank competition has on relationship lending hides significant, but heterogeneous economic effects. Figure 3 plots the schedules for HHI taking the organizational structure variables at the first (the continuous lines) and third quartile (the dotted lines) of their provincial distribution. As we stated above, once we take into account the type of locally-operating banks, the U-shaped relation between HHI and relationship lending tends to vanish and the schedules are increasing or decreasing depending on the type of banks operating in the relevant market. It is interesting to note that the two curves in the diagrams tend to cross at values of HHI close to one, suggesting that the organizational structure of the local banking system matters either in very competitive or in very concentrated markets.

If we condition the effect of HHI to the functional distance of the banking system in the province (Figure 3, panels (a) and (b)), a theoretical shift from a competitive market ($HHI = 1$) to a concentrated one ($HHI = 1.8$) lowers the probability of observing relationship lending by two percentage points, from 30% to 28%, in provinces where the banking system is functionally close[21], while it increases that probability to 37% in provinces where the banking system is functionally distant (a 23% increase in relative terms). Therefore, the net effect of a shift from competition to concentration on the likelihood of establishing a bank-firm relationship in two markets characterized by, respectively, the presence of many functionally close and distant banks is 9 percentage points. The economic impact of a change in HHI on the intensity of relationship lending is significant even considering the actual variations in market concentration in Italian provinces between 1998 and 2003. For instance, a reduction in HHI of 0.9, as happened in the province of Enna where banks are functionally distant ($F-DISTANCE = 4.42$), is associated with a 8.5% decrease in the probability of relationship lending (from 42%

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[20]Although the different definitions of relationship banking used in these studies make any direct comparisons difficult, differences in the datasets and relevant markets can help to explain such divergent findings. First, Degryse and Ongena (2007) analyze the case of a single national bank likely following a single orientation strategy in response to stronger competition. By contrast, our dataset is at the firm level and considers relationships with all possible types of banks (large and small, national and local, mutual and commercial), each reacting in its own way to changes in interbank competition. Second, the importance of close bank ties in Italy is lower than in Belgium, as testified by the greater propensity to multiple banking of Italian firms (Detragiache *et al.*, 2000; Ongena and Smith, 2000). Third, Degryse and Ongena consider the postal zone as the relevant market, while in our paper the relevant market is the province which includes a great number of postal zones.

[21]In relative terms this effect is not much lower than that found by Degryse and Ongena (2007). Precisely, they find that an increase of HHI from 1 to 1.8 leads to a 8.6% diminution in the probability of relationship banking (from 0.69 to 0.63), while we find that this effect is 6.6%.

to 33.5%). By contrast, a similar variation in market concentration (-0.7) in a province, such as Teramo, where the banking system is functionally close, is associated with a 4% increase in $RELBANK$ (from 22.6% to 26.5%).

These effects are opposite, but smaller in magnitude, when we interact interbank competition with the presence of mutual banks (Figure 3, panels (e) and (f)). In this case, as a result of the same shift from a competitive to a concentrated market $RELBANK$ passes from 30% to 31% in markets where $MUTUAL\ BANKS$ is equal to 4%, while it decreases to 27% in provinces where the market share of mutual banks is 15%, with a net effect on the probability of relationship lending of 4 percentage points.

Finally, a similar aggregate effect is observable when we make the schedules conditional upon the size of banks in the market (Figure 3, panels (c) and (d)). However, in this case, this effect results from a small increase (from 29% to 29.6%) in $RELBANK$ where large banks predominate ($LARGE\ BANKS$ equal to the third quartile of its provincial distribution) and from a greater reduction in the probability of relationship lending (from 27% to 23.7%) in markets with a limited presence of large banks.

If we look at the continuous measure of the intensity of relationship banking, $FINSHARE$, the magnitude of the economic impact of interbank competition is somewhat smaller, but qualitatively identical. In provinces where the banking system is functionally close, a theoretical shift from the average competitive market ($HHI < 1$) to the average concentrated one ($HHI > 1.8$) lowers the share of credit supplied by the main bank from 40.8 to 39.2 percent. By contrast, the same variation of HHI in provinces whose credit markets are dominated by functionally distant banks ($F - DISTANCE$ equal to the third quartile of its provincial distribution) increases the likelihood of strong bank-firm ties from 39.8% to 43.2%. Similarly, moving from a competitive to a concentrated credit market reduces the $FINSHARE$ from 40.4 to 39.1 percent in markets with a limited presence of large banks, while when large banks predominate ($LARGE\ BANKS$ equal to the third quartile of its provincial distribution), a shift from competition to concentration would be associated to an increase in the measure of relationship lending from 40.5 to 42 percent. Finally, in local markets where $MUTUAL\ BANKS$ is equal to 4% (15%) a shift from competitive to concentrated markets increases (reduces) $FINSHARE$ from 40.5 (40.7) to 41.9 (39.6) percent.

5   Robustness

We control the validity of our main findings undertaking a number of robustness checks. First, results do not change significantly across different samples and on changing the set of firm-specific control variables. Namely, we limited our analysis to SMEs with less than 250 employees and we controlled for the firms' return on assets, volume of sales, alternative measures of propensity to innovate, juridical status and affiliation to interfirm groups and consortia. On the top of that, we addressed more specific concerns regarding the econometric methodology, the bank organizational variables and the measure of market competition. Given that the adoption of $FINSHARE$ and $RELBANK$ provides qualitatively similar results, in the following we concentrate exclusively on the former as

a dependent variables[22].

5.1 Alternative testing for non-linearities

Throughout the paper we modeled the non-monotonic effect of credit market concentration on relationship lending by adding a quadratic term for HHI. However, imposing a quadratic functional form could lead to erroneously accept the hypothesis of a U-shaped relationship, because the estimated minimum point can be outside the data-range and, especially, because the significance of the quadratic term may be driven by a few extreme values. Therefore, we address these concerns in two alternative ways. Firstly, we adopt a less parametric approach, estimating a linear spline with one discontinuity point (Marsh and Cormier, 2002):

$$
\begin{aligned}
Y_{ij} &= f(HHI_j, (HHI_j - HHI_T) \times I_T, ORGMKTSTRC_j, \\
&\quad FIRM_i, PROV_j)
\end{aligned}
\tag{2}
$$

where I_T is an indicator function such that:

$$
I_T = 0 \text{ if } HHI_j < HHI_T \text{ and } I_T = 1 \text{ if } HHI_j > HHI_T
\tag{3}
$$

In order to avoid any arbitrariness we chose the threshold HHI_T estimating equation (2) by OLS with all possible discontinuity points of HHI and retaining the one which maximizes the overall adjusted R^2. Following this approach, we can set HHI_T at 0.975, very close to the antitrust threshold separating competitive and concentrated markets and somewhat smaller than the minimum of the U-shaped curve estimated in Table 4. As illustrated by columns 1 and 3 in Table 6, consistent with results from quadratic specification, in competitive markets, fiercer interbank competition is associated with an increase in relationship banking, while in moderately concentrated and in concentrated markets interbank competition is associated with lower values of $FINSHARE$.

Further confirmation of the presence of a U-shaped relationship between market concentration and our measure of relationship lending is provided by the estimation of a fractional polynomial model with two power terms of HHI (Royston and Sauerbrei, 2008). As reported in Table 6 (columns 2 and 4), among the 44 possible combinations, the best-fitting fractional polynomial powers of HHI are -2 and +2[23]. Figure 4 maps the resulting fit and the 95% confidence interval, both for the fractional logit (panel (a)) and for the linear model (panel (b)). The inspection of regression results and the diagrams clearly confirm the presence and significance of a U-shaped relation between market concentration and relationship lending.

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[22]Robustness results are generally similar when $RELBANK$ is taken as dependent variable, but they are not shown to save space. For the same reasons, in the following robustness tables we do not show the coefficients on the control variables, which are similar to the ones discussed in section

[23]We also estimated a fractional polynomial of degree three, but the results did not significantly differ from those reported with two power terms.

5.2 Alternative measures for credit market variables

Beside bank size and organization, the theoretical and empirical literature has suggested other characteristics of local credit markets as possible drivers of bank orientation. In particular, bank interaction across local credit markets would be a factor facilitating coordination amongst rival banks and restraining price undercutting competition (Heggestad and Rhoades, 1976; Bernheim and Whinston, 1990)[24]. If this is true, then, following the rationale of the investment theory of relationship banking, banks may have incentives to invest in relation-specific assets in order to establish exclusive ties with borrowers (Anand and Galetovic, 2006).

Recently, Degryse and Ongena (2007) corroborated this theoretical prediction finding that multiple contacts of banks across markets are positively associated with the probability of relationship lending. We therefore augmented model (1) with the inclusion of a provincial measure of multi-market contacts (MMC) that, for reasons of comparability, exactly follows Degryse and Ongena (2007, pp. 408-409)[25]. MMC is strongly correlated with market concentration and with the organizational variables: correlation indexes computed by provinces are 0.56 with HHI, 0.16 with $F-DISTANCE$, 0.46 with $LARGE\ BANKS$ and -0.48 with $MUTUAL\ BANKS$, all statistically significant at the 5 percent level.

For the sake of space, we only report results for the basic specification, without interaction terms (Table 7, columns 1 and 4). The effect of of MMC on relationship lending is not statistically different from zero and its inclusion does not affect the other coefficients[26]. Even if in contrast with the evidence discussed by Degryse and Ongena (2007), this result is consistent with the lack of evidence supporting the multi-market contact hypothesis in the Italian banking market (De Bonis and Ferrando, 2000).

Further robustness checks concern the definitions of functional distance and size structure of the local banking system. So far, we have assumed that agency problems inside the bank organization which makes relationship lending more costly increases with physical distance between the loan officer and the headquarter. However, organizational diseconomies also depend on the branch-headquarter cultural distance, i.e., on trust, norms and cultural affinities between local loan officers and bank's managers at the parent bank (Alessandrini *et al.*, 2008). In this view, we build an alternative measure of functional distance ($F-DISTANCE\_SC$) according to which bank branches are weighted by the difference in social capital between the provinces where the branch and its headquarter

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[24]Multi-market contacts may also have pro-competitive effects, because banks may strategically decide to lend more than the optimal level in one market to reduce competition in others (Mester, 1987) or because of their funding advantages (Park and Pennacchi, 2009).

[25]In their turn, Degryse and Ongena follow Evans and Kessides (1994), who suggest calculating MCC as the sum of all bank pairs in the borrower's credit market (in our case the province) weighted by the relative frequency of their bilateral contacts in other markets (provinces):

$$MMC_j = \frac{2}{95 \cdot f_j \cdot (f_j - 1)} \sum_{k=1}^{B} \sum_{l=k+1}^{B} a_{k,l} D_{k,j} D_{l,j}$$

where $i = 1, ..., B$ are the banks, $j = 1, ..., 95$ are the provinces, f_j is the number of banks operating in province j, $D_{i,j} = 1$ if bank i operates in province j, and $a_{k,l} = \sum_{j=1}^{B} D_{k,j} D_{l,j}$.

[26]This is also true when we include interactions between HHI and bank organizational variables and even when we consider the interacted term $HHI \times MMC$.

are located (Alessandrini *et al.*, 2009b)[27].

A second refinement relates to the bank-asset threshold used to define the size structure of the local banking system. In particular, we replicate regressions substituting *LARGE BANKS* with *MEDIUM BANKS*, the share of branches in the province owned by medium-sized banks, where a bank is classified as medium if its total assets are more than 9 billion euros at 2003 prices (see above footnote 11).

As shown in Table 7, columns 2-3 and 5-6, estimation results are virtually unchanged with regard both to the banking and the firm-specific variables. It is worth noting, however, that the importance of functional distance of the local banking system in promoting relationship lending and in shaping the effect of market concentration is higher when it is measured in terms of social capital rather than in terms of kilometers. By contrast, the effects of the size of the local banking system on relationship lending are found to be lower when we include medium banks in the size index.

5.3   An alternative measure for market competition

By measuring market rivalry with the Herfindhal-Hirschmann index, we have implicitly espoused a structural approach to competition on the track of the structure-conduct-performance paradigm. In reaction to the theoretical flaws of this paradigm, the so-called New Empirical Industrial Organization literature has suggested measuring the degree of competition in the market by looking at the (estimated) behavior of firms. In particular, a widely used non-structural measure of competition is the H-statistic introduced by Panzar and Rosse (1987)[28].

The H-statistic is the sum of the elasticities of a bank's revenues (R) with respect to m input prices (w),

$$H \;=\; \sum_{k=1}^{m} \frac{\partial R}{\partial w_k} \frac{w_k}{R}$$

and, on real data, it is calculated by summing the estimated coefficients of a log-log reduced form revenue equation. Under the assumption that the market is in a long-run equilibrium, Panzar and Rosse (1987) prove that values of the statistic $H \leq 0$ are consistent with the case of firms operating as monopolists or under a monopolistic cartel, values $0 < H < 1$ are consistent with the case of monopolistic competition and $H = 1$ with the case of perfect competition.

In this paper we draw the H-statistic ($H - STAT$) at the provincial level in 1998 and 2001 from Agostino and Trivieri (2009)[29]. Then, we build three dummy variables for

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[27]To be precise, social capital is computed as the average voter turnout at the 21 referenda held in Italy in 1993, 1995 and 2001 as published by the Home Department. The same results hold if we use the number of blood bags per million population voluntarily donated in each province to the Italian Association of Blood Donors (AVIS) in 1995 (Guiso *et al.*, 2004b).

[28]In the banking literature, the H-statistic has been recently employed, amongst others, by Bikker and Haaf (1998), Claessens and Laeven (2005), and, with regard to Italy, by Agostino and Trivieri (2009) and Coccorese (2009).

[29]We thank Mariarosaria Agostino and Francesco Trivieri for sharing their dataset and estimation procedure generously with us. Refer to their paper for details on the revenue equations at the provincial level and on the statistical validation of the long-run equilibrium assumption.

perfectly competitive, imperfectly competitive and monopolistic credit markets, respectively: (i) $H-STAT_{PC}$ which assumes the value of 1 when we cannot reject the null that the sum of price elasticities is equal to one; (ii) $H-STAT_{MC}$ which assumes the value of 1 when we reject at 10% level of confidence the null hypotheses that the sum of the estimated price elasticities of revenue is equal to zero (i.e., $H-STAT = 0$) and equal to one (i.e., $H-STAT = 1$); (iii) $H-STAT_M$ which assumes the value of 1 when we cannot reject the null that the sum of price elasticities is equal to zero[30].

Estimation results are reported in Table 8, where $H-STAT_{PC}$ is taken as the reference category. First, the stability of all our findings relative to control and bank organizational variables testifies that our model of relationship banking is robust to the measure of interbank competition. Second, the coefficients on $H-STAT_{MC}$ and $H-STAT_M$ are both positive, highly significant and virtually identical in magnitude (columns 1 and 5). Consistent with the investment theory of relationship lending, this result indicates that interbank competition reduces the possibility and/or the convenience of establishing exclusive ties with borrowers and lend on a relational base. However, when we consider the interplay between competition and the organizational structure of the local banking system (columns 2-4 and 6-8), we also have clear confirmation that the beneficial impact of bank market power on relationship lending only holds in markets where the presence of large and functionally distant banks predominates (the interaction terms between the $H-STAT_M$ dummy and $MUTUAL\ BANKS$ has the right negative sign but is not statistically significant). On average, the share of credit supplied by the main bank is 2.5 percentage points larger in monopolistic than in competitive markets. This effect vanishes in local credit markets with a small share (15%) of branches owned by large banks and where banks are functionally close, while it is twice as large in credit markets with a dominant share of branches belonging to large banks (46%) or to functionally distant banks ($F-DISTANCE$ equal to the third quartile of its provincial distribution).

6 Concluding remarks

The current global financial crisis is affecting the structure of local credit markets, via government interventions and bank mergers and acquisitions, and it is bringing exclusive and stable lending relationships with borrowers back to the center of banks' business models. Relationship-based technologies appear to be of great value both for banks, which are refocusing their activities on their core business, and for small-medium enterprises (SMEs), whose financial needs are more urgent in times of widespread distress[31]. However, deregulation and improvement in communication technologies has also made credit markets more competitive, the incidence of large and geographically dispersed banks more pervasive and transactional lending more profitable. Is relationship lending going to survive these changes? How does interbank competition and the organizational

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[30]On the base of the Vesala's (1995) demonstration that the H-statistic is increasing with demand elasticities, in the few cases in which the F-statistics did not reject both the hypotheses of equality to one and equality to zero of price elasticities, we considered the provincial credit market as perfectly competitive, imperfectly competitive or monopolistic according to whether $H-STAT < 0.25$, $0.25 \leq H-STAT \geq 0.75$, or $H-STAT > 0.75$.

[31]On the value of relationship lending on Korean SMEs during the 1997 financial crisis, see Ferri *et al.* (2001).

structure of local banking systems affect the exclusiveness of bank-firm relationships?

Theoretical predictions on the impact of interbank competition on relationship lending are contrasting. According to the investment theory of relationship lending, as the credit market concentration increases, the firms' borrowing options shrink, giving banks the opportunity to recoup in the course of the lending relationship the specific investments needed to build extensive ties with a firm. On the other hand, following the strategic theory of relationship lending, fiercer interbank competition drives local lenders to take advantage of their specific knowledge of local economies as a competitive edge, reorienting their lending activity towards relational-based loans to small, local firms.

Hence, to establish whether relationship lending can survive competition is essentially an empirical matter. In two recent papers, Elsas (2005) and Degryse and Ongena (2007) documented a non-linear U-shaped effect of market concentration on relationship lending which cannot be easily accommodated with theory. In this paper we show that this non-monotonicity can be explained by the organizational structure of local credit markets. Marginal increases in interbank competition are detrimental to relationship lending in markets where large and out-of-market banks are predominant. On the contrary, where relational-based lending technologies are already widely in use in the market by a large group of small mutual banks, an increase in competition may drive banks to further cultivate their extensive ties with customers.

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A Tables

Table 1: Definition of variables and sample statistics

Variable Name	Variable Definition	Mean	St.Dev.
	DEPENDENT VARIABLES		
$FINSHARE$	The share of banking credit supplied to the firm by its main bank. Source: Unicredit Surveys.	0.406	0.199
$RELBANK$ (0,1)	= 1 if the firm obtains more than 33 per cent of banking credit from its main bank and has credit lines with no more than four banks. Source: Unicredit Surveys.	0.322	0.467
	MARKET ORGANIZATIONAL STRUCTURE VARIABLES		
HHI	Summed squares of bank market shares by number of branches in the province (ranging from 0 to 10). Source: Bank of Italy.	1.119	0.493
$F-DISTANCE$	The ratio of branches weighted by the logarithm of 1 plus the kilometric distance between the province of the branch and that where the parent bank is headquartered, over total branches in the province. See also footnote 9. Source: Bank of Italy.	2.731	0.876
$LARGE\ BANKS$	The ratio of branches owned by large banks (assets > €26 bn) to the total number of branches operating in each province. Source: Bank of Italy.	32.378	16.203
$MUTUAL\ BANKS$	The ratio of branches owned by mutual banks to the total number of branches operating in each province. Source: Bank of Italy.	10.148	8.864
$H-STAT$	The Panzar-Rosse H-statistic calculated at the provincial level. It is divided into three categories: monopoly (M, $H-STAT \leq 0$), monopolistic competition (MC, $0 < H-STAT < 1$) and perfect competition (PC, $H-STAT = 1$). Source: Agostino and Trivieri (2009).	0.414	0.350
$F-DISTANCE\_SC$	The ratio of branches weighted by the logarithm of 1 plus the cultural distance between the province of the branch and that where the parent bank is headquartered, over total branches in the province. See also footnote 22. Source: Bank of Italy.	0.856	0.451
$MEDIUM\ BANKS$	The ratio of branches owned by medium banks (assets > €9 bn) to the total number of branches operating in each province. Source: Bank of Italy.	59.722	19.176
MMC	A measure of multi-market contacts. See Degryse and Ongena (2007). Source: Bank of Italy.	0.241	0.127
	CONTROL VARIABLES		
$SIZE$	The number of firm's workers, divided into four categories: 11-20, 21-50, 51-250, 251-499 employees. Source: Unicredit Surveys.	61.563	75.307
$RISK$	The firm's one-year risk of default. Source: RiskCalc^{TM} (Dwyer et al., 2004)	0.013	0.021
AGE	The logarithm of 1 plus the years from the firm's inception. Source: Unicredit Surveys.	3.079	0.651
$ISO9000$ (0,1)	= 1 if the firm is ISO 9000 certified by the International Organization for Standardization. Source: Unicredit Surveys.	0.471	0.499
$R\&D$ (0,1)	= 1 if the firm made expenditures on Research and Development in the three-year period covered by each survey. Source: Unicredit Surveys.	0.435	0.496
$OFFSHORE$ (0,1)	= 1 if the firm realizes part of its production abroad. Source: Unicredit Surveys.	0.046	0.210
$EXPORT$ (0,1)	= 1 if the firm sells part of its production abroad. Source: Unicredit Surveys.	0.717	0.450
$VALUE\ ADDED$	the logarithm of the provincial real per capita value added in the year before the survey. Source: ISTAT (National Institute of Statistics).	9.879	0.241

Notes: Elaboration over the sample drawn from the Eight and Ninth Surveys of Manufacturing Firms (Capitalia, 2005).

The number of observations amounts to 4,121.

Table 2: Distribution of $FINSHARE$ and $RELBANK$ across HHI

	$FINSHARE$	$RELBANK$	Obs.
$HHI = 1°$ quintile	0.405	0.320	1260
$HHI = 2°$ quintile	0.393*	0.281**	1197
$HHI = 3°$ quintile	0.405	0.338	739
$HHI = 4°$ quintile	0.430**	0.364**	571
$HHI = 5°$ quintile	0.419	0.367**	354
Whole sample	0.406	0.322	4,121

Notes: Numbers are obtained considering the sample of 4,121 firms used in the regression analysis. $FINSHARE$ is the share of bank credit supplied to the firm by its main bank. $RELBANK$ is a dummy variable which identifies firms that borrow more than 33 percent of credit from the main bank and have contacts with no more than four banks. (**) (*) indicate statistical significance at the 5% (10%) level of a one-tailed test of the null that the values of the 2°-5° quintiles of $FINSHARE$ and $RELBANK$ are equal to their values at the first quintile of the HHI provincial distribution over the period 1998-2003.

Table 3: Pairwise correlation

	HHI	$LARGE\ BANKS$	$F-DISTANCE$	$MUTUAL\ BANKS$
HHI	1.000			
$LARGE\ BANKS$	-0.039	1.000		
$F-DISTANCE$	0.179*	0.350*	1.000	
$MUTUAL\ BANKS$	-0.312*	-0.262*	-0.394*	1.000

Notes: Elaboration over the sample of 95 provinces and the sample period 1998-2003. (*) indicates statistical significance at the 5% level.

Table 4: Determinants of relationship lending

Dependent variable Estimator	FINSHARE Fractional Logit					RELBANK Probit				
	1	2	3	4	5	6	7	8	9	10
Market structure variables										
HHI	-0.057	-0.013	-0.161**	-0.218**	0.010	-0.068*	-0.001	-0.153***	-0.177***	-0.011
	[0.054]	[0.064]	[0.070]	[0.097]	[0.071]	[0.036]	[0.038]	[0.047]	[0.067]	[0.045]
HHI^2	0.021**	0.017*	-0.010	0.036***	0.011	0.022***	0.015***	-0.007	0.033***	0.014*
	[0.009]	[0.009]	[0.016]	[0.011]	[0.011]	[0.006]	[0.006]	[0.010]	[0.008]	[0.007]
$F-DISTANCE$			-0.079*					-0.058**		
			[0.042]					[0.025]		
$HHI \times F-DISTANCE$			0.066**					0.058***		
			[0.029]					[0.024]		
$LARGE\ BANKS$		0.003**		-0.003			0.003***		-0.001	
		[0.001]		[0.003]			[0.001]		[0.002]	
$HHI \times LARGE\ BANKS$				0.004**					0.003**	
				[0.002]					[0.002]	
$MUTUAL\ BANKS$		0.002			0.005**		0.003**			0.004***
		[0.002]			[0.002]		[0.001]			[0.001]
$HHI \times MUTUAL\ BANKS$					-0.005*					-0.004**
					[0.003]					[0.002]
Control variables										
$SIZE_{21-50}$	-0.134***	-0.134***	-0.136***	-0.134***	-0.133***	-0.114***	-0.116***	-0.116***	-0.113***	-0.113***
	[0.031]	[0.031]	[0.032]	[0.031]	[0.031]	[0.016]	[0.016]	[0.016]	[0.016]	[0.016]
$SIZE_{51-250}$	-0.335***	-0.335***	-0.338***	-0.335***	-0.335***	-0.309***	-0.312***	-0.309***	-0.309***	-0.308***
	[0.032]	[0.031]	[0.032]	[0.032]	[0.031]	[0.013]	[0.012]	[0.013]	[0.012]	[0.012]
$SIZE_{251-500}$	-0.476***	-0.475***	-0.476***	-0.473***	-0.473***	-0.367***	-0.370***	-0.364***	-0.367***	-0.364***
	[0.086]	[0.087]	[0.087]	[0.086]	[0.087]	[0.028]	[0.028]	[0.028]	[0.028]	[0.028]
AGE	-0.129	-0.112	-0.136	-0.119	-0.126	-0.054	-0.035	-0.059	-0.038	-0.053
	[0.116]	[0.114]	[0.117]	[0.114]	[0.118]	[0.062]	[0.059]	[0.062]	[0.059]	[0.062]
AGE^2	0.025	0.022	0.026	0.023	0.024	0.009	0.005	0.010	0.006	0.009
	[0.018]	[0.018]	[0.018]	[0.018]	[0.019]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]
$RISK$	-1.228**	-1.271***	-1.205***	-1.250***	-1.222**	-1.115***	-1.170***	-1.109***	-1.147***	-1.111***
	[0.494]	[0.484]	[0.491]	[0.489]	[0.494]	[0.282]	[0.282]	[0.284]	[0.287]	[0.285]
$R\&D$ (0,1)	-0.064**	-0.063**	-0.064**	-0.063**	-0.064**	-0.064***	-0.062***	-0.064***	-0.062***	-0.064***
	[0.028]	[0.029]	[0.029]	[0.029]	[0.029]	[0.014]	[0.014]	[0.014]	[0.014]	[0.014]
$ISO9000$ (0,1)	-0.046*	-0.051**	-0.047**	-0.050**	-0.045*	-0.069***	-0.076***	-0.071***	-0.075***	-0.069***
	[0.024]	[0.024]	[0.024]	[0.024]	[0.024]	[0.014]	[0.014]	[0.014]	[0.013]	[0.014]
$OFFSHORE$ (0,1)	-0.110*	-0.106*	-0.112*	-0.109*	-0.108*	-0.122***	-0.114***	-0.122***	-0.119***	-0.120***
	[0.059]	[0.058]	[0.058]	[0.059]	[0.059]	[0.040]	[0.040]	[0.040]	[0.041]	[0.040]
$EXPORT$ (0,1)	-0.085**	-0.083**	-0.082**	-0.083**	-0.086***	-0.085***	-0.083***	-0.082***	-0.083***	-0.085***
	[0.033]	[0.033]	[0.033]	[0.033]	[0.033]	[0.014]	[0.014]	[0.014]	[0.015]	[0.014]
$VALUE\ ADDED$	-0.243***	-0.201**	-0.277***	-0.177**	-0.237***	-0.122***	-0.027	-0.122**	-0.052	-0.116***
	[0.065]	[0.097]	[0.092]	[0.073]	[0.066]	[0.044]	[0.049]	[0.052]	[0.042]	[0.045]
Observations	4,121	4,121	4,121	4,121	4,121	4,121	4,121	4,121	4,121	4,121

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__Notes to Table 4__: The table reports regression coefficients (columns 1-5) and the average partial effects (columns 6-10) and, in brackets, the associated standard errors, clustered at provincial level. * significant at 10%; ** significant at 5%; *** significant at 1%. In columns 1-5 the dependent variable ($FINSHARE$) is the share of bank credit supplied to the firm by its main bank and the model is estimated by fractional logit, using the Stata 10 SE package with GLM command. In columns 6-10 the dependent variable ($RELBANK$) is a dummy equal to one if the firm obtains at least one third of banking credit from its main bank and has credit lines with no more than four banks and the model is estimated by probit, using the Stata 10 SE package with PROBIT command. The average partial effects reported in columns (6-10) are computed at sample means using the MARGEFF command, while the marginal effects of the interaction terms (columns 8-10) are computed by the INTEFF command (Norton *et al.*, 2004). In all specifications, the variable $SIZE$ is split into four categories, with the reference category being 11–20 employees. All regressions include industry and time dummies and a constant, not reported for reasons of space.

Table 5: Determinants of relationship lending – OLS estimates

| Dependent variable | FINSHARE | | | | | RELBANK | | | | |
| Estimator | OLS | | | | | OLS | | | | |
	1	2	3	4	5	6	7	8	9	10
MARKET STRUCTURE VARIABLES										
HHI	-0.014 [0.013]	-0.003 [0.015]	-0.039** [0.017]	-0.053** [0.023]	0.002 [0.017]	-0.070 [0.046]	-0.001 [0.048]	-0.159** [0.061]	-0.190** [0.084]	-0.009 [0.058]
HHI^2	0.005** [0.002]	0.004* [0.002]	-0.002 [0.004]	0.009*** [0.003]	0.003 [0.003]	0.023*** [0.007]	0.016** [0.007]	-0.008 [0.013]	0.035*** [0.009]	0.014 [0.009]
$F - DISTANCE$		-0.003 [0.005]	-0.019* [0.010]				0.005 [0.014]	-0.062* [0.033]		
$HHI \times F - DISTANCE$			0.016** [0.007]					0.062** [0.025]		
$LARGE\ BANKS$		0.001** [0.000]	-0.001 [0.007]	-0.001 [0.001]			0.003*** [0.001]		-0.002 [0.002]	
$HHI \times LARGE\ BANKS$				0.001** [0.000]					0.003* [0.002]	
$MUTUAL\ BANKS$		0.001 [0.001]			0.001** [0.001]		0.003** [0.002]			0.004** [0.002]
$HHI \times MUTUAL\ BANKS$					-0.001* [0.001]					-0.004** [0.002]
CONTROL VARIABLES										
$SIZE_{21-50}$	-0.033*** [0.008]	-0.033*** [0.008]	-0.033*** [0.008]	-0.033*** [0.008]	-0.033*** [0.008]	-0.111*** [0.020]	-0.112*** [0.020]	-0.112*** [0.020]	-0.110*** [0.020]	-0.110*** [0.020]
$SIZE_{51-250}$	-0.080*** [0.008]	-0.080*** [0.008]	-0.081*** [0.008]	-0.080*** [0.008]	-0.080*** [0.008]	-0.282*** [0.018]	-0.281*** [0.018]	-0.283*** [0.018]	-0.280*** [0.018]	-0.281*** [0.018]
$SIZE_{251-500}$	-0.112*** [0.019]	-0.111*** [0.019]	-0.112*** [0.019]	-0.111*** [0.019]	-0.111*** [0.019]	-0.315*** [0.032]	-0.314*** [0.032]	-0.315*** [0.032]	-0.312*** [0.031]	-0.313*** [0.031]
AGE	-0.031 [0.028]	-0.027 [0.027]	-0.033 [0.028]	-0.029 [0.027]	-0.030 [0.028]	-0.056 [0.076]	-0.039 [0.072]	-0.062 [0.076]	-0.042 [0.071]	-0.054 [0.076]
AGE^2	0.006 [0.004]	0.005 [0.004]	0.006 [0.004]	0.005 [0.004]	0.006 [0.004]	0.010 [0.012]	0.006 [0.012]	0.010 [0.012]	0.007 [0.012]	0.009 [0.012]
$RISK$	-0.291** [0.115]	-0.302*** [0.113]	-0.286** [0.115]	-0.297** [0.114]	-0.290** [0.115]	-1.085*** [0.304]	-1.146*** [0.304]	-1.075*** [0.306]	-1.123*** [0.310]	-1.079*** [0.306]
$R\&D$ (0,1)	-0.015** [0.007]	-0.015** [0.007]	-0.015** [0.007]	-0.015** [0.007]	-0.015** [0.007]	-0.052*** [0.014]	-0.050*** [0.014]	-0.052*** [0.014]	-0.051*** [0.014]	-0.052*** [0.014]
$ISO9000$ (0,1)	-0.011** [0.006]	-0.012** [0.006]	-0.011* [0.007]	-0.012** [0.006]	-0.011** [0.006]	-0.060*** [0.015]	-0.065*** [0.015]	-0.061*** [0.015]	-0.065*** [0.014]	-0.060*** [0.015]
$OFFSHORE$ (0,1)	-0.025* [0.013]	-0.024* [0.013]	-0.026* [0.013]	-0.025* [0.014]	-0.025* [0.013]	-0.080** [0.032]	-0.075** [0.032]	-0.081** [0.032]	-0.078** [0.033]	-0.079** [0.033]
$EXPORT$ (0,1)	-0.021** [0.008]	-0.020** [0.008]	-0.020** [0.008]	-0.020** [0.008]	-0.021** [0.008]	-0.078*** [0.017]	-0.075*** [0.017]	-0.075*** [0.017]	-0.075*** [0.017]	-0.078*** [0.017]
$VALUE\ ADDED$	-0.058*** [0.016]	-0.048** [0.023]	-0.067*** [0.022]	-0.042** [0.017]	-0.057*** [0.016]	-0.126** [0.059]	-0.033 [0.063]	-0.127* [0.070]	-0.054 [0.054]	-0.120** [0.060]
Observations	4,121	4,121	4,121	4,121	4,121	4,121	4,121	4,121	4,121	4,121
R^2	0.053	0.054	0.054	0.055	0.053	0.108	0.115	0.112	0.115	0.110

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Notes to Table 5: The table reports regression coefficients and, in brackets, the associated standard errors, clustered at provincial level. * significant at 10%; ** significant at 5%; *** significant at 1%. In columns 1-5 the dependent variable ($FINSHARE$) is the share of bank credit supplied to the firm by its main bank. In columns 6-10 the dependent variable ($RELBANK$) is a dummy equal to one if the firm obtains at least one third of banking credit from its main bank and has credit lines with no more than four banks and the model is estimated by probit, using the Stata 10 SE package with PROBIT command. The model is estimated by OLS, using the Stata 10 SE package with REG command. In all specifications, the variable $SIZE$ is split into four categories, with the reference category being 11–20 employees. All regressions include industry and time dummies and a constant, not reported for reasons of space.

Table 6: Alternative testing for non-linearities

Dep. Var.: $FINSHARE$	Fractional Logit		Linear Model	
	1	2	3	4
MARKET STRUCTURE VARIABLES				
$HHI_{<0.975}$	-0.170**		-0.041**	
	[0.082]		[0.020]	
$HHI_{>0.975}$	0.065**		0.016**	
	[0.028]		[0.007]	
HHI^{-2}		0.021*		0.005*
		[0.011]		[0.003]
HHI^2		0.013***		0.003***
		[0.003]		[0.001]
Observations	4,121	4,121	4,121	4,121
R^2			0.053	0.053

Notes to Table 6: The table reports regression coefficients and, in brackets, the associated standard errors, clustered at provincial level. * significant at 10%; ** significant at 5%; *** significant at 1%. The model is estimated by fractional logit, using the Stata 10 SE package with GLM command, in columns (1-2) and by OLS, using the Stata 10 SE package with REG command, in columns (3-4). The fractional polynomial model with two power terms (columns 2 and 4) is estimated using also the FRACPOLY command. The dependent variable is the share of bank credit supplied to the firm by its main bank ($FINSHARE$). $HHI_{<0.975}$ and $HHI_{>0.975}$ refer, respectively, to the linear spline for values of HHI below and above the threshold set at 0.975. All regressions include, as controls, $SIZE$ (split into four categories), AGE, AGE^2, $RISK$, $R\&D$, $ISO9000$, $OFFSHORE$, $EXPORT$, $VALUE\ ADDED$, industry and time dummies and a constant, not reported for reasons of space.

Table 7: Alternative market structure variables

Dep. Var.: $FINSHARE$	Fractional Logit			Linear Model		
	1	2	3	4	5	6
MARKET STRUCTURE VARIABLES						
HHI	-0.035	-0.109**	-0.141**	-0.009	-0.027**	-0.035**
	[0.065]	[0.052]	[0.063]	[0.016]	[0.013]	[0.015]
HHI^2	0.018**	-0.012	0.002	0.005**	-0.003	0.000
	[0.009]	[0.016]	[0.015]	[0.002]	[0.004]	[0.004]
MMC	-0.087			-0.021		
	[0.155]			[0.037]		
$F - DISTANCE\_SC$		-0.240**			-0.058**	
		[0.094]			[0.022]	
$HHI \times F - DISTANCE\_SC$		0.143**			0.035**	
		[0.056]			[0.014]	
$MEDIUM\ BANKS$			-0.002			-0.001
			[0.002]			[0.000]
$HHI \times MEDIUM\ BANKS$			0.002*			0.001*
			[0.001]			[0.000]
Observations	4,121	4,121	4,121	4,121	4,121	4,121
R^2		.	.	0.052	0.055	0.054

Notes to Table 7: The table reports regression coefficients and, in brackets, the associated standard errors, clustered at provincial level. * significant at 10%; ** significant at 5%; *** significant at 1%. The model is estimated by fractional logit, using the Stata 10 SE package with GLM command, in columns (1-4) and by OLS, using the Stata 10 SE package with REG command, in columns (5-8). The dependent variable is the share of bank credit supplied to the firm by its main bank ($FINSHARE$). All regressions include, as controls, $SIZE$ (split into four categories), AGE, AGE^2, $RISK$, $R\&D$, $ISO9000$, $OFFSHORE$, $EXPORT$, $VALUE\ ADDED$, industry and time dummies and a constant, not reported for reasons of space.

Table 8: Panzar-Rosse H statistic as a measure of competition

Dep. Var.: $FINSHARE$	Fractional logit				Linear model			
	1	2	3	4	5	6	7	8
MARKET STRUCTURE VARIABLES								
$H-STAT_{MC}$	0.106***	-0.079	-0.114*	0.089	0.025***	-0.019	-0.028*	0.021
	[0.036]	[0.108]	[0.067]	[0.067]	[0.009]	[0.026]	[0.016]	[0.016]
$H-STAT_M$	0.104***	-0.113	-0.098*	0.128**	0.025***	-0.027	-0.024*	0.031**
	[0.031]	[0.102]	[0.057]	[0.064]	[0.007]	[0.024]	[0.014]	[0.015]
$F-DISTANCE$		-0.044*				-0.011		
		[0.027]				[0.006]		
$H-STAT_{MC} \times F-DISTANCE$		0.066*				0.016*		
		[0.039]				[0.010]		
$H-STAT_M \times F-DISTANCE$		0.077**				0.019**		
		[0.033]				[0.008]		
$LARGE\ BANKS$			-0.004***				-0.001***	
			[0.001]				[0.000]	
$H-STAT_{MC} \times LARGE\ BANKS$			0.007***				0.002***	
			[0.002]				[0.000]	
$H-STAT_M \times LARGE\ BANKS$			0.006***				0.002***	
			[0.002]				[0.000]	
$MUTUAL\ BANKS$				0.000				0.000
				[0.004]				[0.001]
$H-STAT_{MC} \times MUTUAL\ BANKS$				0.002				0.000
				[0.004]				[0.001]
$H-STAT_M \times MUTUAL\ BANKS$				-0.002				-0.001
				[0.005]				[0.001]
Observations	4,121	4,121	4,121	4,121	4,121	4,121	4,121	4,121
R^2	.	.	.	.	0.055	0.056	0.057	0.055

Notes to Table 8: The table reports regression coefficients and, in brackets, the associated standard errors, clustered at provincial level. * significant at 10%; ** significant at 5%; *** significant at 1%. The model is estimated by fractional logit, using the Stata 10 SE package with GLM command, in columns (1-4) and by OLS, using the Stata 10 SE package with REG command, in columns (5-8). The dependent variable is the share of bank credit supplied to the firm by its main bank ($FINSHARE$). $H-STAT$ is divided into three categories: monopoly (M), monopolistic competition (MC) and perfect competition (PC), with the latter taken as reference category. All regressions include, as controls, $SIZE$ (split into four categories), AGE, AGE^2, $RISK$, $R\&D$, $ISO9000$, $OFFSHORE$, $EXPORT$, $VALUE\ ADDED$, industry and time dummies and a constant, not reported for reasons of space.

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B   Figures

Figure 1: Bank-firm relationships

(a) Sample distribution of $FINSHARE$ (b) Sample distribution of the number of banks
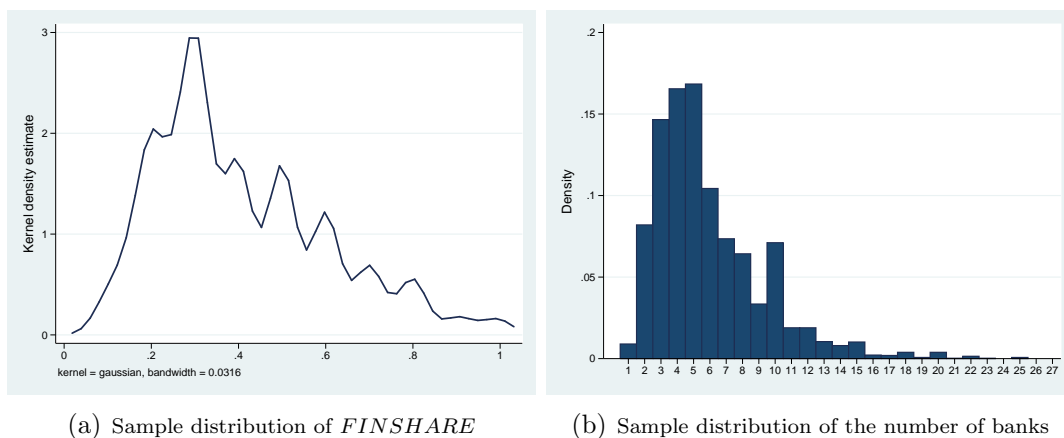
Notes: Elaboration over the sample of 4,121 firms. $FINSHARE$ is the share of bank credit supplied to the firm by its main bank.

Figure 2: Market concentration and relationship lending

(a) $FINSHARE$, fractional logit   (b) $RELBANK$, probit
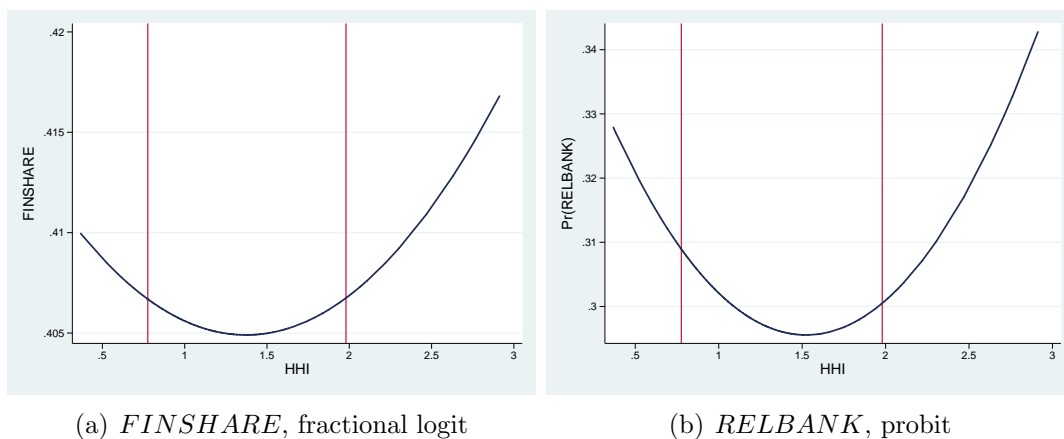
Calculations based on the estimates of Table 4 (columns 1 and 6). In the left hand-side diagram relationship lending is proxied by the share of bank credit supplied to the firm by its main bank ($FINSHARE$). In the right hand-side diagram relationship lending is proxied by a dummy equal to one if the firm obtains at least one third of banking credit from its main bank and has credit lines with no more than four banks ($RELBANK$). All the control variables are taken at their sample mean. The red vertical lines plot the $10°$ percentile and the $90°$ percentile of the provincial distribution of HHI over the sample period 1998-2003.

Figure 3: Market organisational structure, concentration and relationship lending

(a) *FINSHARE*, fractional logit

(b) *RELBANK*, probit

(c) *FINSHARE*, fractional logit

(d) *RELBANK*, probit

(e) *FINSHARE*, fractional logit

(f) *RELBANK*, probit
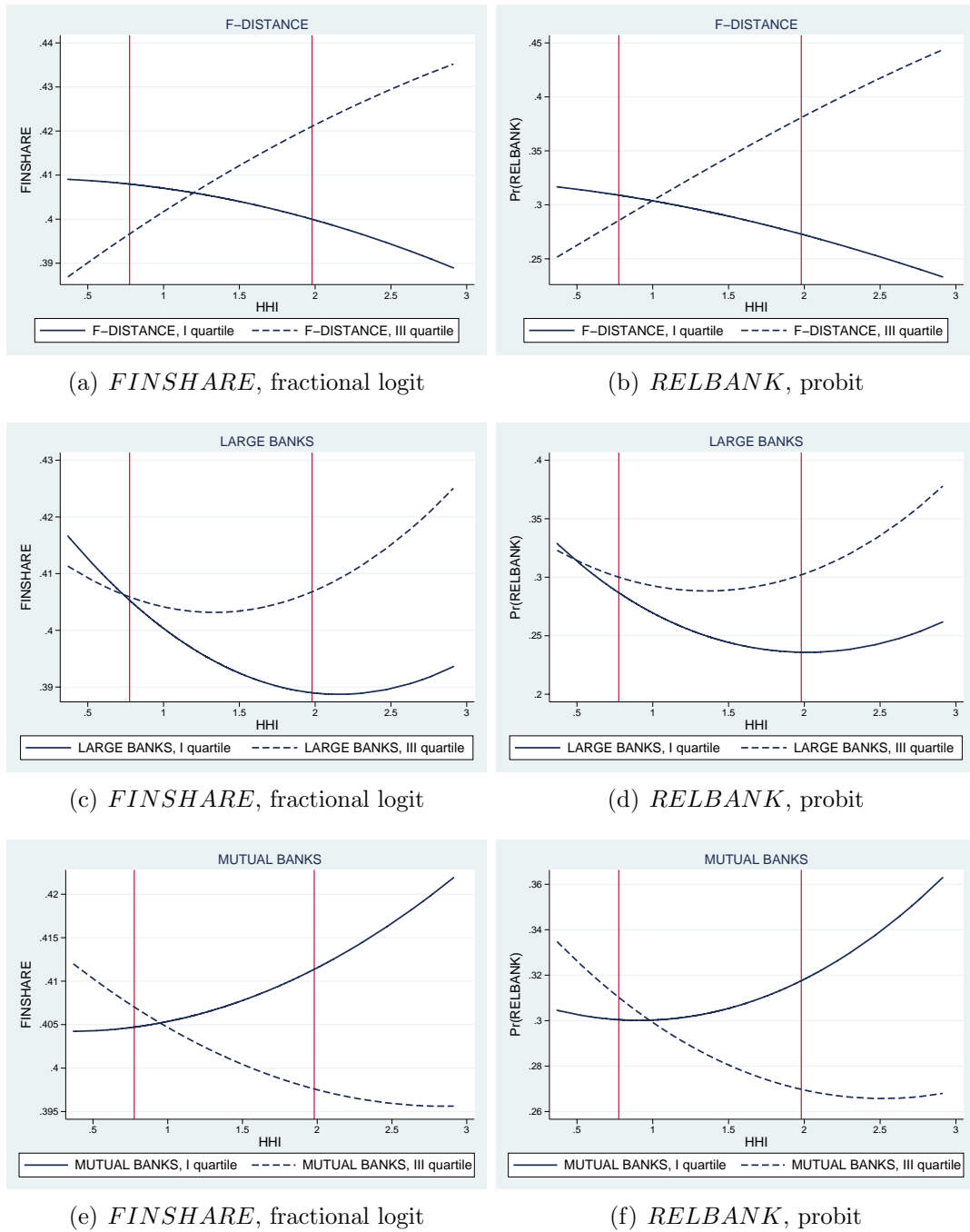
Notes: Calculations based on the estimates in Table 4 (columns 3-5 and 8-10). In the left hand-side diagrams relationship lending is proxied by the share of bank credit supplied to the firm by its main bank (*FINSHARE*). In the right hand-side diagrams relationship lending is proxied by a dummy equal to one if the firm obtains at least one third of banking credit from its main bank and has credit lines with no more than four banks (*RELBANK*). The market structure variables are taken at the first (third) quartile of their provincial distribution over the sample period 1998-2003, while the other variables are taken at their sample mean. The red vertical lines plot the 10° percentile, the median and the 90° percentile of the provincial distribution of *HHI* over the sample period 1998-2003.

Figure 4: Fractional polynomial models with two power terms

(a) Fractional logit   (b) Linear model
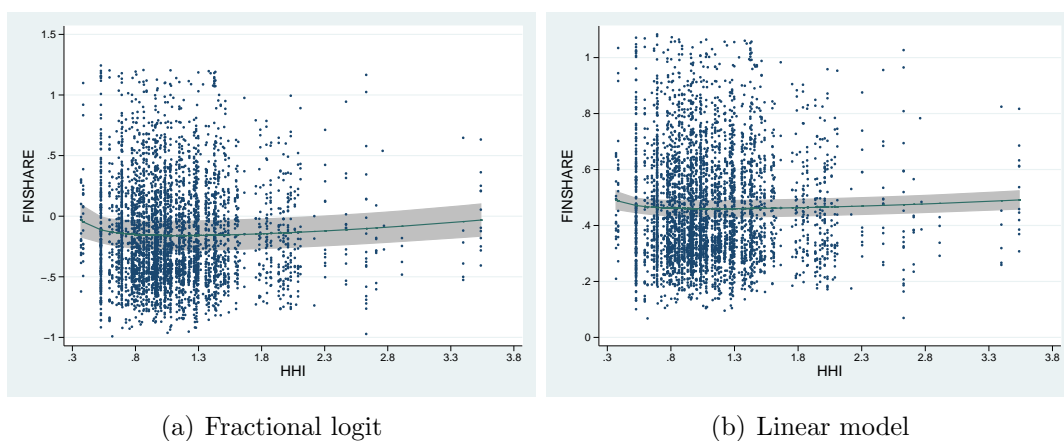
Notes: Calculations based on the estimates in Table 6 (columns 2 to 4). Diagrams show the fit and the 95% confidence interval, adjusted for covariates, resulting from a fractional polynomial model of degree two, estimated by a fractional logit (panel (a)) and a linear model (panel(b)).

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