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The impact of competition on bank orientation

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Abstract

How do banks react to increased competition? Recent banking theory significantly disagrees regarding the impact of competition on bank orientation—i.e., the choice of relationship-based versus transactional banking. We empirically investigate the impact of interbank competition on bank branch orientation. We employ a unique data set containing detailed information on bank–firm relationships. We find that bank branches facing stiff local competition engage considerably more in relationship-based lending. Our results illustrate that competition and relationships are not necessarily inimical.

JEL classification: G21; L11; L14

Keywords: Bank orientation; Bank industry specialization; Competition; Lending relationships

1. Introduction

Significant disagreement exists regarding the impact of competition between banks on relationship lending. In their seminal paper in the *Quarterly Journal of Economics* Petersen and Rajan (1995) investigate the effects of interbank competition on the loan rate and the availability of bank credit to firms. Petersen and Rajan model how competition between banks *negatively* affects especially lower quality firms, as banks may be unwilling to invest in relationships by incurring initial loan losses when firms can later on obtain low loan rates in a competitive banking market (see also Mayer, 1988). Petersen and Rajan document that young firms in more concen-

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trated banking markets obtain more relationship benefits, i.e., lower loan rates and easier access to bank credit, than firms in more competitive banking markets.[1]

However, recent work is starting to question whether credit market competition is always inimical to the formation of mutually beneficial relationships between firms and banks. Boot and Thakor (2000), for example, extensively revisit the presumed incompatibility between competition and relationship finance and argue that the source of competition matters in the determination of *bank orientation* (i.e., relationship-based versus transactional lending).

Boot and Thakor distinguish between two sources of competition, i.e., capital market competition and interbank competition, and they allow banks to choose between relationship lending and transactional lending. In their model stiffer capital market competition reduces relationship lending, while interbank competition leads to *more* relationship lending. A bank offering a relationship loan augments a borrower's success probability. Relationship lending then allows extracting higher rents from the borrower. Fiercer interbank competition pushes banks into offering more relationship lending, as this activity permits banks to shield their rents better. In their model stiffer interbank competition also reduces bank industry specialization in relationship loans as on the margin the returns to industry specialization decline. Hence, the value added of a relationship loan for the borrower also decreases.[2]

Relationship lending is further *non-monotonically* related to the degree of concentration in banking markets in models in Dinç (2000), Yafeh and Yosha (2001) and Anand and Galetovic (2006).[3] Hence, whether interbank competition and relationships are inimical and how competition affects bank orientation seems ultimately an empirical question.

We analyze a unique data set consisting of all loans granted by an important Belgian bank. This data set is ideally suited to investigate the effect of interbank competition on bank orientation. The data set allows us to:

(1) adequately measure local concentration, multi-market contact of banks across postal zones, and borrower—bank distance, respectively, and
(2) construct multiple objective measures of relationship lending. Ongena and Smith (2000), for example, define a bank relationship to be *the connection between a bank and customer that goes beyond the execution of simple, anonymous, financial transactions* and argue that a bank relationship can be more specifically measured along two dimensions: duration and

[1] Boyd and De Nicolo (2005) also argue that banks may become more risky as the concentration in loan markets increases. Consequently fiercer loan market competition makes banks less interested in monitoring and relationship lending.

[2] Fiercer interbank competition also results in *more* relationship lending in Banerjee (2002), Dell'Ariccia and Marquez (2004), Freixas (2005), Gehrig (1998), Hauswald and Marquez (2006), and Schmeits (2004), and fosters renegotiation of contracts in Berlin and Butler (2002). But in contrast to Boot and Thakor (2000), more interbank competition also leads to more bank industry specialization across both arm's length and relationship loan categories in Dell'Ariccia and Marquez (2004) and Hauswald and Marquez (2006).

[3] Dinç (2000) focuses on the degree of competition and the bank's incentive to keep its commitment to lend to a borrower when the borrower's credit quality deteriorates. In the absence of competition banks already earn rents in the arm's length market, so the cost of a relationship commitment may not be fully covered. But reputational rents ultimately decrease with the number of banks that already have a good reputation. In Yafeh and Yosha (2001) increased competition in the arm's length market forces the bank to increase the share of the surplus that goes to firms seeking relationship loans, making investment in relationships ultimately less profitable. In Anand and Galetovic (2006) establishing a relationship is costly, but relationships are not verifiable nor is the generated information excludable. In their model relationships only arise when few banks with similar market shares can cooperate. Elsas et al. (2004) and Minetti (2005) model firms engaging *both* transactional and relationship banks.

scope (see also Boot, 2000). We employ both relationship length and scope (combined and individually) as objective measures of bank orientation.

We find, in line with Boot and Thakor (2000), that when local interbank competition is fiercer a borrower is more likely to be engaged in relationship banking (but that more intense competition only marginally increases industry specialization of the bank branches). Borrowers located physically closer to the bank branch are also more likely to consume other bank services and to be engaged over a longer time period. Finally, larger bank branches lend substantially more on a transactional basis (but are less likely to be specialized in particular industries). The estimated coefficients on these three variables, market concentration, bank–borrower distance, and bank branch size (which in a spatial model of competition are jointly decreasing in bank entry) are negative, significant, and have almost equal economic relevancy. In addition, we find that the presence in the borrower's postal zone of banks with multiple contacts across other postal zones results in substantially more relationship lending. Our findings hold for different subsamples and proxies for relationship banking and are seemingly not spurious.

We organize the rest of the paper as follows. Section 2 reviews the recent empirical findings regarding interbank competition and bank orientation. Section 3 introduces the data and discusses the variables used in our empirical analysis. Section 4 displays and discusses the empirical results. Section 5 concludes.

2. Recent empirical findings

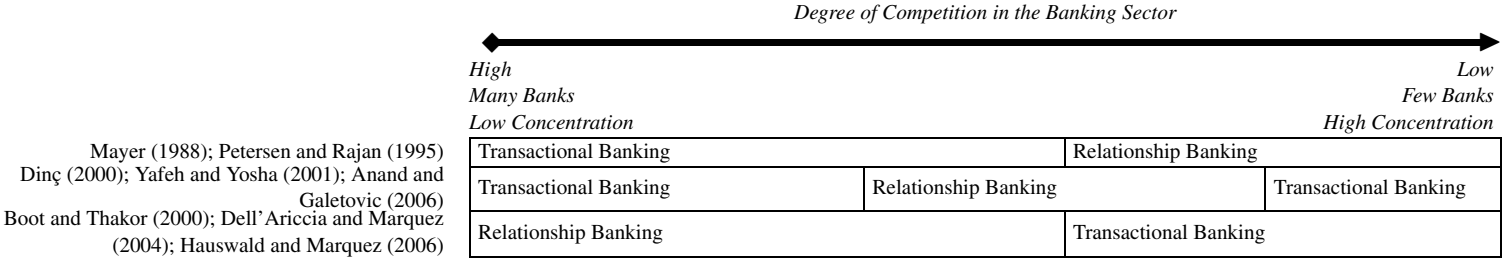
Most empirical work so far has investigated the effects of interbank competition on bank orientation indirectly. The reasoning is that information on whether relationship lending takes place is typically not available (Fig. 1 tabulates the main empirical findings and also summarizes the predictions of the different theoretical models). Petersen and Rajan (1995), for example, investigate the effect of local interbank competition on the loan rate and the availability of bank credit for credit-constrained (e.g., young or distressed) firms in the 1988 US National Survey of Small Business Finance data set. They employ a Herfindahl–Hirschman Index (HHI) in the local market for deposits to measure concentration. Petersen and Rajan find that young firms in more concentrated markets (HHI > 0.18) obtain lower loan rates and take more early (trade credit) payment discounts (i.e., have easier access to bank credit) than firms in more competitive banking markets. Banks seemingly smooth loan rates in concentrated markets and as a result provide more financing, in line with the predictions of their theoretical model.[4]

Black and Strahan (2002) revisit the local competition—bank orientation issue exploring an alternative measure of local credit availability. In particular, they investigate the rate of new business incorporations across US states. They find that deregulation of bank branching restrictions positively affects new incorporations and, more importantly, that, in contrast to Petersen and Rajan (1995), deregulation reduces the *negative* effect of banking market concentration on new incorporations. They also find that the widespread presence of small banks decreases business formation.[5]

[4] Recent work by Zarutskie (2006) and Scott and Dunkelberg (2001) analyzing other US data sets broadly confirm these findings. On the other hand preliminary work by Montoriol Garriga (2005) and Ogura (2005) using the NSSBF data set show competition and relationship banking are not necessarily incompatible.

[5] Cetorelli (2001, 2003), and Cetorelli and Strahan (2006) also find that banking market power may represent a financial barrier-to-entry in product markets. However Bonaccorsi di Patti and Dell'Ariccia (2004) find opposite results for Italy.

Panel A. Theoretical Predictions



Panel B. Empirical Findings

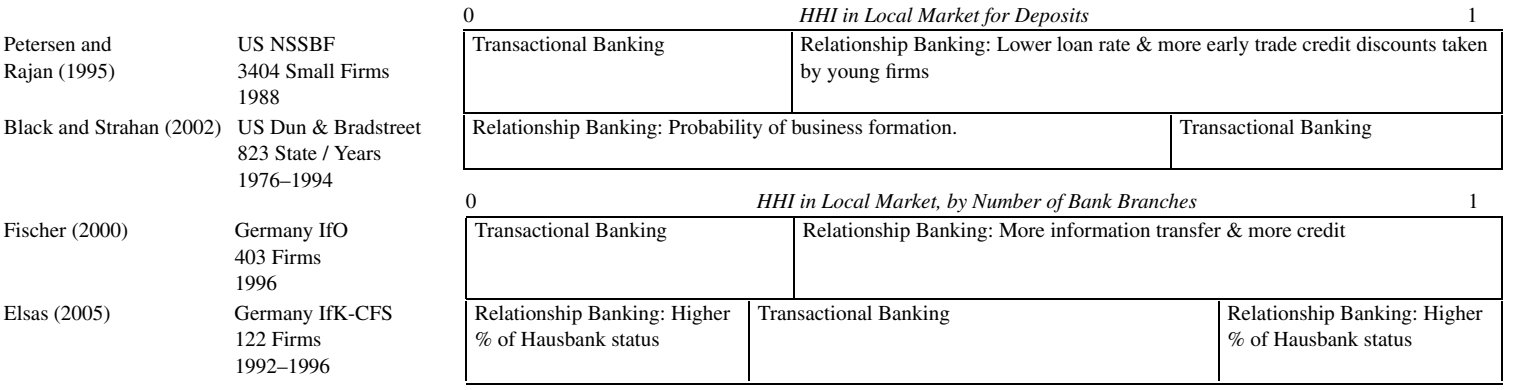


Fig. 1.

Recent papers by Fischer (2000) and Elsas (2005) investigate the local competition—bank orientation correspondence using German data. Fischer (2000) focuses on the transfer of information and the availability of credit and finds that both are higher in more concentrated markets. A paper by Elsas (2005), published in this *Journal*, is the first to empirically study the determinants of relationship lending. Elsas employs a cross-sectional data set containing bank credit files on 122 large German firms to investigate the relationship between local bank market concentration and the likelihood a bank assesses itself to be the "Hausbank" of a firm. He documents a mostly decreasing relationship between concentration and the incidence of the Hausbank status.

The empirical approach taken by Elsas (2005) has two fundamental merits. First, any comprehensive measure of the lending arrangement is better suited for a cross-sectional exploration of the determinants of relationship banking and such a measure can capture relationship formation far better than any individual loan rate or proxy of credit availability (because of bank fees and cross-selling for example).[6] Second, his study of the lending arrangement per se can be further motivated by the salient observation that in "relationship models" the ultimate effects on loan rates and welfare of changes in competition can be ambiguous, but the effects on bank orientation typically are not (as in Boot and Thakor, 2000).

However, his study also suffers from serious shortcomings we aim to overcome in our empirical analysis. Indeed, his Hausbank measure is tenuous and subjective, affected by *framing* directly related to bank market concentration. First, Elsas analyzes a small sample of 122 German firms that are quite large: the median firm in his sample is around 500 times larger in sales than the median US firm in the widely employed 1993 NSSBF sample, for example, and on average almost 300 times larger in sales than the firms in the main sample we employ. For large firms borrowing regionally or nationally, bank market concentration measured in the local debt market at the registered seat of the firm may not be all that relevant. Second, banks may be quick to claim to be the Hausbank of large and prestigious firms (an interpretation not incompatible with some of the size results in Elsas) and the hurdle above which a bank may be reporting Hausbank status may increase in concentration.[7] On this account his Hausbank–market concentration findings could be spurious.

Our paper follows the astute empirical approach taken by Elsas (2005), but addresses its original shortcomings. Rather than relying on a single subjective measure of the lending arrangement, we employ multiple objective measures. We also analyze a much larger data set containing loans to *small* firms for which the informational asymmetry building blocks of theory are more relevant. This data set allows us for the first time to study how local *and* national competition affects the lending *orientation* at the local level (which we will argue later is actually the relevant level to study in our case).

[6] In this regard Elsas' study complements Petersen and Rajan (1995) who employ cross-sectional data to infer loan rate smoothing and increased availability of credit over the lifetime of their sample firms (Black and Strahan, 2002, p. 2812, f. 4).

[7] For firms borrowing locally, a 30% share of total debt financing for example may lead a bank to assess itself to be a Hausbank in a market with 20 equally sized banks but not in an equally shared duopoly. If banks know other banks' market shares but not individual borrower shares, the case in Elsas (2005), a 30% share seems large in the 20-bank case, but is known for sure to be the smallest share in the duopoly. Even if all banks would know borrower shares and even if there is only one other lender covering the remaining 70%, the 30%-bank may be more likely to designate itself a (second) Hausbank in the 20-bank market than in the duopoly.

3. Data and variables

3.1. Data

The unique data set we analyze consists of loans granted to 13,098 firms by an important Belgian bank that operates all over Belgium. The sample includes all existing loans at the bank as of August 10, 1997 that were initiated after January 1, 1995. Degryse and Van Cayseele (2000) and Degryse and Ongena (2005) employ the same data set. For each borrower we take the characteristics at the time of the first contract observed in the bank's loan portfolio.

Critical elements of both the Belgian financial landscape and the bank itself make this data ideally suited to investigate the effect of local and nation-wide interbank competition on bank orientation. Previous studies show that the highly developed Belgian banking market is very representative for many other banking markets around the world in terms of concentration and competition.[8] In addition to a representative banking sector, the Belgian financial system was characterized by a high degree of capital market stability before and during the sample period and most firms we study did not have access during the sample period; hence we can safely abstract from changes in capital market competition in our empirical work.

The bank we study is one of a handful of truly national and general-purpose banks operating in Belgium in 1997. As such the bank lends to firms located in most postal zones and is active in 50 different industries (according to a two-digit NACE classification). Around 83% of the firms in its portfolio are single-person businesses and most borrowers obtain just one, relatively small, loan from this bank. Small Belgian firms typically do not tap into the equity or bond markets for their external financing, and typically apply for loans at local bank branches.

To control for key firm characteristics, we hand collect age and conservatively match our borrower data set with *Belfirst*, a database containing end-of-1994 information on 176,382 Belgian firms. We end up with 645 borrowers. We also report a full set of results for the 9213 (70.3%) of the borrowers that are both single-person business and sole proprietorship to assuage sample selection concerns.

Table 1 provides summary statistics for the samples of 645 and 9213 borrowers we will analyze, showing the definition, mean, standard deviation, minimum, median, and maximum of our variables, broken down into six sets of characteristics: (1) dependent variables measuring bank branch orientation, (2) competition measures, (3) proximity variables, (4) the bank branch characteristic, (5) postal zone variables, and (6) key firm characteristics. We turn to each of these sets of variables in the next subsections. Before doing so, we first elaborate on why we study the competition–orientation correspondence at the local and branch level.

3.2. Level of analysis: local and branch

We a priori choose to analyze the competition–orientation correspondence at the local level. Most sample firms are small, implying that loan applications by firms and loan decisions by banks are taken locally both at the data-granting bank as well as at rival banks. Formalized

[8] For example, Barth et al. (2004) report that the three largest banks in the market account for 57% of all bank assets, while foreign banks hold 24%. The average percentages in their sample covering 55 countries are 50 and 36% respectively, ranking (from high to low) the Belgian banking sector in 21st and 23rd position. Claessens and Laeven (2004) report that the Panzar and Rosse (1987) H-statistic for Belgium equals 0.73 for the years 1994–2001 ($H < 0$ indicates a monopoly, while $H = 1$ indicates perfect competition), while the average for the 50 countries in their sample is 0.67.

Table 1
Variable names, variable definitions, and sample statistics

Variables	Variable Definitions	Number of Observations = 645					Number of Observations = 9213				
		Mean	St.Dev.	Min.	Median	Max.	Mean	St.Dev.	Min.	Median	Max.
Relationship Banking	= 1 if the length of the relationship with the borrower exceeds one year and if the bank considers itself as main bank[a]	0.66	0.47	0.00	1.00	1.00	0.51	0.50	0.00	1.00	1.00
ln(Duration)	Log of the length of relationship with current lender, in years	1.73	0.70	0.00	1.84	3.13	2.02	0.81	0.00	2.25	3.31
Main Bank	= 1 if the firm buys at least two products from the bank and if the current account turnover is at least BEF 100,000 per month[ab]	0.67	0.47	0.00	1.00	1.00	0.53	0.50	0.00	1.00	1.00
Bank Industry Specialization	the proportion of the number of loans of the bank branch loan portfolio in the same industry as the borrower, in percentage	15.6	13.6	0.6	11.7	100.0	18.7	13.8	0.6	15.7	100.0
Herfindahl–Hirschman Index	Summed squares of bank market shares by number of branches in borrower's postal zone[c]	0.18	0.14	0.06	0.14	1.00	0.17	0.12	0.06	0.15	1.00
(Herfindahl–Hirschman Index)^2	Herfindahl–Hirschman Index squared	0.05	0.14	0.00	0.02	1.00	0.04	0.12	0.00	0.02	1.00
Multi-Market Contact	Sum of the bank pairs in borrower's postal zone weighted by the relative frequency of their bilateral contacts in other postal zones	0.17	0.08	0.00	0.18	0.33	0.18	0.07	0.00	0.19	0.34
Closeness of Lender	Inverse of one plus the shortest traveling time to the lender, in minutes	0.21	0.15	0.02	0.17	1.00	0.23	0.15	0.02	0.20	1.00
Remoteness of Competitors	One minus the inverse of one plus the shortest traveling time to closest quartile competitor in borrower's postal zone, in minutes	0.73	0.15	0.00	0.75	0.93	0.73	0.15	0.00	0.77	0.96
Branch Size	Proportion of bank loan portfolio at the bank branch, in percent	0.27	0.16	0.01	0.24	0.91	0.24	0.15	0.01	0.21	0.91
Number of Firms in Postal Zone	Number of registered firms in the borrower's postal zone, in thousands	0.85	0.97	0.00	0.52	6.01	0.74	0.86	0.00	0.45	6.10
Industry Concentration in Postal Zone	Proportion of registered firms in borrower's postal zone in industry of borrower, in percentage	0.01	0.03	0.00	0.00	0.20	0.02	0.03	0.00	0.00	0.31
Assets of Firms in Postal Zone	Average amount of assets of registered firms in the borrower's postal zone, in billions of BEF	0.08	0.18	0.00	0.05	3.74	0.07	0.13	0.00	0.04	3.74
Urban	= 1 if located in agglomeration >250, 000 inhabitants	0.11	0.32	0.00	0.00	1.00	0.09	0.29	0.00	0.00	1.00
Firm Age	in hundreds of years	0.20	0.26	0.00	0.08	0.96	n/a	n/a	n/a	n/a	n/a
Firm Assets	in billions of BEF[a]	0.01	0.05	0.00	0.01	0.88	n/a	n/a	n/a	n/a	n/a
Firm Earnings/Assets	in percentage	0.12	0.15	−0.53	0.09	1.25	n/a	n/a	n/a	n/a	n/a
Firm Short-Term Debt/Assets	in percentage	0.41	0.22	0.00	0.38	0.96	n/a	n/a	n/a	n/a	n/a

[a] 40 Belgian Francs (BEF) are approximately equal to 1 Euro.
[b] Definition for Single-Person Businesses and Small Firms.
[c] We set HHI = 1 if the number of branches = 0.

interviews we conducted within the data-granting bank indeed indicated that loan officers located in the bank's branches enjoyed considerable autonomy granting and pricing small business loans. Upon deciding loan conditions officers merely file a mostly qualitative summary report with the headquarters in Brussels (calculated credit scores were surprisingly only used as inputs to determine bank level re-insurance). Crucial for our purposes, the officers' own assessment of the development of the relationship with the firm played a key role in motivating past lending decisions.

Accordant to this apparent de jure local autonomy in lending orientation, in Degryse and Ongena (2005) we document substantial variation in loan rates across bank branches and patterns of spatial price discrimination at the branch level. Such pricing behavior strongly substantiates also de facto local autonomy and even branch profit maximization. The interpretation of our competition–orientation specifications, however, never truly hinges upon branch autonomy. The reasoning is that even when "Brussels" would optimally determine lending orientation vis-à-vis each individual borrower based upon the intensity of local competition and distance (which we find rather unlikely given the knowledge we have about the bank), our results would still remain interpretable as such. The only place where the empirical analysis would veer somewhat off the theoretical track is when we investigate branch industry specialization (further down in the paper).

Consequently given the characteristics of our sample firms, our inside information about the bank, and the results of our earlier empirical work it is essential to test the relevant theoretical predictions at the local and branch level, though the theoretical modeling mostly relates to decision units that are labeled 'banks'.

3.3. Dependent variables measuring bank orientation

We employ as our central dependent variable of bank orientation a dummy *Relationship Banking*. This dummy is equal to one if the length of the relationship with the borrower exceeds one year *and* if the firm buys at least two products from the bank and the current account turnover is at least BEF 100,000 (€2500) per month,[9] and is equal to zero otherwise. Hence our main dependent variable reflects both the duration and the scope of the engagement between bank and borrower. Boot (2000) and Ongena and Smith (2000) argue that both duration and scope characterize relationship banking. In addition we note that Petersen and Rajan (1995) focus on intertemporal pricing in a relationship, while in Boot and Thakor (2000) the scope of an existing relationship may enhance project success.

A bank–firm relationship starts when a firm buys for the first time a product from that bank. The average *duration* of the relationship in the sample is around seven years. Duration proxies for the increased time for a firm to experience the banks' products and to appreciate the added flexibility the bank has to maintain and fulfill implicit contracts. While the bank gains private information about a firm to tailor its products, the firm may also become locked-in (for example, Sharpe, 1990, and Rajan, 1992).

We find justification for using a duration cut-off of only one year in Angelini et al. (1998) and Cole (1998), who document that credit availability does not increase much beyond the first year

[9] We use Belgian Francs (BEF) throughout the paper but indicate equivalent amounts in Euros. Belgium switched to the Euro on January 1st, 1999.

of a relationship (we replace one year by three years in robustness exercises). We also note that the repayment duration of more than 60% of the observed loans is shorter than or equal to one year. Hence it seems likely that for the majority of the borrowers rollovers of loans take place within the first year of the relationship.

The *scope* of the relationship is captured by a dummy, we call *Main Bank*. This dummy equals one if the borrower "buys at least two products from the bank and has a monthly 'turnover' on its current account of at least BEF 100,000 (€2500)," and equals zero otherwise. More than half of all borrowers are classified as Main Bank customers. Banks may obtain an important informational advantage from servicing the firm with other products and from observing turnover on checking accounts (Nakamura, 1993; Vale, 1993; Mester et al., 2006). But as de Bodt et al. (2005) and Degryse et al. (2006) document that small Belgian firms employ on average few banks, our Main Bank variable captures variation beyond the mere mechanical outcome of the firms' preference for a single checking account and relationship. On the other hand, we recognize that the competition–orientation models we highlighted disregard the option of multiple bank relationships. However, we conjecture that the main hypotheses in these models may unfold qualitatively unaffected if this additional choice is introduced, a topic we leave for future theoretical research.

We frame the dependent variable as a dummy variable because theory suggests a dichotomy between relationship and transactional lending. However we will employ the *log of Duration* of the relationship and Main Bank separately as dependent variables in equivalent exercises. Additional advantages of our dummy approach are that:

(1) given our definition somewhat more than half the firms are engaged as relationship borrowers (i.e., the mean of Relationship Banking, our central dependent variable, is 66%);
(2) the reported partial derivatives allow for a straightforward percentage interpretation; and
(3) comparison with results in other papers, in particular Elsas (2005), is possible.

3.4. Herfindahl–Hirschman Index of banking market concentration

As of December 31st, 1994, we identify 7477 branches operated by 145 different banks and located in 837 different postal zones. Each postal zone carries a postal code between 1000 and 9999 (the first digit in the code indicates a geographical region, which we call "postal area" and which in most cases coincides with one of the ten Provinces in Belgium). A postal zone covers on average 26 sq. km and contains approximately six bank branches. A postal area covers 3359 sq. km on average. Not surprisingly borrowers are often located in more densely banked areas, with on average more than 17 bank branches per postal zone.

Previous research has argued that the relevant loan market is local in nature for small businesses. Branch proximity continues to play an important (though decreasing) role in determining bank choice by borrowers in both the US (Hannan, 1991; Petersen and Rajan, 2002) and Europe (Sapienza, 2002). Results reported in Degryse and Ongena (2005) show that loan rates in Belgium are not uniform across borrowers or across branches. In addition, physical distance between borrower and local financier affects loan conditions.

The median borrower in our sample is located less than 2.5 kilometers from the lending bank branch. This distance seemingly has not increased by much since the mid-seventies (Degryse and Ongena, 2005). As the number of bank branches decreased by only around 4% during the period 1975–1997 and major nationwide entries or M&As took place only after our sample period, local

branch configurations most likely hardly changed. We therefore a priori select each postal zone as the relevant market.[10]

Our main measure of competition is the *Herfindahl–Hirschman Index* (*HHI*). This variable is widely used as a measure of concentration in the literature; Petersen and Rajan (1995), for example, employ the HHI as a measure of competition in their empirical work, while in Boot and Thakor (2000) the number of banks and hence by extension the HHI delineates the degree of competition in their model. We define HHI as the summed squares of bank market shares by the number of branches in each postal zone. US bank concentration studies always use deposit market shares. However, Elsas (2005) also employs branch market shares for Germany while Fischer (2001) shows that for US Metropolitan Statistical Areas the "branch HHI" is highly correlated with the "deposit HHI."[11]

3.5. Multi-market contact

The postal zone is our a priori chosen banking market. However, many banks are operating in more than one postal zone and often interact with other multi-location banks across zones (Barros, 1999 or Park and Pennacchi, 2005). Edwards (1955) introduced the "linked oligopoly" hypothesis that predicts cross-market contacts among banks to increase the incentives for banks to collude. The hypothesis implies that banks compete less when geographical market-overlap increases. Multi-market contact facilitates anti-competitive "mutual forbearance," as the punishment for deviation from collusion becomes large (Heggestad and Roades, 1978; Bernheim and Whinston, 1990), and coordination between banks then fosters relationship banking as in Anand and Galetovic (2006).

However, other theoretical work points towards a possible pro-competitive effect of multi-market contact (Scott, 1982). Mester (1987), for example, presents a Cournot competition model in which banks have incomplete information about their rivals' marginal costs. As a result banks claim to have low marginal costs to sway competitors to produce less. If costs are imperfectly correlated across markets, multi-market banks have an incentive to put larger quantities on the market than the profit-maximizing level. "In markets with high concentration, control is in the hands of a few banks. Thus incentives for these [banks] to mislead other [banks] are greater since they stand to gain more" (p. 540). Similarly, but in a different setting, Park and Pennacchi (2005) show that the presence of large multi-market banks promotes local competition, in particular in highly concentrated markets.

We construct a state-of-the-art *Multi-Market Contact* measure as proposed in Evans and Kessides (1994). We first have to consolidate the branches in 104 banks (sometimes banks comprise distinctly incorporated sets of branches in Brussels, Flanders, and Wallonia). There are 837 postal zones with bank branches. Then, let $D_{ij} = 1$ if bank i operates in postal zone j, and $= 0$ otherwise, for $i = 1, \ldots, 104$; $j = 1, \ldots, 837$. And, let $a_{kl} = \sum_{j=1}^{837} D_{kj} D_{lj}$, and f_j: the number of different banks offering service in postal zone j. The Multi-Market Contact measure is then

[10] An incorrect a priori choice of the relevant geographical market cuts against finding significant results. The reason is that with inappropriate market delineation we expect the resulting "markets" not to be relevant in determining competitive conditions.

[11] For postal zones without bank branches we set the HHI equal to one. However, as a robustness check, we remove postal zones with an HHI equal to one in part of the exercises.

defined as:

$$MMC_j = \frac{2}{837 f_j (f_j - 1)} \sum_{k=1}^{104} \sum_{l=k+1}^{104} a_{kl} D_{kj} D_{lj}.$$

Consequently, the multi-market contact variable can be described succinctly as the sum of all bank pairs in the borrower's postal zone weighted by the relative frequency of their bilateral contacts in other postal zones. The variable is bounded between zero (banks in the postal zone have no contact elsewhere) and one (all banks in the zone have contact with all other banks across all other postal zones).

3.6. Distance variables

Location may determine the degree of competition for a borrower when either borrower (Hotelling, 1929; Salop, 1979) or lender (Sussman and Zeira, 1995) face transportation costs. In standard spatial models, borrowers select the closest bank and the location of the median borrower determines the intensity of competition. However, there is no distinction in these models between "relationship" and "transactional" banking, as borrowers seek only one bank product in a single period.

In *multi-product* spatial models, firms in need of multiple products may engage a single bank, most likely the closest one, in order to minimize transportation and search costs (Armstrong and Vickers, 2001). Consequently in multi-product spatial models firms close to the lender may be more likely to opt for "relationship banking" (in *scope*).

Alternatively, in *multi-period* spatial models in which borrowers can switch lender, "close" borrowers may be more likely to stay than the borrowers located farther away from their first-period lender (Dell'Ariccia, 2001). Again, close borrowers are destined to be "relationship borrowers" (now in *duration*) on the basis of their proximity to the lender. In addition, this effect may actually strengthen (Hauswald and Marquez, 2006) if the number of local banks increases.

To control for the effects of proximity, we calculate the distance between the borrower and both the lending bank and the branches of all other, competing banks located in the same postal zone as the borrower (Degryse and Ongena, 2005 provide details). We transform both measures to $(1 + \text{distance to lender})^{-1}$ and $[1 - (1 + \text{distance to closest competitors})^{-1}]$, and call these newly created variables *Closeness of Lender* and *Remoteness of Competitors*, respectively. Again, both transformations account at once for the possibly decreasing effects of distance and constrain the variables to be between zero and one enabling easier benchmarking. For example, if both Closeness of Lender and Remoteness of Competitors equal one, the borrower is located close to the observed lender but really far from a competing bank. Conditioning on the fact that we observe the close lender granting the loan, we expect, as in a multi-product or multi-period setting, that the engagement is more likely to be relationship-based. On the other hand, if both Closeness of Lender and Remoteness of Competitors equal zero, the borrower is located far from the observed lender but really close to a competing bank. Conditioning on the fact that we observe a far-away lender granting the loan, we can expect the engagement to be transactional.

3.7. Control variables

We introduce bank branch size, postal zone variables, and key firm characteristics in the base regressions. Start with the variable *Branch Size*. Berger et al. (1999) argue that organizational diseconomies of engaging in different type of lending activities may prevent large banks

from efficiently providing both transaction-based lending to large corporations and relationship-based lending to small businesses. Large hierarchical banks in Stein (2002) only succeed when information is "hard" enough to flow freely inside the bank. On the other hand, only loan officers at small banks may have the proper incentives to collect and take advantage of "soft" information (that cannot "travel" so easily up the chain of command), precisely the type of information that could be needed to advance relationship banking (see also Berger et al., 2005; Liberti, 2004).

We conjecture that Stein's arguments are also relevant when assessing the lending activities of autonomous bank branches. Large branches may have one or two hierarchical layers. As a result, loan officers employed in large branches then are less willing to engage in the collection of soft information and relationship lending suffers. We include Branch Size to control for the size differences across the branches. We measure Branch Size by the proportion of the bank's business loan portfolio at each branch (we take the number of loans at a branch over the total number of loans). There are substantial differences in Branch Size across the bank. The mean bank branch accounts for 44 loans (0.25%) while the largest branch reports 161 of all 17,776 loans (0.91%). The smallest branch has only one business loan.

To control for regional variation in corporate demand for banking services, we introduce a set of postal zone variables. The variable *Number of Firms in the Postal Zone* measures the number of registered firms in the borrower's postal zone, while the variable *Assets of Firms in the Postal Zone* averages the amount of assets of registered firms in the borrower's postal zone. Both variables are constructed using *Belfirst*. We similarly construct *Industry Concentration in the Postal Zone* to measure the proportion of registered firms in the borrower's postal zone in the industry of the borrower. Finally, we introduce a dummy variable *Urban* to control for general differences between businesses located in rural and urban communities. Urban may further capture heterogeneity in information available to banks. For example, banks in urban areas may rely more on hard information while rural banks may collect more soft information (Klein, 1992). Urban equals one when the borrower is located in an agglomeration with more than 250,000 inhabitants, and zero otherwise.

To control further for key firm characteristics we include *Firm Age*, *Assets*, *Earnings/Assets*, and *Short-Term Debt/Assets*. Younger, smaller, more profitable and highly leveraged firms are often hypothesized to seek more intense bank relationships. Younger and smaller firms are often opaque, lack a track record of hard financial information, or do not have assets that can serve as collateral. Relationship finance is the best lending technology available to service such firms (Berger, 2006). More profitable, high quality firms may seek confidentiality in a bilateral relationship financing, to minimize the loss of proprietary firm information for example (Bhattacharya and Chiesa, 1995; Yosha, 1995), while highly leveraged firms may prefer to renegotiate with a single relationship lender in times of distress.

4. Empirical results

4.1. Postal zone competition and relationship banking

In this section we analyze the regressions of the dependent variables measuring bank orientation on the set of competition and control variables. The correlations displayed in Table 2 between our central dependent variable Relationship Banking and the discussed competition variables already indicate the direction of some of our results. We start discussing the effects of the competition variables and return to a discussion of all the control variables at the end of the

Table 2
Correlation table

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	15	16
1	1	*0.357*	*0.977*	*0.0499*	*−0.016*	*−0.004*	*−0.002*	*0.039*	*0.005*	*−0.054*	*0.020*	*−0.006*	*0.019*	*−0.001*			
2	0.454	1	*0.311*	*−0.044*	*−0.053*	*−0.042*	*0.019*	*0.091*	*0.016*	*−0.123*	*−0.030*	*−0.015*	*−0.003*	*−0.021*			
3	0.966	0.399	1	*0.0535*	*−0.011*	*0.000*	*0.000*	*0.032*	*0.007*	*−0.053*	*0.023*	*−0.007*	*0.020*	*0.002*			
4	0.0663	−0.0192	0.0833	1	0.0202	0.0131	−0.013	−0.0311	*0.0226*	*−0.041*	*0.0344*	*0.013*	*0.1771*	*0.0579*			
5	0.047	−0.009	0.036	0.0152	1	*0.949*	*0.066*	*−0.181*	*−0.038*	*0.069*	*0.000*	*−0.033*	*−0.158*	*−0.106*			
6	0.055	−0.004	0.048	0.0121	0.958	1	*−0.157*	*−0.148*	*−0.007*	*0.072*	*−0.002*	*−0.026*	*−0.069*	*−0.061*			
7	0.045	0.075	0.038	0.0138	−0.007	−0.204	1	*−0.048*	*−0.162*	*−0.063*	*0.001*	*−0.084*	*−0.461*	*−0.337*			
8	0.085	0.193	0.084	−0.0388	−0.182	−0.154	−0.050	1	*−0.285*	*−0.168*	*−0.031*	*−0.001*	*−0.014*	*0.020*			
9	0.003	0.000	0.007	0.0106	−0.105	−0.071	−0.128	−0.214	1	*0.040*	*0.022*	*0.005*	*0.136*	*0.056*			
10	−0.054	−0.050	−0.046	−0.1123	0.125	0.115	−0.090	−0.070	−0.065	1	*0.027*	*−0.020*	*0.024*	*−0.007*			
11	−0.005	0.025	−0.005	−0.0029	0.003	−0.006	0.020	0.030	0.054	0.036	1	*−0.018*	*0.000*	*−0.007*			
12	0.020	−0.024	0.020	0.0366	0.048	0.037	−0.036	−0.036	0.026	0.086	−0.021	1	0.102	*0.169*			
13	0.055	0.000	0.065	0.1072	−0.178	−0.091	−0.452	0.049	0.133	0.006	−0.080	*0.144*	1	*0.447*			
14	0.024	−0.042	0.023	0.1205	−0.132	−0.081	−0.344	0.073	0.004	0.023	−0.084	0.150	0.501	1			
15	−0.077	0.026	−0.070	−0.0361	−0.016	−0.012	−0.049	0.024	0.023	0.000	0.057	−0.027	−0.003	0.007	1		
16	−0.042	−0.090	−0.036	−0.0269	−0.029	−0.025	−0.031	−0.051	0.018	−0.001	−0.025	0.004	0.180	0.064	0.007	1	
17	0.100	−0.002	0.096	−0.006	−0.009	−0.028	0.032	0.030	0.002	−0.045	0.094	−0.031	−0.006	−0.003	−0.053	−0.049	1
18	−0.057	−0.057	−0.047	0.0047	−0.020	−0.007	−0.012	0.036	−0.044	−0.068	−0.093	−0.055	0.037	−0.045	−0.038	0.056	−0.132

Notes. The number of observations is 645 below the diagonal and 9213 above the diagonal (italicized). Pearson correlation coefficients exceeding approximately 0.25 (0.16) are significant at 1% (10%) level.

section. We first discuss the results for the dependent variable Relationship Banking and turn to the alternative measures of bank orientation, i.e., Duration and Main Bank in robustness checks.

4.1.1. Local competition

Since Relationship Banking is a binary dependent variable, we employ a Probit model.[12] In Table 3 we report the partial derivatives, in percent, at the means and significance levels based on t-ratios for the coefficients. In Model I in Table 3 we start with the commonly used (and previously detailed) measure of market concentration, i.e., the *Herfindahl–Hirschman Index* (*HHI*) and include the HHI^2 to allow for the possibility that the mechanisms modeled by either Petersen and Rajan (1995) or Boot and Thakor (2000) would dominate over different ranges of the concentration index or to capture the non-monotonicity present in Dinç (2000), Yafeh and Yosha (2001), or Anand and Galetovic (2006), for example.

As argued before, banks may take into account exactly whom their competitors are in the postal zone given contact in other postal zones, i.e., banks may care about multi-market contact. To control for either pro- or anti-competitive effects arising from Multi-Market Contact we also include this contact variable. Proximity could encourage firms to frequent the same bank for multiple services during a longer time period. Hence we include the proximity variables in Model II. In Model III we further include the full set of other control variables. We discuss the coefficients of Model III, as the estimates of Models I and II turn out to be very similar.

Both coefficients on the HHI variables are statistically significant in Model III, though in sign opposite to the non-monotonicity predictions. Intuition in Yafeh and Yosha (2001), for example, would have suggested a *concave* inverted U-relationship between relationship banking and concentration. Figure 2 displays the resulting *convex* schedule we estimate (at the means of the other variables) in bold. The percentage probability of observing Relationship Banking is measured along the left vertical axis, while HHI is on the horizontal axis. When the HHI in the postal zone is close to zero and the local market can therefore considered to be competitive, the percentage of the borrowers in a relationship equals 78%. When the HHI increases to 0.1 the percent relationship banking drops to 69%, when HHI exceeds 0.18 and the local market can now be considered concentrated the percent equals less than 63%. When the HHI equals 0.37, the percent Relationship Banking reaches its minimum at 57%, and climbs back to almost 100% as HHI increases to one (we will return to the issue of the postal zones with an HHI equal to one in robustness).

We further note (jumping ahead somewhat in the discussion of the economic significance of different variables) that this drop of 21% (from 78 to 57%) is similar in magnitude to the effect of distance: a borrower located around the corner from the bank is 28% more likely to be engaged as a relationship customer than a borrower located (infinitely) far away (from 87 to 59%, respectively). Consequently the effect of local market concentration (admittedly measured with some error) on relationship banking is similar to the effect of distance (probably measured more precisely) and hence the concentration effect should be assessed to be sizeable and economically relevant.

As 95% of all postal zones in Belgium have an HHI below 0.37 (where the minimum percent Relationship Banking occurs), these findings confirm a key result in Boot and Thakor (2000), but are at odds with Petersen and Rajan (1995). Branches seemingly engage in more relationship banking when facing fiercer banking competition. These findings may also be at odds with

[12] "On theoretical grounds it is difficult to justify this choice" (Greene, 1997, p. 875) of a Probit model, hence we also rerun all exercises using a Logit model. Given that the mean of the dependent variable is close enough to 50%, not surprisingly results are almost unaffected.

Table 3
Bank orientation

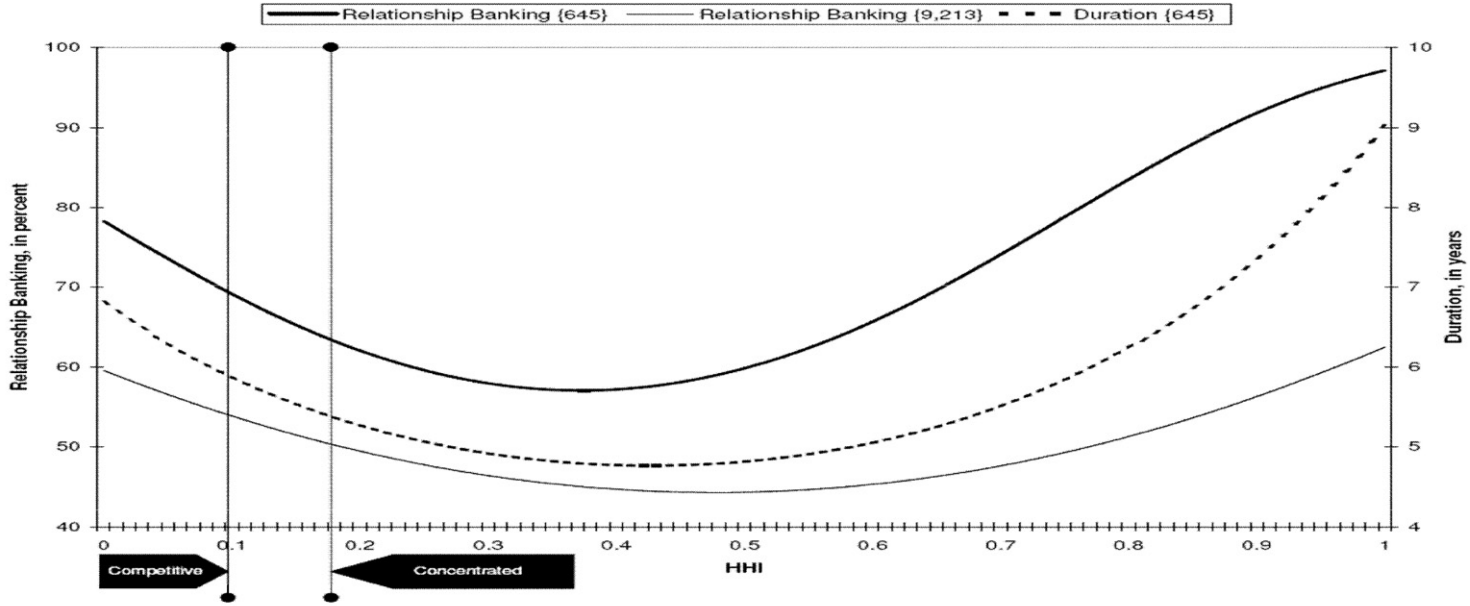
Model: Estimation: Dependent Variable	**I** Probit Relationship Banking	**II** Probit Relationship Banking	**III** Probit Relationship Banking	**IV** Probit Main Bank	**V** Probit Main Bank	**VI** Tobit ln(Duration)	**VII** Tobit ln(Duration)	**VIII** Tobit Industry Specialization
Herfindahl–Hirschman Index	−126.52**	−110.78*	−118.17*	−126.65**	−134.44**	−173.09*	−165.98*	−0.51
	(62.57)	(62.73)	(64.04)	(61.62)	(62.84)	(93.44)	(94.40)	(15.86)
(Herfindahl–Hirschman Index)^2	150.50**	142.32**	158.72**	154.25**	170.49***	197.60**	193.90**	3.38
	(64.46)	(64.40)	(65.69)	(63.29)	(64.42)	(93.25)	(94.23)	(15.84)
Multi-Market Contact	77.58**	80.42**	112.86***	80.41**	114.15***	151.36***	166.41***	6.18
	(32.17)	(32.27)	(35.95)	(31.83)	(35.42)	(48.19)	(53.30)	(8.96)
Closeness of Lender		33.97**	33.03**	32.82**	32.04**	101.08***	98.31***	−4.37
		(13.46)	(13.70)	(13.33)	(13.56)	(19.36)	(19.34)	(3.25)
Remoteness of Competitors		11.97	8.34	12.35	8.68	27.86	21.69	0.00
		(13.20)	(13.62)	(13.03)	(13.46)	(19.26)	(19.36)	(3.26)
Branch Size			−11.49		−7.96		−8.05	−9.34***
			(11.77)		(11.57)		(17.24)	(2.90)
Number of Firms in the Postal Zone			5.74**		6.17**		6.24*	−0.72
			(2.57)		(2.55)		(3.60)	(0.60)
Assets of Firms in the Postal Zone			6.05		6.25		−5.16	1.78
			(13.08)		(12.94)		(15.78)	(2.65)
Industry Concentration in the Postal Zone			−12.34		−10.22		28.21	51.23***
			(63.28)		(62.38)		(91.50)	(15.38)
Urban			2.67		1.47		−9.62	6.91***
			(7.25)		(7.14)		(10.29)	(1.73)
Firm Age			−0.13*		−0.11		0.08	−0.02
			(0.07)		(0.07)		(0.11)	(0.02)
Firm Assets			−42.70		−38.79		−118.01**	−6.69
			(37.68)		(36.71)		(56.16)	(9.45)
Firm Earnings/Assets			31.24**		30.40**		−7.52	−1.83
			(13.78)		(13.57)		(18.79)	(3.16)
Firm Short-Term Debt/Assets			−12.98		−10.71		−21.19	1.10
			(8.90)		(8.78)		(12.98)	(2.18)
Constant	16.67***	−1.91	−1.35	1.55	−0.51	124.38***	133.47***	15.33***
	(6.27)	(13.54)	(15.71)	(13.34)	(15.49)	(19.88)	(22.51)	(3.80)
(Pseudo)-R^2	0.37	0.38	0.40	0.38	0.40	0.05	0.07	0.06

Notes. The table reports the partial derivatives at the means, in percent, from (binary) Probit and Tobit models. The dependent variables are Relationship Banking, Main Bank, ln(Duration) and Industry Specialization. The definition of the variables can be found in Table 1. The number of observations is 645. The Pseudo-R squared is calculated as in Zavoina and McElvey (1975).

* Significance at the 10% level, two-tailed.

** Idem, 5%.

*** Idem, 1%.



645	10.9%	64.5%	24.7%
9,213	8.6%	66.7%	24.7%
Sample	Proportion of Observations in Competitive, Intermediate, and Concentrated Postal Zones		

The figure plots Relationship Banking, in percent, and Duration, in years, as a function of the Herfindahl–Hirschman Index (HHI), using the estimated coefficients from the Probit Models 3.III and 4.I and the Tobit Model 3.VII. Other variables are set equal to their means. Two bottom rows indicate the proportion of observations in each HHI range (competitive, intermediate, concentrated) for both samples. The definitions of the variables are in Table 1.

Fig. 2. Bank market concentration and bank orientation.

the correspondence between market power in banking and market power in the firms that banks lend to (Cetorelli and Strahan, 2006). Concentrated product markets show less firm entry, hence contain older firms with potentially longer and broader relationships with their banks. Concentration in the banking sector through concentration in the product market would consequently be connected with more relationship banking. But that is not what we find.

4.1.2. Multi-market contact and proximity

Next we focus on the coefficient of *Multi-Market Contact* in Model III in Table 3. Multi-Market Contact carries a positive sign, is statistically significant, and economically relevant. An increase in the variable from 0 to 0.33 (as with the other variables we explore the impact of a variable over its observed range) increases the probability of observing Relationship Banking by 36% (from 46 to 82%).

Now we turn to the proximity measures. The coefficient on *Closeness of Lender* is positive, statistically significant, and economically relevant, confirming either a multi-product or multi-period switching hypotheses emanating from spatial models. As already indicated, the probability of observing Relationship Banking for a borrower close to the Lender (i.e., Closeness of Lender = 1) is 28% higher than for a far-away borrower (i.e., Closeness of Lender = 0). On the other hand, the transformed *Remoteness of Competitors* is not statistically significant.

These results are unaffected if we simply remove either one of the two HHI and/or Multi-Market Contact variables. Similarly, removing both distance variables, as in Model II, leaves the other coefficients unaffected. We further add all possible combinations of Multi-Market Contact^2, Closeness of Lender^2, Remoteness of Competitors^2 to specification III. Admittedly we know of little theoretical justification for doing so (hence we choose not to tabulate the results). However, the coefficients of HHI, HHI^2, Multi-Market Contact, and Closeness of Lender are virtually unaffected in significance, sign and size in all specifications.

Motivated by Hauswald and Marquez (2006) we further interact HHI and/or HHI^2 with our distance measures. The coefficients on HHI and HHI^2 remain broadly the same in sign and magnitude, but are no longer significant. The interaction terms are insignificant as well. We suspect multicollinearity problems. As an alternative, we split the sample in firms that are closer to the lender than to the closest bank competitor (we call these firms the "relatively close" firms) and those firms that are closer to the closest bank competitor than to the lender (the "relatively far" firms). The coefficients on our competition measures in both subsamples retain the same sign, significance, and magnitude. The proximity measures are only significant for the firms that are "relatively far."

Finally, we replace Branch Size (a variable to be discussed in the next section) by random branch effects (employing OLS).[13] Branch effects could capture omitted variables that could be correlated with bank orientation, such as branch service quality and local firm presence and/or competition (Cetorelli, 2001), for which we could not construct reasonable proxies. However, results are unaffected; if anything they are even more "striking" in statistical significance and economic relevance.

Taken together, these results suggest the distance variables may proxy for other factors (transportation costs as in Degryse and Ongena, 2005, for example) than those picked up by our postal zone and national competition measures. The branch effects specification suggests that Relationship Banking and proximity are seemingly not driven jointly by an omitted variable and that

[13] A Hausman test cannot reject at a 1-% level that random effects should be favored.

proximity (marked as a complement and not a substitute to Relationship Banking) may not proxy for the intensity and ease of informational flows as in Petersen and Rajan (2002). Given the short distances involved these findings probably should not come as a surprise.

To conclude, the observed lender engages more borrowers in relationship banking if many other banks (possibly with equal market shares) operate in the same postal zone or if the banks in the postal zone have multiple contacts across other postal zones. More relationship banking is also being observed when firms are located close to the bank.

4.1.3. Control variables

Finally, we turn to the coefficients on the control variables (in Model III of Table 3), starting with *Branch Size*. The coefficient is economically quite relevant, though not statistically significant (jumping ahead somewhat, this coefficient will be similar in magnitude but highly significant in the other subsample). The partial derivative at the means for Relationship Banking equals −11.5, indicating that an increase from the smallest to the largest branch (0.01 to 0.91) decreases the incidence of relationship banking by 10% (from 69 to 59%). Hence, *ceteris paribus*, larger bank *branches* pursue more transactional banking, a result similar to Berger et al. (2005) who document that larger *banks* have less exclusive and shorter relationships than smaller banks.

None of the four postal zone coefficients, except for the *Number of Firms*, are statistically significant. The coefficient on the latter variable seems also economically relevant, as variation over its entire range changes percent Relationship Banking by 28% (from 61 to 89%).

Firm characteristics also seem to play a secondary role in the determination of the incidence of Relationship Banking, except for *Firm Earnings / Assets*. Its coefficient is statistically significant and implies that the most profitable firm in the sample has a 47% higher probability of being engaged as a relationship borrower than the least profitable firm (92 versus 45%). Robustness exercises show this result to arise from the scope but not the duration of the relationship, findings similar to Degryse and Ongena (2001) and Fok et al. (2004), who show that more profitable firms choose bilateral (domestic) rather than multilateral bank borrowing arrangements. In another set of robustness exercises we alter the definitions of the included firm characteristics. For example, we replace Assets by *Fixed Assets*, subtract *Interest Expenses* from Earnings, and replace Short-Term Debt by *Total Debt*. Results are unaffected.

4.1.4. Alternative definitions of bank orientation

We also employ our other two variables capturing bank orientation, i.e., Main Bank and Duration. Elsas (2005), for example, argues that duration may be a poor proxy for the significance of the relationship; hence we employ *Main Bank* (by itself) as the dependent variable. We report the almost unaffected results in Models IV and V in Table 3.

We also estimate a Tobit model (censored at zero) with *ln(Duration of Relationship)* as the dependent variable and report the results in Models VI and VII in Table 3. Fig. 2 displays the resulting U-schedule we estimate in Model VI (at the means of the other variables) as a dashed line, with the duration of the relationship in years now measured along the right vertical axis. The length of the relationship decreases from 6.8 years when HHI equals zero to 4.7 years when HHI equals 0.43. Overall, we find our results robust to the definition of the dependent variable.

Finally, as the duration cutoff of one year in the construction of the dependent variable Relationship Banking was somewhat arbitrarily chosen (remember however that results in Angelini et al., 1998 and Cole, 1998 suggested a short duration cutoff), we also run all specifications with a three-year duration cut-off. Results are virtually unaffected.

4.2. Bank industry specialization

Theory also provides hypotheses concerning the relation between interbank competition and bank industry specialization. In Boot and Thakor (2000), for example, competition affects the banks' investment in industry expertise and hence the "value" of bank–firm relationships. In their model interbank competition reduces bank industry specialization in relationship loans as on the margin the returns to industry specialization decline. Hence, the value added of the relationship loan for the borrower also decreases.

We construct a new dependent variable measuring bank industry specialization. We classify the borrowers in the 50 two-digit NACE code classes and for each branch calculate a variable *Industry Specialization* as the proportion of loans of the loan portfolio of the bank branch in the same industry as the borrower, in percentage.[14] To calculate the proportion of loans, we use both the number as well as the volume of all loans granted by the bank branch to small businesses. As our findings are very similar, we report only the results using the number of loans.

The mean of industry specialization is 15.6% with a standard deviation of 13.6%. The cost of industry specialization is bank-specific in Boot and Thakor (2000) and further depends on the diversity of borrower types served by the bank. Consequently when estimating the impact of competition on industry specialization we again control for branch characteristics such as branch size.[15]

We now analyze the regression of the dependent variable(s) measuring bank industry specialization on the same set of competition and control variables. The dependent variable, *Industry Specialization*, is by construction always larger than zero, but it is also censored at 100. However, as the variable is equal to 100 for only 19 borrowers we disregard this minor censoring issue and estimate a standard Tobit model. We follow the same line-up of exercises as for bank orientation, but report only the final step as Model VIII in Table 3.

Our results indicate that market concentration is neither statistically significant nor economically relevant in explaining industry specialization. Both the coefficients on *HHI* and HHI^2, as the measures for concentration, are statistically and economically insignificant, providing no ev-

[14] Our measure assumes that the bank's knowledge about a particular industry flows from observing the loan repayments by other bank borrowers active in that industry. However, in Boot and Thakor (2000) the degree of industry specialization is chosen ex ante and is not derived from the actual composition of the realized loan portfolio. In addition, the degree of industry specialization is observable in their model by the individual borrower upon their first contact with the bank. We doubt the bank branches we study ever recorded their "ex ante" choices and costs of industry specialization, but we consider these costs unlikely to be observable by the borrowers in any case. In that sense our ex post measure relying on portfolio composition may be a reasonable proxy for the branch's selected degree of specialization as the bank's clientele in an industry may have been partially observable by (and even "advertised" by the branch to) interested firms from that industry.

[15] The bank chooses first the degree of industry specialization followed by its orientation in Boot and Thakor (2000). Its specialization decision is conditioned on the assessed probability distribution over borrower quality, while the orientation decision is made on the basis of the actual (representative) borrower's quality. For any outside observer (uninformed about the bank's initial assessment and decision) the two decisions appear inseparable and estimating two reduced-form equations containing orientation and specialization respectively (as dependent variables) seems appropriate. The borrower can decide to go to either the capital market or the banking market in between the bank's industry specialization and orientation decision. The corresponding selection issue appears minimal for most firms in our sample that have no access to the capital market anyway. The first-round matching with the banks is stochastic (borrowers also do not know the degree of bank specialization in the model) and is followed by the orientation decision and random competitive bidding by outside banks. Hence no additional selection takes place.

idence in favor of banks specializing in an industry when competition is high (Dell'Ariccia and Marquez, 2004) or intermediate (Boot and Thakor, 2000).

If more contact implies a pro-competitive effect, Boot and Thakor (2000) hypothesize less industry specialization should be observed, whereas according to Dell'Ariccia and Marquez (2004) more industry specialization should be observed. Our estimated coefficient on the *Multi-Market Contact* variable however is statistically not significant. The same is true for the coefficients on the two proximity variables.

However, the coefficients on *Branch Size*, *Industry Concentration in the Postal Zone*, and *Urban* are statistically significant at a one percent level. Industry Specialization decreases from 18 to 9% going from the smallest branch to the largest branch and from 16 to 4% going from the postal zone that is most concentrated in industrial composition to the least concentrated. Industry Specialization in Urban postal zones is six percent higher than in rural areas (17 to 23%).

To conclude, larger branches of the analyzed bank located in rural areas or where the industry more diversified engage fewer borrowers in the same industry. But local bank market concentration, multi-market contact, or bank proximity seem to play no role in determining bank branch industry specialization.

4.3. Sample of single-person businesses and sole proprietorships

4.3.1. Bank orientation

Table 4 focuses on the regressions results when employing the 9213 firms that are both single-person businesses and sole proprietorships.[16] It is interesting to investigate the possible correspondence between competition and bank orientation also for this sample. First, remember that we are looking at the loan portfolio of one single bank and that we now retain just one type of firm, potentially controlling for a substantial source of variation in bank orientation. While we do not have access to the key firm characteristics employed before for this sample, we can control for industry and postal area effects. Second, single-person businesses / sole proprietorships are the smallest (possibly most opaque and locally restricted) firms that are affected most by the structure of the local banking market. Among the 645 firms in the previous sample only 5% of the firms were single-person businesses, 87% were small firms and 8% medium and large firms. In this sample, in contrast, by definition 100% of the firms are single-person businesses. Third, the number of postal zones where firms are present more than doubles from 309 (in the '645 sample') to 717.

The findings in Table 4 mainly confirm our earlier results. The non-monotonicity in HHI is again economically relevant. Fig. 2 displays the resulting U-shaped schedule. Increasing HHI from zero to 0.48 decreases the probability of Relationship Banking from 60 to 44%.

4.3.2. Robustness

Given the higher number of postal zones involved the substantial increase in Relationship Banking for HHI values close and equal to one can also be explored here. Replacing HHI and HHI^2 by a set of dummies that equal one if HHI is situated in a certain range and are zero otherwise (to partly neutralize the effects of these observations) yields qualitatively similar results. Similarly, the partial derivative on HHI equals -27.3^{***} and -26.6^{***} respectively, if we drop

[16] We further run the main specifications (adjusted for the availability of relevant variables) on the sample containing the 1991 firms for which we collect age, the sample of 11,222 firms for which we collect distance, and the sample of all 13,098 firms. Results are mostly unaffected and we choose not to report these sets of exercises.

Table 4
Bank orientation: 9213 observations

Model:	**I**	**II**	**III**	**IV**
Estimation:	Probit	Probit	Tobit	Tobit
Dependent Variable	Relationship Banking	Main Bank	ln(Duration)	Industry Specialization
Herfindahl–Hirschman Index	−64.39***	−65.09***	−126.46***	9.10**
	(20.75)	(20.69)	(33.76)	(4.25)
(Herfindahl–Hirschman Index)^2	67.44***	70.05***	117.53***	−7.79*
	(20.90)	(20.86)	(34.00)	(4.28)
Multi-Market Contact	26.41**	30.17***	71.34***	−6.17**
	(11.70)	(11.68)	(19.02)	(2.39)
Closeness of Lender	12.65***	10.38***	42.62***	−1.46*
	(3.83)	(3.82)	(6.22)	(0.78)
Remoteness of Competitors	2.66	2.95	17.99***	1.07
	(3.83)	(3.82)	(6.21)	(0.78)
Branch Size	−11.77***	−11.76***	−46.69***	−6.93***
	(3.89)	(3.88)	(6.29)	(0.79)
Number of Firms in the Postal Zone	1.44*	1.47*	1.47	0.15
	(0.76)	(0.76)	(1.23)	(0.16)
Assets of Firms in the Postal Zone	−2.00	−2.69	−3.82	−0.36
	(4.39)	(4.38)	(7.02)	(0.88)
Industry Concentration in the Postal Zone	−52.85	−44.70	−45.78	−11.76*
	(33.58)	(33.56)	(54.88)	(6.91)
Urban	−1.82	−0.69	−4.45	1.67***
	(2.23)	(2.23)	(3.62)	(0.46)
Constant	−10.35	−10.67	163.05***	5.06*
	(14.92)	(14.90)	(24.02)	(3.03)
8 Postal Area Dummies	Yes	Yes	Yes	Yes
49 Industry Dummies	Yes	Yes	Yes	Yes
(Pseudo)-R^2	0.40	0.40	0.05	0.38

Notes. The table reports the partial derivatives at the means, in percent, from (binary) Probit and Tobit models. The dependent variables are Relationship Banking, Main Bank, ln(Duration) and Industry Specialization. The definition of the variables can be found in Table 1. The number of observations is 9213. The Pseudo-R squared is calculated as in Zavoina and McElvey (1975).

* Significance at the 10% level, two-tailed.
** Idem, 5%.
*** Idem, 1%.

HHI^2 and remove observations for HHI equal to one or larger than 0.75. Hence the derivative remains statistically significant and economically relevant in both exercises.[17] The coefficients

[17] If Relationship Banking decreases with concentration in less concentrated markets, why then do we observe more relationship banking in very concentrated markets? Physical proximity, as pointed out earlier, could compel a firm to frequent a close-by bank for all its needs. A monopolist in a postal zone then simply satisfies this *demand* by providing all services, in particular when banks in other postal zones are far away. An increase in Relationship Banking for high HHI values then merely affirms our a priori choice of the postal zone as the relevant geographical market. Alternatively, we note that Boot and Thakor (2000) predict that a monopoly bank should engage in little or no Relationship Banking. However, the monopolist bank may become an industry specialist at zero or low cost (by servicing all firms in the vicinity) and hence *supply* relationship banking nevertheless. This is not modeled in Boot and Thakor, as in their model even a monopolist incurs specialization costs (that are not a function of market structure).

on all the other variables remain virtually unaltered in sign, size, and significance, except for Branch Size that, as already indicated before, becomes now highly significant.

We are further concerned that duration caused or is affected by factors that caused current market concentration. For example, a pool of high-quality firms in the postal zone 10 years ago may have contributed to the longevity of the observed relationships as both relationships and firms survived (on the other hand high-quality firms may have had less need for a relationship lender). But circumstances in the postal zone 10 years ago that led to the high quality of the firm pool may also have attracted other banks to set up branches there in the period since then. To deal with this pernicious problem we toss out all observations with durations exceeding 10 (7) years and rerun our specifications. Even though we loose more than one third (one half) of the sample, the competition results are almost unaffected. We further collect bank branch information from the end of the year 1985,[18] recompile the HHI, and rerun all relevant exercises. This newly constructed "HHI 1985" is highly correlated with the HHI for 1995, the correlation coefficient for the full sample equals 0.92***, and therefore not surprisingly results are almost unaffected when the new HHI 1985 measure replaces the HHI 1995.

4.3.3. Bank industry specialization

In Model IV in Table 4 we continue to assume that Industry Specialization is based on the entire loan portfolio of the branch. In contrast to Model VIII in Table 3, the coefficients on the variables measuring local competition, multi-market contact, and lender proximity now turn statistically significant. The branches of the analyzed bank engage somewhat fewer borrowers in the same industry if local market concentration decreases or when banks in the postal zone have more contacts across other postal zones. Branches possibly reduce industry specialization as competition intensifies. Less industry specialization is also being observed when firms are located closer to the bank. In that case, industry specialization may become less prevalent because borrowers are less discriminate about their choice of bank branch. Overall these findings on industry specialization do not reject hypotheses present in Boot and Thakor (2000). But the effects seem at best rather modest in terms of economic relevancy, raising the possibility that our measure of industry specialization is inappropriate.

In Boot and Thakor (2000) competition affects bank industry specialization only for *relationship borrowers*. We run all models on the set of borrowers we identified as relationship borrowers, (i.e., Relationship Banking = 1). We first assume that industry specialization should be measured only for the portfolio containing these relationship borrowers. We rerun all specifications but choose not to report. Most coefficients are similar in sign and size, but somewhat less statistically significant. Next we measure industry specialization for the entire loan portfolio of the branch (assuming some positive knowledge spillovers from transactional lending) and re-run all models for the same sets of relationship borrowers. Results are virtually unaffected and again we choose not to tabulate them.

Next we are concerned about overweighing industry specialization by large branches (by definition many borrowers belong to those industries that large branches specialize in). We weigh all observations by the inverse of the number in each industry–branch group. None of the coefficients on the competition variables are statistically significant or economically relevant any longer indicating that only large branches adjust their degree of specialization in their focused

[18] Unfortunately we could not find a comprehensive listing of branches of savings banks for 1985, but the total number of savings branches we know has remained constant during this time period. Consequently we employed the 1995 list to impute the 1985 HHI. Savings banks operate around one half of all branches.

industries somewhat to competition. This interpretation may also explain the percentage-wise small adjustments we pick up. Our "linear" industry specialization measure may further fail to accommodate for the possible presence of fixed specialization costs and/or learning. We take the natural log of Industry Specialization and rerun all OLS and WLS exercises. Results are qualitatively unaffected.

5. Conclusion

There is significant disagreement on whether interbank competition and relationship banking are inimical or not—both in theory and in empirical findings. We address the issue of the impact of interbank competition on bank branch orientation employing a unique data set containing detailed information on both bank–firm relationships and the local banking market structure. Interbank competition seemingly affects bank branch orientation (and to a much lesser extent bank branch industry specialization). Fiercer interbank competition results in more relationship banking (in most observed cases). Borrowers located closer to the bank branch are more likely to consume other bank services and to be engaged over a longer time period. Finally, larger bank branches lend substantially more on a transactional basis but are less likely to be specialized in particular industries. We notice that bank entry in a spatial model of competition decreases market concentration, bank–borrower distance, and bank branch size, and that the estimated coefficients on all three variables are negative, significant, and of almost equal economic relevancy.

Taken at face value these results cannot reject hypotheses proposed by Boot and Thakor (2000), among others, suggesting competition and relationships are not necessarily inimical. However the results seem at odds with insights and results by for example Petersen and Rajan (1995). Reconciling both sets of hypotheses and results seems a natural but challenging task for future research. As a first step, it may be fruitful to corroborate our results and to analyze different samples, to employ other proxies of the intensity of competition (such as the Panzar and Rosse, 1987 H-statistic), and to construct more comprehensive measures of bank orientation and industry specialization. Ultimately though we want to understand more in-depth which of the theoretical mechanisms, briefly discussed earlier, best explains the somewhat unexpected co-existence in credit markets between competition and relationships.

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