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Distance, Lending Relationships, and Competition

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Abstract

A recent string of theoretical papers highlights the importance of geographical distance in explaining pricing and availability of loans to small firms. Lenders located in the vicinity of small firms have significantly lower monitoring and transaction costs, and hence considerable market power if competing financiers are located relatively far. We directly study the effect on loan conditions of the geographical distance between firms, the lending bank, and all other banks in the vicinity. For our study, we employ detailed contract information from more than 15,000 bank loans to small firms and control for relevant relationship, loan contract, bank branch, firm, and regional characteristics. We report the first comprehensive evidence on the occurrence of spatial price discrimination in bank lending. Loan rates decrease in the distance between the firm and the lending bank and increase similarly in the distance between the firm and competing banks. Both effects are statistically significant and economically relevant, are robust to changes in model specifications and variable definitions, and are seemingly not driven by the modest changes over time in lending technology we infer.

Keywords: spatial price discrimination, bank credit, lending relationships.
JEL Classification: G21, L11, L14.

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1. Introduction

Banks derive market power ex post from private information they obtain about firms during the course of the lending relationship or ex ante from their relative physical proximity to the borrowing firms. Closer banks enjoy significantly lower costs of monitoring and transacting with small firms, such that "if other banks are relatively far, close banks have considerable market power" (Petersen and Rajan (1995), p. 417).

We directly study the effect on loan conditions of the geographical distance between firms, the lending bank, and all other banks in the vicinity, controlling for relevant relationship, loan, bank branch, firm, and regional characteristics. For our study, we employ a unique data set containing detailed loan contract information (including firm and lender identities and addresses) from more than 15,000 bank loans to (predominantly) small firms as well as information on competing bank branches in the vicinity of the firm.

We find that, in line with predictions emanating from theory modeling spatial price discrimination, borrowing costs decrease in the distance between the firm and the lending bank. We identify banking competition and pricing strategies in our analysis by including both the number of bank branches (or branch concentration) and the distance between the borrower and competing bank branches in the vicinity. We observe that increasing distance between the borrower and alternative lenders significantly relaxes price competition and results in substantially higher borrowing costs for the firm.

Petersen and Rajan (2002) and Berger, Miller, Petersen, Rajan and Stein (2001b) also study the correspondence between distance and lending conditions. Petersen and Rajan (2002) focus on the increasing distance and changing modes of communication between small firms and their lenders in the United States over the last 25 years. Berger et al. (2001b) document how large banks lend at a greater distance than small banks in the U.S. In contrast, we analyze contract terms of loans granted by a single bank and incorporate not only the distance between the borrowing firm and this lender, but also the distance between the firm and the competing banks in the vicinity to identify the presence of spatial price discrimination. We further document that the distance between the European firms and the bank in our study did not increase substantially over the period 1975-1997.

Other empirical work reveals the impact of geographical distance on related activities of financial intermediaries, such as for example, cross-border bank lending and branching (Berger, Dai, Ongena and Smith (2001a); Buch (2001); Hondroyiannis and Papapetrou (1996); Grosse and Goldberg (1991)). Distance may also determine the effectiveness of internal control mechanisms within bank holding companies (Berger and DeYoung (2001)), the strength of informational contagion between banks (Aharony and Swary (1996)), and the representation of venture capitalists on the boards of U.S. private firms (Lerner (1995)).

Physical distance may further influence activities on financial markets in general. International capital flows seem bound by geographical proximity (Portes and Rey (2001)), but so is possibly the composition and returns on actively managed U.S. mutual funds (Coval and Moskowitz (2001)), the trading profitability of traders on the German electronic exchange Xetra (Hau (2001)) and the portfolio choices of Finnish investors (Grinblatt and Keloharju (2001)). We contribute to this growing literature by analyzing the impact of both the distances between lender-borrower and competing banks-borrower on the pricing of bank loans to bank-dependent small firms.

We organize the rest of the paper as follows. Section 2 reviews the literature on distance, lending relationships, and competition. Section 3 introduces the data and discusses the methodology used in our paper. Section 4 displays and discusses the empirical results. Section 5 concludes.

2. Literature Review

2.1. Distance

Recent theoretical papers highlight the importance of distance in explaining the availability and pricing of bank loans. Lending conditions may depend on the distance between the borrower and the lender and the distance between the borrower and the closest competing bank (Table 1 summarizes the theoretical predictions).

In traditional location differentiation models (Hotelling (1929), Salop (1979)), borrowers incur transportation costs visiting their bank branch.[1] Total transportation costs naturally increase in distance. Banks price uniformly if they cannot observe borrower location or are prohibited to charge different prices to different borrowers. Borrowers pay the same interest rate but incur different transportation costs depending on their location *vis-à-vis* the lending bank.

However, if banks can observe the borrowers' location and offer interest rates based on that information, they may engage in spatial price discrimination. If borrowers incur their own transportation cost, a bank will

charge a higher interest rate to those borrowers located closest to its branch (see for example, Lederer and Hurter (1986)). Hence, discriminatory pricing based on transportation costs implies, for a given number of banks, a negative relationship between the loan rate and the borrower-lender distance and a similar, positive relationship between the loan rate and the distance between the borrower and the closest competing bank.
The cost of servicing a borrower could also be related to physical distance. For example, bank costs increase in borrower-lender distance, because of extra communication costs or transportation costs incurred by banks visiting the borrowers' premises. Loan rates passing through such costs will increase in distance. However, monitoring costs increasing in distance may also give rise to discriminatory pricing. For example, in Sussman and Zeira (1995) spatial price discrimination arises because all banks face monitoring costs increasing in distance, have a strong bargaining position, and extract all the gains of trade. Discrimination again implies a negative (positive) relationship between the loan rate and the borrower-lender (borrower-closest competing bank) distance (for a given number of banks). The correspondence between borrower-lender distance and loan rate becomes non-monotonic if monitoring costs are also dependent on loan size (Wong and Chan (1993)).

2.2. Distance and Lender Information

Lenders may initially be unsure about the exact location of the borrower. For example, if the borrower maintains multiple centers of activity, it is not clear at first for the bank where to monitor. In that case, the bank can only engage in discriminatory pricing upon becoming informed about the location and transportation costs faced by their borrowers. In Dell'Ariccia (2001), for example, banks become informed about the location of the borrower through first period lending. In his model, only "relationship" banks, lending in their second period, can engage in spatial price discrimination, while *de novo* "transactional" banks have to resort to “mill pricing”.
The severity of the asymmetric information problem itself may also increase in distance. Hauswald and Marquez (2000) develop a model in which the precision of the signal about a borrower’s quality received by a bank decreases in distance. Because banks will receive more precise signals about close borrowers, competing banks will face increasing adverse selection problems when approaching borrowers closer to the most informed bank. Hence, the informed relationship bank can charge higher interest rates to closer borrowers while the uninformed transactional banks will charge higher interest rates to borrowers located farther afield due to the increase in the adverse selection problem. *Ceteris paribus*, Hauswald and Marquez (2000) derive a negative (positive) relationship between the loan rate and the distance between the borrower and the relationship (transactional) bank.

2.3. Competition

The number of banks in the market is inversely related to the distance between the lender and the (closest) competing banks. An increase in the number of banks leads to more competition and possibly lowers the loan rates. For example, a decrease in the fixed setup costs per bank in Sussman and Zeira (1995) and Harrison, Sussman and Zeira (1999) increases the number of banks, decreases the distance between any two neighboring banks, and decreases the loan rate for each bank-borrower distance combination.[2]
On the other hand, competition between more banks aggravates an adverse selection problem by enabling lower quality borrowers to obtain financing, resulting in moral hazard and credit rationing (Petersen and Rajan (1995)) or a higher interest rate (Broecker (1990), Cao and Shi (2001)). In Dell'Ariccia (2001), adverse selection generates an endogenous fixed cost constituting a barrier to entry in the industry limiting the number of banks competing in the market.
A decrease in the fixed cost component of the relationship building technology in Hauswald and Marquez (2000) similarly not only leads to an increase in the number of banks and more competition, but also results in a retrenchment towards relationship lending.[3] The lower entry barrier then leads to sharper adverse selection problems and higher loan rates for the borrowers closest to the relationship lender but lower loan rates for customers farther away. In effect, loan rates will decrease (increase) more per unit in distance between the borrower and the relationship (transactional) bank.

2.4. Distance, Borrower Information, and Experience

Borrowers may not be fully informed about the precise location of all the competitors’ branches and the availability and conditions of the loans offered there. For example, Grossman and Shapiro (1984) and Bester and Petrakis (1995) model such location *cum* informational differentiation. In Grossman and Shapiro (1984), consumers buy a product from a particular seller upon becoming informed of its location through advertising.

The advertising itself is not localized. The sales price in their model exceeds the full information price, by the magnitude of the transportation cost, as informational differentiation lowers the elasticity of demand. In addition, consumers in their model, as they are unaware of all sellers, not necessarily patronize the closest one.

Bester and Petrakis (1995) model the advertising of lower price offers. Absent advertising, customers are only informed about "local" prices. They show that firms will advertise lower prices to attract customers from distant locations. Hence, more distant and informed customers will be observed to receive lower prices.

However, it should be noted that the location of the bank branch is just one out of many characteristics of a banking product that are important for the borrowers. Consequently, borrowers not always visit the bank branch located closest when another bank's product exhibits other, more preferred, characteristics.[4] And, once borrowers have experienced a good match and observed the high quality of the services provided by their current bank, they will only switch to another bank branch when offered a considerably lower price (Tirole (1988), p. 294).

To conclude, most theoretical models imply a negative (positive) correspondence between the borrower-lender (competing bank) distance and the loan rate, but information availability, experience, and other product characteristics may abate the strength of the distance – loan rate relationship. However, as far as we are aware no paper has yet empirically investigated these associations, or lack thereof, directly and comprehensively.

3. Data

3.1. Loan Contracts

We extend a data set detailed in Degryse and Van Cayseele (1998) and employed by Degryse and Van Cayseele (2000). The original data set consists of 17,776 loans given to independents (or single-person businesses),[5] and small, medium, and large sized firms by an important Belgian bank which operates all over Belgium. Around 80% of the firms are single-person businesses (sole proprietorships). Some borrowers take several loans from this bank; the data set covers loans granted to 13,104 borrowers — implying that the average borrower maintained 1.36 loans at that bank. The sample commences with all existing loans at the bank as of August 10, 1997 that were initiated after January 1, 1995.[6]

For each borrower we calculate the distance to both the lending bank and the branches of all other, competing banks located in the same postal zone as the borrower. As of December 31st, 1994, we identify 7,477 branches,[7] operated by 145 different banks and located in 837 different postal zones (Table 2). Each postal zone carries a postal code between 1,000 and 9,999. The first digit in the code indicates a geographical area, we call "postal area", which in most cases coincides with one of the ten Provinces in Belgium. A postal zone covers on average 36 sq km,[8] and contains approximately nine bank branches. Not surprisingly borrowers are often located in more densely banked areas, with on average more than 17 bank branches per postal zone, resulting in around 250,000 possible borrower – bank branch pairs.

We employ both web-based MapBlast.com and PC-based MS Mappoint to track the shortest traveling time (in minutes) by car between the borrower and each bank branch. We choose the shortest traveling time, the default setting in both programs, over a number of other mapping alternatives,[9] as we suspect that for most entrepreneurs in our sample variable transportation costs consists mainly out of traveling time spent. We provide concrete statistics on this issue when we discuss the results and employ the fastest driving distance (in kilometers) in robustness exercises.

Address recording errors, incomplete map coverage, and changes in street names (we have 1995 addresses but the software is using up-to-date maps) cut in our sample. We drop 801 contracts that were either relocated or where the borrower switched to another or a new branch after the closure of their old one. Next, we conservatively remove the 1-% borrowers located farthest from their lending bank, as we discover that a combination of address-recording errors,[10] mapping problems,[11] and non-standard borrowing motives and business arrangements[12] is responsible for most of these longer distances. Finally, we lay aside 612 contracts located in postal zones without competing banks. We return to this set of contracts later in the paper.

Table 3 provides summary statistics for the remaining 15,044 contracts.[13] Table 3 shows the definition, mean, median, minimum, maximum, and standard deviation of our variables, broken down into seven sets of characteristics: geographical distances, relationship characteristics, competition measures, loan rate and size, other loan contract characteristics, firm characteristics, and interest rate variables.

3.2. Distance to Lender

The median borrower is located around 4 minutes and 20 seconds from the lender, which depending on the local road conditions translates into 2.25 kilometers (1.40 miles) of driving at 31 km/h (20 mph).[14] In contrast, Petersen and Rajan (2002) find that the median distance between lending banks and small US firms covered by the 1993 National Survey of Small Business Finance (NSSBF) is more than double, i.e. 4 miles. However, the median firm in the NSSBF employs 2 to 4 employees,[15] while the median firm in our sample is a sole proprietorship.[16] In addition, costs of driving may differ substantially between Belgium and the U.S.,[17] and Belgian businesses may be limited by the size of the country in their choice of domestically located banks.[18] These arguments may also explain the even larger differences with the other distance statistics Petersen and Rajan (2002) report. For example, the average (75 percentile) borrower – bank distance in our sample is around 3 (3.5) miles, while the same borrower in Petersen and Rajan (2002) communicates across 42.5 (14) miles with her bank,[19] or across a whopping 252 (255) miles with her other financial institutions.

Petersen and Rajan (2002) also report that the distance between U.S. borrowers and banks has increased dramatically over time.[20] For example, the median bank-borrower distance has more than doubled between the mid-70s and the early-90s from 2 to 5 miles, while the average distance more than quadrupled from 16 to 68 miles. In contrast, in our sample, the median and average distances between the borrowers and the Belgian bank we study increased by only around 30%, from 4 (6.85) in 1975 to 5.2 (8.86) minutes in 1997.[21]

In Figure 1, we display the traveling time statistics for each year, which is calculated by subtracting the duration of the relationship between lender and borrower from the initiation year of each loan contract. In effect, we assume that the address of the borrower didn't change during the relationship period. The horizontal scale of the figure lists the year and the resulting number of contracts in each year. The right scale reports the means (dots) plus or minus two standard deviations (thin vertical lines) of the traveling times in minutes.

Most of the modest increase in traveling time in our sample seems to occur during the early-90s. This increase may be partly driven by the changes in the number of bank branches because of regulatory driven de-specialization of financial intermediation and resulting consolidation. Indeed, Figure 1 (left scale) illustrates the small decrease in the number of branches of all banks during the same period.[22]

We regress the Distance to Lender on an intercept, the Starting Year of the Relationship, a Large Firm dummy, and an interaction term between the latter two variables. We want to investigate whether technology affects larger firms in a different way than other firms. Distance grows significantly, but only by around 9 seconds per year, while the growth in distance between large firms and their lenders is indistinguishable from the growth in distance between small firms and their lenders. When we add the (national) number of bank branches to this specification, the growth in distance drops to a significant but small 4 seconds per year. The closure of one branch in each postal zone (implying a decrease in the number of bank branches about equal the observed drop between 1990 and 1997) increases the traveling time by around 1 minute and 40 seconds.

Possible selection issues may further complicate the assessment of this moderate growth in distance between bank and borrowers (Petersen and Rajan (2002)). For example, firms may be poached, and hence may switch banks, more frequently if they are located farther away from a bank branch.[23] And, if we look at the evolution of distance by loan origination date, we find that average distance actually decreases from 7.7 minutes in 1995 to 6.68 minutes in 1997! We are therefore tempted to conclude that our findings with respect to the evolution over time of the lender-borrower distances match a study by Buch (2001).[24] She reports that in the period 1983 through 1998 distance became less important for international bank lending by U.S. banks, in stark contrast to European banks for which distance remained of the same importance. We will nevertheless control for possible changes over time in lending technology in robustness exercises.

3.3. Distance to Closest Competitors

We now turn to our other main variable of interest, distance to the closest competitors. The median (average) borrower in our sample is located 2 (2) minutes from the closest competitor or 3 minutes and 15 (50) seconds from the quartile closest competitor located in the same postal zone. The quartile closest competitor is the bank branch with the 25-percentile traveling time located in the same postal zone as the borrower. We select this second measure as our metric of competitor proximity for obvious measurement reasons. Omissions, recording, or mapping errors are less likely to influence the 25-percentile statistic than the shortest distance statistic. In addition, bank branches may not be entirely homogeneous in their product offerings. In that case, we also conjecture our 25% measure to be more highly correlated with the distance to the closest, "truly" competing bank branch than the minimum distance metric. In any case, we will also check for robustness of our results with respect to this a priori choice of proximity metric.

The lending bank is located closer than the quartile (closest) competitor in more than 44% (25%) of the borrower contract cases making distance a relevant bank (product) characteristic for a sizeable minority of the borrowers in our data set. A majority of the borrowers though doesn't seem overly constrained by geographical proximity.[25] Hence, our statistics suggest that, while distance is important, information, reputation, and other bank characteristics may also determine the choice of lender and the resulting loan conditions.

3.4. Relationship Characteristics

Relationship characteristics are therefore central to our analysis in capturing information and experience effects. The first characteristic in this category, Main Bank, indicates whether this bank considers itself as the main-bank of that firm or not. The definition used by the bank to determine whether it is the main-bank is "having a monthly 'turnover' on the current account of at least BEF 100,000 (U.S. Dollar 2,500),[26] and buying at least two products from that bank". More than half of all borrowers are classified as Main Bank customers. Main Bank captures the *scope* of the relationship. That is whether this firm also buys other products from this bank and executes most of its payments via this bank. If these sources of information improve the accuracy of the bank's information or reduce the monitoring costs, the measure Main Bank should reduce the expected cost of such loans.[27] But Main Bank also proxies for the lack of information a borrower has about alternatives. In that case, a main bank customer will pay a higher loan rate, but may be less subject to spatial price discrimination.

The second relationship variable is the Duration of the financial Relationship in years with that particular bank at the time the loan rate is decided upon. A 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 about eight years. Duration proxies for the increased time for a firm to experience the banks' products and appreciate the added flexibility the bank has to maintain and fulfill implicit contracts. While the bank gains private information about a firm and tailors its products, the firm may also become locked-in. Hence, a long-term bank customer may pay a higher loan rate, but become less subject to discriminatory pricing.

3.5. Competition

Finally, we also enlist in our main analysis the Number of Competitors, which is defined as the number of bank branches (minus the lender's) in the borrower's postal zone. In most of the discussed spatial models, the number of competitors corresponds inversely to the sum of the distance to the lender and the closest competitor. This is also the case in our sample, though the correlation coefficient seems small in absolute value. The correlation coefficient for the Number of Competitors and the sum of the Distance to Lender and Distance to the quartile (actual) Closest Competitor for each contract is only –0.023*** (–0.103***).

An obvious candidate to explain the small correlation coefficient is the spatial simplification embedded in the theoretical models discussed earlier in the paper. Geographical clustering of business and banking activities across a land surface may weaken any correspondence between distance and the number of bank branches. In addition, there are also the differences in surface size of the postal zones. Many postal zones are roughly equal in size, a cursory look on the map suggests. However, there are exceptions such as the postal zones in the Capital Brussels (which are small) and the postal zones in the provinces Luxembourg or West-Flanders (which are large). Such differences are most likely related to differences in for example population density, the number of businesses, and other possible criteria the postal system used to zone the country. We include 8 postal area dummies (which cover around 100 zones each) in addition to the base case to control for these differences in zone size. We will also introduce postal zone and bank branch effects in robustness exercises.

3.6. Other Variables

The rest of the variables are also discussed at length in Degryse and Van Cayseele (2000), so we limit the write-up here. Consider the *loan contract characteristics*. The first is the Interest Rate on the loan until the next revision. For fixed interest rate loans, this is the yield to maturity of the loan. For variable interest rate loans, this is the interest rate until the date at which the interest rate will be revised as stipulated in the contract. The average interest rate on a loan in our sample is 8.12% or 812 basis points (we will employ basis points throughout the paper to facilitate the tabulation and interpretation of the results). The variable rate loans are, after an interest rate revision, treated in the sample as a new observation, with a revised interest rate. Loan fees are not included, but are typically not charged to sole proprietorships, set nationally and unlikely to be determined by any of the local variables of interest.

The median loan size is BEF 300,000 (USD 7,500), but varies between BEF 5,000 and 80,000,000. We will

assume in our empirical analysis that loan rate and size are determined jointly. The variable Collateral indicates whether the loan is collateralized or not. We have no further information on the type of collateral provided. Approximately 26% of the loans are collateralized. We will assume, as in for example Berger and Udell (1995), Harhoff and Körting (1998), and Elsas and Krahnen (1998) among others, that collateral and interest rate conditions are determined sequentially, with the collateral decision preceding the interest rate determination. Indeed, collateral is often pledged at the beginning of a relationship, possibly infrequently and/or inconsistently adjusted, and may end up covering multiple loans. However, we will investigate alternative decision sequences with respect to loan size and collateral in robustness checks.

Another loan contract characteristic is the Repayment Duration of the Loan. For all loans to the firms, we know at what 'speed' the loans are repaid. This allows us to compute the exact repayment duration of a loan. We include the natural logarithm of this variable in the regression analysis in order to proxy for the risk associated with the time until the loan is repaid. We also include dummies capturing the type of loan the firm is taking. We have five types of loans in our sample. For bank-strategic considerations, we cannot reveal the relative importance of the types of loans. We include the types of loans in Table 3 for convenient reference, but cannot report statistics. The distinction is made between Business Mortgage, Bridging Finance, Prepay Taxes, Business Term, and Consumer Credit loans. The size of most loans is rather small, since a large part of our loans are of the Prepay Taxes and Consumer Credit type. We also include a Rollover dummy, which takes a value of one if the loan is given to prepay another loan, and is zero otherwise. Four dummies capture the effect of the revisability of the loan.

The *firm characteristics* include both proxies for the size and legal form of the firm. We distinguish between Sole Proprietorships (82.99% of the sample), Small (15.98%), Medium (0.89%), and Large (0.14%) Firms, and between Sole Proprietorships, Limited Partnerships (11.97%), Limited Partnerships with Equal Sharing (1.17%), Corporations (3.78%), and temporary Bridge Arrangements (0.09%). In the regressions, we exclude the dummy for Sole Proprietorships. We include 49 two-digit NACE code dummies to capture industry characteristics.[28]

The *interest rate variables* are incorporated to control for the underlying cost of capital in the economy. We control for variations in the cost of capital by including four variables. The first is the interest rate on a Belgian Government Security with the same repayment duration as the loan granted to the firm. We calculate this interest rate using the exact date of granting the loan to the firm. Secondly, we include a Term Spread, defined as the difference between the yield on a Belgian government bond with repayment duration of five years and the yield on a 3-months Treasury bill. Finally, we incorporate two year dummies (1995 is the base case) to control for business cycle effects.

4. Empirical results

4.1. Regression Analysis

This section provides the empirical results of the determinants of the loan rate. We analyze the determinants of the loan rate by regressing the loan interest rate on our distance, relationship, competition, and control variables (which include loan contract characteristics, firm characteristics, and interest rates). We use the ordinary least squares estimation technique. We focus on the distance, relationship, and competition variables. We first discuss a start-up specification. Afterwards, we add our competition and distance variables of interest, and perform supplementary robustness tests.

First, we regress the loan interest rate (in basis points) on the relationship characteristics and control variables. This specification merely replicates an exercise by Degryse and Van Cayseele (2000) for the retained 15,044 observations. Our sample also includes large firms.[29] Most coefficients remain virtually unaltered, both as a departure from Degryse and Van Cayseele (2000) and throughout the exercises in this paper; hence we therefore only briefly discuss, but do not tabulate, the estimated coefficients.

The loan contract characteristics include whether the loan is collateralized, the repayment duration of the loan, and loan type and goal. The coefficient of Collateral indicates that when a loan is collateralized, the loan rate decreases by approximately 51*** basis points.[30] This result seems in line with the sorting-by-private-information paradigm, which predicts that safer borrowers pledge more collateral (for example, Berger and Udell (1990) and Besanko and Thakor (1987)). However, it contrasts with results by for example Elsas and Krahnen (1998) and Machauer and Weber (1998), who report a positive, though economically small, effect of collateralization on loan rates. The coefficient of ln(Repayment Duration of Loan) is significantly negative at a 1-% level: an increase of the duration from five to six years reduces the interest rate by 17 basis points.[31]

Small firms pay a higher interest rate (43.7**), while large firms pay a significantly lower interest rate (-

171.3***) than do single-person businesses (the base case). Both the Corporations (-116.2***) and the Limited Partnerships with Equal Sharing (-46.2*) pay a significantly lower interest rate than single-person businesses with unlimited liability for business debts.
Finally, a significant fraction of the variation in the loan rate is explained by economy-wide factors. The change in the loan rate due to a basis point change in the interest rate on a Government Security with the same repayment duration equals 0.5***. A basis point parallel shift of the Term Spread implies a positive 0.4*** basis point shift in the loan rate. The size of the coefficient on the government security variable found by Petersen and Rajan (1994) is around 0.3*** whereas the one for the term spread is negative and insignificant. Degryse and Van Cayseele (2000) reported a somewhat higher coefficient on their government security variable (0.7***), but a somewhat lower term spread coefficient (0.3***).

4.2. Relationship Characteristics

We now report the empirical results concerning the role of relationships. These variables play a more prominent role in our analysis of the impact of distance on loan conditions. We capture the role of the bank-firm relationship in two complementary ways. Our first indicator of relationship strength, Main Bank, measures the *scope* of the bank-firm relationship. The loan rate is decreasing in the scope of the relationship. The results show that a firm pays 41*** basis points less when the scope of a relationship is sufficiently broad.[32]
The second indicator is the Duration of the Relationship between the lending bank and the borrower. We take the log of the Duration of the Relationship as we expect the marginal impact on the loan rate to decrease in the duration of the financial relationship. The coefficient is significantly positive, around 19***, implying that the loan rate increases in the duration of the relationship, as in Degryse and Van Cayseele (2000). An increase in duration from say 7.5 (median) to 13 (median plus one standard deviation) years increases the loan rate by around 10 basis points.

4.3. Competition

We incorporate in Models I, II, and III both our measures of banking competition (and the resulting market power of the lending bank) and geographical distance. Table 5 presents the results. We first discuss the competition measures. In line with the discussed spatial models, we start by employing the Number of bank branches of the Competitors operating in the postal zone where the borrower is located. We add the natural log of one plus this number to the regression, and report the results in Model I. The coefficient on ln(Number of Competitors) is not significantly different from zero. Hence, when competition is measured by the number of bank branches present in the same postal zone as the borrower, neither the effects of induced competition nor adverse selection effects seem to dominate.
Next, we add the number of bank branches of competitors in adjacent postal zones to this variable, as the delineation of postal zones may not correspond to the relevant geographical clustering of banking activities (for example, the capital Brussels covers more than a dozen postal zones). The coefficient on the adjusted variable is not significant either, and we choose not to report the results.
In Model II, we replace the number of competitors by a more commonly used measure of competition, the Herfindahl – Hirschman Index (HHI). We resort to using the number of bank branches of each bank in the postal zone to construct market shares. In effect, we assume coordination occurs between branches of the same bank, while our previous measure of competition assumed branch independence.[33] The resulting coefficient on the HHI equals a significant, but small, 35.3**. This estimate implies that an increase of 0.1 in the HHI, say from a competitive (HHI < 0.1) to a "highly concentrated" (HHI > 0.18) market,[34] would increase the loan rate by only 3.5 basis points.
The coefficient on the HHI in our regression model corresponds to the (mostly) positive coefficients reported by, for example, Berger, Rosen and Udell (2001c), Hannan (1991), Hannan (1997), and Sapienza (2002). Appendix A tabulates a few selected studies. The estimates imply that bank loan rates change between -6 and 61 basis points corresponding an increase in the HHI by 0.1. However, it remains hard to compare results across specifications, banking markets, periods, and HHI measures. For example, concentration measures are alternatively based on loans, deposits, or branches, and vary widely (across studies) in geographical span.[35]
We introduce postal zone effects in Model III to control better for the geographical variation in competition and firm characteristics. We exclude HHI and the postal area dummies, as these variables are by definition spanned by the postal zone effects. We also drop the industry dummies, as collinearity problems hobble our calculations. A Lagrange multiplier test indicates the effects are significant. We further test for the orthogonality of the random effects and the regressors using a Hausman (1978) test and cannot reject orthogonality. In addition, we view our sample to be drawn from a large population. Hence, we report the

coefficients for the random effects model in column III (the results for the fixed effects model are very similar). The coefficients on all variables of interest are virtually unaffected.
Finally, we replace the postal zone effects by bank branch effects to capture branch specific variation in competition and/or spatial variation. Again, random effects seem preferred and the estimated coefficients are very similar. We choose not to report the results.

4.4. Distance

We now turn to our distance variables of interest. We take the log of both distance measures, ln(Distance to Closest Competitors) and ln(Distance to Lender), as we conjecture the marginal impact on the loan rate to decrease (in absolute value) in distance. We will investigate the impact of this choice of functional form in a robustness exercise. The positive and significant coefficients on ln(Distance to Closest Competitors) in Models I, II, and III suggest that borrowers located farther away from competing bank branches face a higher loan rate at the lending bank. These results are consistent with price discrimination resulting from transportation costs, monitoring costs, as well as asymmetric information. Moreover, our proxy for the distance between the borrower and the closest competitor may identify strategic behavior between banks, which our other competition variables did not (or only partly) pick up. Indeed, even after controlling for the number of competitors, branch concentration, postal zone and bank branch effects, the lending bank seems to enjoy substantial market power that increases in the distance to the closest competitors. In addition, this market power decreases in the distance between the borrower and the lender itself, as indicated by the negative and significant coefficient on the variable ln(Distance to Lender).
The location models discussed in section 2 provide precise theoretical predictions concerning the sum of the coefficients on both distance measures. In particular, given the locations of bank branches, a marginal shift in the location of the borrower implies that the sum of the coefficients on both distance measures should equal zero. Therefore, in line with this theoretical prediction emanating from simple location models, we restrict the sum of the coefficients on both distance measures to equal zero in Model II (which coefficients are mostly easily interpretable). We test the restriction and report the results in Model IV. The F-statistic equals 8.6 and hence we cannot reject the equality restriction.
Both distance effects are not only statistically but also economically relevant. Using the estimates of Model IV, for example, an increase of one standard deviation in the distance between borrower and lender, i.e., the traveling time increasing from 0 to 7.3 minutes, decreases the loan rate by 18 basis points. An increase of one standard deviation in the distance between borrower and the closest competitors (from 0 to 2.3 minutes) increases the loan rate by about 10 basis points.
For the median loan of BEF 300,000, annual outlays for the borrower decrease by BEF 72 (USD 1.8) per extra minute of traveling to the lender.[36] Belgian entrepreneurs and (bank) managers made around BEF 20 / minute in 1995,[37] while the operating costs for a car (gas, maintenance, tires) may have amounted to around BEF 3 / minute of driving.[38] Hence, according to a simple linear transportation cost model the median borrower is expected to make one-and-a-half additional round-trips to his bank branch as a direct result of the new loan. Alternatively, according to a linear monitoring cost model, bank managers are expected to make three round-trip visits to their median borrowers. We find these estimates reasonable (given that for example loan repayment can be organized by mail) but economically interesting on the margin.

4.5. Relationship Characteristics and Distance

The lending bank in our study does not seem to practice uniform loan pricing. On the contrary, borrowers located closer to the lender and farther away from competitors incur higher loan rates. We also observe that an increase in the distance between borrower and lender decreases the loan rate by a similar amount than a decrease in the distance between borrower and the closest competitors.
Borrower-Lender and borrower-competing bank distances also have implications for the information of banks about borrowers. To investigate whether informational arguments hinge on distance, we interact our two distance measures with the bank-firm relationship variables in Model V. The results are very interesting. The distance coefficients (as such) now capture the impact of distance for "transactional borrowers" (Main Bank = 0 and Duration = 0). The restricted coefficients from this regression (which equal minus and plus 14.2***) suggest that a transactional borrower in our sample expects to visit his branch two-and-a-half times per year as a result of a new BEF 300,000 loan (according to a linear transportation model), one time more than the median borrower in Model IV.
Remember that in Hauswald and Marquez (2000), the uninformed (transactional) lenders charge a higher loan rate to remote borrowers to compensate for the adverse selection problem which intensifies in the vicinity of informed (relationship) lenders. Our results show, however, that the loan rate decreases in distance, i.e. the

coefficient on the Distance to Lender variable is significantly negative (this result is independent of the equality restriction, which can not be rejected in the first place). We see three potential interpretations. First, banks in the vicinity of the firm are informed, as in Hauswald and Marquez (2000). Our results then suggest that the magnitude of the adverse selection problem does not increase significantly in distance. Alternatively, no bank in the vicinity of the firm is informed and there is no adverse selection issue. In other words, the loans we observe are transactional "all-around" and the lending bank can infer that no alternative lender in the vicinity of the borrower is informed about the borrower either. Finally, non-main bank firms become informed and attracted by the advertisements of lower prices by the lender (Bester and Petrakis (1995)). All three scenarios accommodate a negative correspondence between distance and loan rate.

Main Bank customers seem shielded from discriminatory loan pricing, as we cannot reject the joint equality to zero of the sum of the coefficients on the distance measures and the respective interaction terms with the Main Bank variable (F = 0.156). Remember that a main bank borrower buys at least two products from the same bank and has a turnover on the current account at that same bank of at least BEF 100,000 per month. Hence, main bank borrowers may face price discrimination on other products and/or be less informed about alternative banks, their products, and prices. However, main bank customers also pay a lower loan rate in our sample. The latter result is not compatible with the main bank borrowers being less informed in a location *cum* information model. However, the lower loan rate may be caused by cross-subsidization between loans and other banking products. The duration of the relationship between borrower and bank has an insignificant effect on the harshness of price discrimination.

To conclude, broadly in line with theories incorporating asymmetric information, we find that "transactional" borrowers pay higher interest rates and seem therefore more affected by spatial price discrimination than less informed "relationship" borrowers.

4.6. Robustness Checks

We subject our main results reported in Table 5 to a battery of robustness checks. First, we revisit our a priori choices regarding our distance measures. We rerun all models employing traveling times in levels (rather than logs). Results are mostly unaffected, though (not surprisingly) the coefficients entail somewhat smaller effects. For example, in Model III the coefficient on ln(Distance to Lender) equals –1.1***, implying a decrease in the annual outlays for the median borrower of BEF 33 per extra minute of traveling to the lender. Again, we cannot reject the equality restrictions in either Models IV or V.

We also replace the Distance to Closest Competitors, i.e. the 25-percentile measure, by the (possibly more noisy) Distance to the actual Closest Competitor in all specifications discussed so far. We report the coefficients for the representative Models III, IV, and V in Appendix B with the label "actual", but do not tabulate standard errors to conserve space. As can be seen from the table, coefficients are unaffected both in sign and magnitude, though (not unexpectedly) significance levels are somewhat higher. We also replace traveling time by physical distance in all specifications and again report the three models in Appendix B, labeled "physical". Remember that based on our calculations physical distance may well be less indicative as a measure of transportation costs for entrepreneurs. Nevertheless, while the coefficients decrease somewhat in size (for longer trips physical distance exceeds traveling time in minutes), signs and significance levels are broadly unaffected.

We remain concerned that technological developments and/or the location of competitors determine the choice of lender, partly driving our results rather than for example spatial price discrimination. Hence, we add the Starting Year of the Relationship (assuming technology progresses linearly through time) and the (national) Number of Branches to all models. Even though ln(Duration of Relationship) and Starting Year are by construction almost interchangeable and highly correlated (-0.91), both coefficients are significant. For example in Model IV, the coefficients are respectively 55.4*** and 4.5***. The coefficient on the Number of Branches is insignificant. However more importantly, the results for the distance coefficients of interest in all discussed models remain virtually unaltered. Combining these results with earlier exploratory regressions leads us to conclude that technological developments may not be a major issue when interpreting our results.

Loan size is exogenous in most location models. Nevertheless, we introduce Loan Size in the specifications assuming a sequential decision process setting first loan size followed by loan rate. We report the results in Table 6. We focus on the equivalent of Model IV in Table 5, as its parsimony and efficiency will be needed in subsequent sub sample exercises (the other specifications yield similar results). The coefficient on Loan Size equals –12.3***, indicating that an increase in loan size from the median (BEF 0.30 mln.) to the mean (BEF 0.88 mln.) amount decreases the interest rate by 7 basis points. The other coefficients remain unaltered and we cannot reject the equality restriction involving the distance coefficients.

Next, we aim to recognize the possible interdependence between loan size, rate, and distance. Loan size and rate may be determined jointly. In addition, the impact of distance on the loan rate may decrease in loan size (and possible even duration), due to the fixed cost character of the incurred transportation costs. Rather than estimating an ad-hoc system, we opt for stratifying the sample by loan size, with cut-offs set at BEF 0.2 and 2 mln. Reduced sample size leads us to suppress loan contract and firm characteristics. We report all relevant coefficients by size category in Table 6. The coefficients decrease by loan size, but remain significant for the two categories containing the smallest and medium sized loans. We can also not reject the equality restriction of the distance coefficients in either one of the size categories. In addition, though the coefficients decrease, the outlays per minute of extra traveling are quite similar. For example, for the median loan sizes in each group (i.e., BEF 109,000; BEF 500,001; and BEF 3,105,000), a minute of extra traveling costs BEF 47, 58, and 63 respectively.

In a similar vein, we drop the Collateral dummy from the specifications and in addition study the sets of contracts with and without collateral separately. Dropping Collateral hardly affects our main results. To run all specifications on the subsets of contracts we drop loan contract and firm characteristics. Distance continues to play a large role in the pricing of the 11,073 contracts without collateral. For example, the distance coefficients in Model IV equal minus and plus 18.5*** respectively. On the other hand, for the 3,971 collateralized contracts the distance coefficients drop to -/+ 2.7, with a standard deviation of 2.0 no longer significant at conventional levels. However, we cannot reject the equality restriction. Though borrowers with or without collateral are equally likely to be main bank customers, posting collateral seemingly also softens spatial price discrimination.

We are concerned that firm characteristics such as firm size or legal status may determine distance. Hence, we restrict the sample to sole proprietorships. We are left with 12,360 observations and report the results in the last but one column of Table 6. The coefficients on all measures of interest remain broadly unaltered. We further randomly select one loan per firm (from the original 15,044 observations) to reduce the impact of those (possibly larger) firms subscribing to multiple contracts. Nonetheless, the results for the remaining 11,222 loans are very similar to the results reported in Table 5.

Firms located in one of the 149 postal zones bordering other countries (the Netherlands, Germany, Luxembourg, and France) may face additional constraints in finding an alternative Belgian bank. However, our results remain also robust to dropping the 1,744 contracts located in those postal zones.

Next, we match loan contracts to *BelFirst*, a data set containing yearly balance and profit/loss statements of more than 250,000 Belgian corporations. Conservatively matching on tax identification numbers, we track 1,058 firms. Quite a few sole proprietorships seem not to be listed in *BelFirst*. Nevertheless, the summary statistics of the matched sample are surprisingly similar to the statistics for the entire data set and we choose not to tabulate them. We employ accounting data from the precise year preceding the loan contract. To parsimoniously control for firm risk and funding needs, we insert as explanatory variables firm Assets and the ratios of Earnings, Short Term Debt, and Net Trade Credit over Assets. We find that smaller, less profitable, and firms that are more indebted pay a higher loan rate. The distance coefficients increase in absolute value to 25.9**, but are also estimated much less precisely (the standard deviation on the coefficient increases to 10.3). Again, we cannot reject the equality restriction on our distance measures at a 5%-level of significance. Excluding the four newly introduced variables does not alter the estimated parameters of our other variables. We also collect firm age for 896 out of the 1,058 firms. Adding ln(Firm Age) as a fifth firm variable causes the distance coefficients to decrease in absolute value to 17.6* (the standard deviation equals 10.5).

Finally, we return to the 612 contracts located in postal zones without any identified bank branches. We add these contracts to the sample bringing the number of observations to 15,656. We calculate the Distance to the Lender for each of these additional contracts, but we set their Distance to the Closest Competitors equal to zero. We add a dummy (which equals one for each of the 612 contracts, and zero otherwise) to account for the undetermined effect of distance. We rerun all models. The coefficient on the dummy in the postal zone effects model, for example, equals 39.5*** (with a standard deviation of 13.9). Hence, borrowers located in a postal zone without any competing bank pay on average 40 basis points more than borrowers located in contested postal zones. This coefficient is quite reasonable when interpreted within the confines of a linear transportation model. The average postal zone covers a square of 6 by 6 km, which driving at the average speed of 31 km/h would result in 12 minutes traveling time to the Closest Competitors (now located outside the postal zone). According to the estimates gleaned from the original effects model, such distance to the Closest Competitor increases the loan rate by 47 basis points.

5. Conclusions

We directly study the effect on loan conditions of the geographical distance between firms, the lending bank,

and all other banks in the vicinity of the firm. We report, as far as we are aware, the first comprehensive evidence of the occurrence of spatial price discrimination in bank lending. Loan rates decrease in the distance between the firm and the lender and increase similarly in the distance between the firm and competing banks. Both effects are statistically significant and economically relevant. The results are robust to various changes in model specifications and variable definitions and seem not induced by the modest changes in lending technology we infer. The observed stability of the Belgian bank branch system during our sample period allows us to interpret the coefficients of the simple reduced form specifications within the framework of static models explaining spatial price discrimination.

Loan rates may reflect both distance as well as information effects. Loan rates decrease more in lender-firm distance for transactional (single-product) and un-collateralized loans. As borrowers engage the lending bank more broadly or post collateral, spatial price discrimination seems to relax. We find no direct evidence of adverse selection increasing in geographical distance, though it is possible that most borrowers we classify as transactional are unknown to all banks in the vicinity.

Overall, our results suggest that local loan officers may price loans by location, though distance variables are not featured explicitly in their formally acknowledged credit scoring system. However, granting some autonomy to local loan officers in assessing and pricing local loan applications may be optimal (Stein (2002)). Including qualitative, "soft factors" in the scoring system provides the loan officers with the necessary discretion. Brunner, Krahnen and Weber (2000), for example, provide preliminary empirical evidence (for Germany) of the importance of qualitative factors in setting loan rates (through internal bank ratings). We suspect that the loan officers, employed at the bank we study, wield soft factors to practice price discrimination based on their location and the presence of alternative providers of financing in the vicinity of the firm.

If banks persist in pricing loans by location, brick-and-mortar branching may remain vital in ensuring access to credit at reasonable rates, in particular for small firms and entrepreneurs. While technological developments in communication and travel may ultimately diminish the relevance of distance, we find only minor traces of such developments in our sample (which envelops the 1975-1997 period). The latter result suggests that presaging "the Death of Distance" remains somewhat premature in a European banking context.[39]

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TABLE 1. THEORETICAL MODELS LINKING LOAN RATES AND DISTANCE

Arguments & Discussed Models	Impact on the Loan Rate of the		
	Distance to the Lender*	Distance to the Closest Competitor*	Number of Competitors
Transportation Costs			
Uniform Pricing	no	no	negative
Discriminatory Pricing	negative	positive	negative
Monitoring Costs & Discriminatory Pricing			
Sussman and Zeira (1995)	negative	positive	negative
Wong and Chan (1993)	non-monotonic	non-monotonic	negative
	Distance to the Relationship Bank*	Distance to the Transactional Bank*	Number of Competitors
Asymmetric Information			
Broecker (1990), Cao and Shi (2001)	-	-	positive
Dell'Ariccia (2001)	negative	no	negative
Hauswald and Marquez (2000)	negative	positive	positive / negative

Notes: * For a given number of competitors.

TABLE 2. BANK AND POSTAL ZONE STATISTICS

Total Number of Banks	145				
Total Number of Bank Branches	7,477				
	Postal Zones	Postal Areas			
Total Number	837	9			
Average Surface Area, in sq km	36	3,359			
Average Population	12,045	1,120,209			
	Mean	Median	Min	Max	Std. Dev.
Number of Banks per Postal Zone	8.9	6	1	103	10.4
Number of Adjacent Postal Zones / Postal Zone	5.1	5	0	16	2.0
Number of Banks in Adjacent Postal Zones	53.6	44	2	471	42.4

Sources: *Belgian Bankers' Association, Bankvestigingen in Belgie, 1995, CIA Factbook 1995,* and *Geocart, Administratieve Kaart van Belgie en Groot-Hertogdom Luxembourg, 1992.*

TABLE 3. DATA DESCRIPTION

Variables	Definition	Mean	Median	Min	Max	St.dev.
Distance						
Distance to Lender	Shortest traveling time, in minutes	6.90	4.29	0.00	51.00	7.30
Distance to Closest Competitors	Shortest traveling time to the closest quartile competitor in the borrower's postal zone, in minutes	3.82	3.27	0.00	24.00	2.33
Relationship Characteristics						
Main Bank	= 1 if bank considers itself as main bank[a]	0.59	1	0	1	0.49
Duration of Relationship	Length of relationship with current lender, in years	7.93	7.47	0.00	26.39	5.44
Competition						
Number of Competitors	Number of branches (minus the lender's) in the borrower's postal zone	17.18	13	1	103	15.49
Herfindahl – Hirschman Index	Summed squares of bank market shares, by number of branches, in each postal zone	0.17	0.15	0.05	1.00	0.11
Loan Rate and Size						
Loan Rate	Interest rate on loan until next revision, in basis points	812	782	200	2,200	236
Loan Size	Size of loan, in millions of BEF[c]	0.88	0.30	0.005	80	1.83

Loan Contract Characteristics						
Collateral	= 1 if loan is secured via collateral	0.26	0	0	1	0.44
Repayment Duration of Loan	Repayment duration of loan, in years	2.35	0.55	0.00	20.00	3.26
Business Mortgage	= 1 if loan is a business mortgage loan	n/a[b]				
Bridging Finance	= 1 if loan is a bridging finance loan	n/a[b]				
Prepay Taxes	= 1 if loan is credit to prepay taxes	n/a[b]				
Business Term	= 1 if loan is a business term loan (investment credit)	n/a[b]				
Consumer Credit	= 1 if loan is a consumer credit loan (capturing installment loans)	n/a[b]				
Rollover	= 1 if loan is given to prepay another loan	0.10	0	0	1	0.30
Firm Characteristics						
Small Firm	= 1 if < 10 employees and turnover < BEF 250 mln.[c]	0.16	0	0	1	0.37
Medium Firm	= 1 if > 10 employees or turnover > BEF 250 mln.[c]	0.01	0	0	1	0.09
Large Firm	= 1 if turnover > BEF 1 bln.[c]	0.00	0	0	1	0.04
Limited Partnership	= 1 if firm is limited partnership	0.12	0	0	1	0.32
Limited Partnership w/ ES	= 1 if firm is limited partnership with equal sharing	0.01	0	0	1	0.11
Corporation	= 1 if firm is corporation	0.04	0	0	1	0.19
Bridge Arrangements	= 1 if firm is a temporary, bridge arrangement	0.00	0	0	1	0.01
Interest Rate Variables						
Government Security	Interest rate on a Belgian government security with equal repayment duration as loan to firm, in basis points	389	350	305	805	87
Term Spread	Yield on Belgian government bond of 5-years - yield on treasury bill with maturity of 3-months, in basis points	179	177	100	268	31

Notes. The number of observations is 15,044. [a] The definition used by the bank to determine whether it is the main bank is: for single person businesses and small firms, have a 'turnover' on the current account of at least BEF 100,000 per month and buy at least two products from that bank. [b] For bank-strategic considerations, we cannot reveal the relative importance of the types of loans. [c] 40 Belgian Francs (BEF) are approximately equal to 1 US$.

TABLE 4. CORRELATION TABLE

		(1)	(2)	(3)	(4)	(5)
Distance to Lender	(1)	1	0.184***	-0.033***	-0.122***	-0.072***
Distance to Closest Competitors	(2)		1	0.013	0.013*	0.146***
Main Bank	(3)			1	0.218***	0.010
Duration of Relationship	(4)				1	-0.005
Number of Competitors	(5)					1

Source: The number of observations is 15,044. *, **, and *** = significant at 10%, 5% and 1% level, using Pearson-correlation.

TABLE 5. BORROWING COSTS AND THE ROLE OF DISTANCE

	Models				
Independent Variables	I	II	III	IV	V
Distance					
ln(Distance to Lender)	-4.3*	-5.4**	-10.3***	-8.3***	-14.2***
	(2.5)	(2.5)	(2.7)	(2.2)	(5.5)
ln(Distance to Closest Competitors)	16.1***	16.6***	18.5***	8.3***	14.2***
	(3.8)	(3.6)	(4.0)	(2.2)	(5.5)
Relationship Variables					
Main Bank	-40.9***	-41.1***	-53.0***	-41.0***	-44.4***
	(3.7)	(12.7)	(3.8)	(3.7)	(3.9)
ln(Duration of Relationship)	18.8***	18.8***	23.9***	18.6***	18.4***
	(2.3)	(2.3)	(2.4)	(2.3)	(2.5)
Main Bank *x*					11.1**
ln(Distance to Lender)					(4.6)
Main Bank *x*					-11.1**
ln(Distance to Closest Competitors)					(4.6)
ln(Duration of Relationship) *x*					-0.1
ln(Distance to Lender)					(2.7)
ln(Duration of Relationship) *x*					0.1
ln(Distance to Closest Competitors)					(2.7)
Competition					
ln(Number of Competitors)	-0.4				
	(2.6)				
Herfindahl – Hirschman Index		35.3**		37.6**	36.5**
		(15.2)		(15.2)	(15.2)
Postal Zone Random Effects			Yes[d]		
Loan Contract Characteristics,[a] *Firm Characteristics,*[b] *Interest Rate Variables,*[c] and *Intercept*	Yes	Yes	Yes[e]	Yes	Yes
Equality Restriction(s), F-statistic				8.645	3.597
Adjusted R^2	0.227	0.223	0.143	0.222	0.222

Notes. The dependent variable is the Loan Rate until next revision, in basis points. The number of observations is 15,044. We employ ordinary least squares estimation. *, **, and *** = significant at 10%, 5% and 1% level, two-tailed. The definition of the variables can be found in Table 3. Ln(.) are the natural log of one plus the respective variables. Including: [a] four loan revisability dummies, [b] eight postal area and 49 industry dummies, and [c] two year dummies. [d] Lagrange multiplier test of Effects versus No Effects = 390.1***, and Hausman (1978) test of Fixed versus Random Effects = 35.0. [e] Excluding: postal area and industry dummies.

TABLE 6. LOAN SIZE, SOLE PROPRIETORSHIPS, AND MATCHED SAMPLE

Independent Variables	Incl. Loan Size	By Loan Size (LS), in millions of BEF			Sole Proprietorships	Match
		LS≤0.2	0.2<LS≤ 2	2<LS		
Loan Size	-12.3***					
	(1.1)					
Distance						
ln(Distance to Lender)	-8.0***	-15.0***	-4.0*	-0.7	-6.3**	-25.9**
	(2.3)	(4.1)	(2.1)	(2.3)	(2.5)	(10.3)
ln(Distance to Closest Competitors)	8.0***	15.0***	4.0*	0.7	6.3**	25.9**
	(2.3)	(4.1)	(2.1)	(2.3)	(2.5)	(10.3)
Relationship Variables						
Main Bank	-39.2***	-32.9***	8.3**	-6.6*	-46.5***	-29.4*
	(3.7)	(6.4)	(3.5)	(4.0)	(4.0)	(17.8)
ln(Duration of Relationship)	17.3***	26.0***	14.4***	10.7***	17.7***	49.8***
	(2.3)	(4.4)	(2.0)	(2.1)	(2.5)	(11.5)
Competition						
Herfindahl – Hirschman Index	37.2**	32.0	14.0	38.3***	32.0*	-34.8
	(15.2)	(29.8)	(13.6)	(14.3)	(16.8)	(62.4)
Firm Characteristics						
Assets[a]						-0.4***
						(0.1)
Earnings / Assets						-67.0*
						(40.3)
Short Term Debt / Assets						88.0**
						(42.2)
Net Trade Credit / Assets						-48.0
						(44.2)
Loan Contract[b] *and Firm Characteristics*[c]	Loan Firm				Loan Firm[e]	
Interest Rate Variables[d] and *Intercept*	Yes	Yes	Yes	Yes	Yes	Yes
Number of Obs.	15,044	5,850	7,344	1,850	12,360	1,058
Equality Restriction, F	9.022	3.268	4.616	1.717	11.510	2.736*
Adjusted R^2	0.228	0.011	0.136	0.665	0.210	0.098

Notes. The dependent variable is the Loan Rate until next revision, in basis points. We employ ordinary least squares estimation. *, **, and *** = significant at 10%, 5% and 1% level, two-tailed. The definition of the variables can be found in Table 3. Ln(.) are the natural log of one plus the respective variables. [a] In millions of BEF . Including: [b] four loan revisability dummies, [c] eight postal area and 49 industry dummies, and [d] two year dummies. [e] Excluding all variables but the eight postal area and 49 industry dummies.

APPENDIX A. EMPIRICAL WORK INVESTIGATING THE IMPACT OF BANK MARKET CONCENTRATION ON BANK LOAN CONDITIONS.

Papers	Data Source # Observations in Regressions Observation Type	Concentration in Markets Geographical span: Avg. Pop. / Area Average HHI	Loan Rate Measure The Impact of Concentration on the Loan Rate **Impact of ΔHHI = 0.1, In Basis Points**
Hannan (1991)	STB ±8250 US firms	bank deposits 4,725 0.14	loan rate Mostly Positive **-6 to 61*****
Berger et al. (2001c)	NSSBF 1993 520 small US firms	bank deposits n/a 0.19	credit line rate – prime rate Mostly Positive **7 to 14***
Sapienza (2002)	Credit Register 107,501 Italian firms	bank loans 600,000[a] 0.06	loan rate – prime rate Positive **59*****
Kim, Kristiansen and Vale (2001)	Central Bank of Norway 1,241 Norwegian firms	bank business credit 250,000[a] 0.19	credit line rate - 3 month money market rate Insignificant **3**[b]
Corvoisier and Gropp (2001)	ECB 2001 209 EU country – years	bank loans 30,000,000[a] 0.13	country-specific loan rate margin Positive **10 to 20****[d]

Notes. The measure of concentration in all studies is the Herfindahl – Hirschman Index (HHI), which can be calculated by squaring the market share of each bank competing in the market and then summing the resulting numbers ($0 < HHI < 1$). NSSBF is the National Survey of Small Business Finance. STB is the Federal Reserve's Survey of the Terms of Bank lending to business. [a] Our calculations. [b] For HHI increasing from 0.1 to 0.2. [c] Coefficients in regressions for short term loans in their models 3, 5, and 6. [d] Their models 2 and 5. *, **, and *** = significant at 10%, 5% and 1% level, two-tailed.

APPENDIX B. THE ACTUAL CLOSEST COMPETITOR AND PHYSICAL DISTANCE

	Models					
Independent Variables	II-actual	III-actual	IV-actual	II-physical	III-physical	IV-physical
ln(Distance to Lender)	-5.3**	-10.5***	-8.6***	-3.5*	-7.9***	-4.7**
ln(Distance to Closest Competitors)	16.7***	18.0***	8.6***	10.4***	14.7***	4.7**
Main Bank	-41.2***	-53.2***	-41.0***	-41.0***	-53.0***	-40.9***
ln(Duration of Relationship)	18.9***	24.1***	18.6***	18.9***	24.0***	18.8***
Herfindahl – Hirschman Index	24.1		32.2**	31.3**		33.5**
Postal Zone Random Effects		Yes[d]			Yes[e]	
Loan Contract,[a] *Firm Characteristics,*[b] *Interest Rates,*[c] *Intercept*	Yes	Yes	Yes	Yes	Yes	Yes
Equality Restriction, F- statistic			9.338			3.385
Adjusted R^2	0.223	0.143	0.222	0.222	0.142	0.222

Notes. The dependent variable is the Loan Rate until next revision, in %. The number of observations is 15044. We employ ordinary least squares estimation. *, **, and *** = significant at 10%, 5% and 1% level, two-tailed. In Models labeled "actual", the Distance to the *actual* (not 25%) Closest Competitor is used. In Models "physical", the fastest *physical* distance (not traveling time) is used. The definition of the other variables can be found in Table 3. Ln(.) are the natural log of one plus the respective variables. Including: [a] four loan revisability dummies, [b] eight postal area and 49 industry dummies, and [c] two year dummies. [d] Lagrange multiplier test of Effects versus No Effects = 392.23***. Hausman (1978) test of Fixed versus Random Effects = 35.17. [e] Lagrange multiplier test of Effects versus No Effects = 394.25***. Hausman (1978) test of Fixed versus Random Effects = 35.19.

NOTES

[1] See for example Kilkenny and Thisse (1999) and Chapter 7 in Tirole (1988) for a review.
[2] An increase in the number of banks also decreases the loan rate in more general models of imperfect Cournot competition between a finite number of banks. See for example, the rendition of the Monti (1972)-Klein (1971) model in Freixas and Rochet (1997)(pp. 57-60).
[3] In Boot and Thakor (1999), more interbank competition encourages banks to step up relationship lending but also to diminish sector specialization.
[4] For example, Degryse (1996) and Irmen and Thisse (1998) model bank product placement decisions in multi-dimensional product spaces.
[5] Independents or single-person businesses are natural persons who run a small business in which they are employed themselves. They have no limited liability and are comparable to sole proprietorships.
[6] The bank argues that loans starting earlier than 1995 have been prepaid. We have a dummy variable Rollover in all empirical specifications, capturing whether the new loan served to prepay an old loan.
[7] The Annual Report of the *Belgian Bankers Association* reports 7,668 branches. We consolidate multiple branches of the same bank at the same address.
[8] Belgium covers 30,230 sq km in land surface.
[9] Such as the shortest, but not necessarily fastest, driving distance or the shortest distance-as-the-crow-flies.
[10] For example, a small-town bank branch is listed as underwriting a dozen contracts located around the country. We suspect an address-recording error in the dataset we received. Unfortunately, we cannot ask the bank to check such entries.
[11] For example, serious misspelling of street names invariably leads the mapping software to "overshoot" the correct distance. We track and fix most (but possibly not all) such mapping problems.
[12] For example, some borrowers reside in a ritzy beach resort, often more than an hour drive from their respective lenders in various locations inland, most likely to lower their community taxes.
[13] We are left with 11,222 different borrowers in the sample. We report only the statistics for the set of all contracts, as the borrower-based statistics are very similar.
[14] The sample is highly representative in this regard. The average speed of travel in Belgium across all modes of transportation was 31.1 km/h in 1998 according to a National Survey of Mobility (source: *Belgian National Institute of Statistics*, http://www.statbel.fgov.be/figures/d37_nl.htm#1). Traveling time and driving distance are highly correlated. For example, the correlation coefficient for the 15,044 borrower-lender pairs is 0.96.
[15] For example, Cole and Wolken (1995), Table 1.
[16] Petersen and Rajan (2002) document that firm size is positively correlated with distance (their Table III, column VI). However, the effect seems rather limited for smaller firm sizes.
[17] Belgian gasoline prices at the pump are typically more than double the prices in the US, mainly because of taxation. For example, in the last week of September 2001 regular gasoline at the pump went for 1.48 USD/gallon in the US and 3.11 USD/gallon in Belgium (*Energy Info Administration* and *Belgian Petroleum Federation*).
[18] The US land surface measures 9,158,960 sq km, making the US 303 times larger than Belgium (CIA Factbook 2000).
[19] For example, Berger et al. (2001b) note that reweighing the NSSBF to make the survey nationally representative (because the NSSBF under-samples the very smallest firms) decreases the average distance in their sample from 26.1 to 11.8 miles (their Footnote 15).
[20] See also Cyrnak and Hannan (2001).
[21] We also analyze the postal codes for all 17,776 contracts. The percentage firms located in another postal zone (area) than the lender increased from 35% (2%) prior to 1981 to 47% (7%), after 1993. If we assume a conservatively long average traveling distance of 3 (30) km within a postal zone (area) and 87.5 km across postal areas (i.e., half the square root of the surface of each respective region), average distances increased by around 45%. Hence, our mapping technology and screening procedures seem not to have biased our results across time.
[22] Source: Annual Reports of the *Belgian Bankers' Association*. For years prior to 1991, we imputed the number of bank branches using growth rates in the numbers of commercial bank branches only. Ideally, we would like to break out the numbers for the individual bank we study.
[23] See for example Bouckaert and Degryse (2001).

[24] A study by Corvoisier and Gropp (2001) also seems to suggest that physical proximity continues to play a role in European bank loan markets, but not in European time deposit or mortgage markets.
[25] In less densely branched areas proximity may play a more prominent role. For example, regressing Distance to Lender on Distance to Closest Competitors yields a slope coefficient of 0.57*** and an intercept equaling 4.69***. These estimates suggest a crossover point of around 11 minutes at which the Distance to the Lender on average becomes smaller than the Distance to the quartile Closest Competitor. Less than 1% of all borrowers in our sample are located in such areas.
[26] We use Belgian Francs (BEF) throughout the paper but indicate equivalent amounts in U.S. Dollar (USD). Belgium switched to the Euro on January 1st, 1999.
[27] A possible effect of MAIN is that the bargaining power of a firm increases, as it also buys other products at that bank. In other words, cross-subsidization could negatively influence the loan rate.
[28] The NACE code is the European industrial classification system subdividing industries.
[29] Their Table 2, Model 2. Degryse and Van Cayseele (2000) drop large firms and study 17,429 observations, while Degryse and Van Cayseele (1998) report results for all 17,776 observations.
[30] As in all Tables, *, **, and *** indicate significance at a 10%, 5% and 1% level (two-tailed).
[31] As indicated in the Tables, we always take the log of "one plus" the indicated variables.
[32] For a detailed discussion of these results and the related theoretical and empirical literature, see Boot (2000) and Ongena and Smith (2000).
[33] An intermediate measure would count the number of different banks in each postal zone. This measure seems a-priori less informative than using the market shares.
[34] The U.S. Department of Justice and Federal Trade Commission Horizontal Merger Guidelines (April 1997) label markets with an HHI above 0.18 'highly concentrated'.
[35] See for example, Hannan and Strahan (2000), Morgan (2002), and Radecki (1998).
[36] All calculations are averaged over the zero to one standard deviation interval.
[37] The gross monthly wage of Belgian entrepreneurs and managers was 153,416 BEF and full-time employees worked 1,543 hours on average per year (source: *Belgian National Institute of Statistics*, http://www.statbel.fgov.be/figures/d321_nl.htm).
[38] Including 1.8 BEF / minute for gas (at a speed of 31 km / h in a car using 10 liters of gasoline / 100 km and a pump price of 35 BEF / liter) and 1.20 BEF / minute for maintenance and tires (source: *Belgian Petroleum Federation* and *AAA "Your Driving Costs"*).
[39] "The Death of Distance" is the title of a book by Frances Cairncross. Its second edition is published by Harvard Business School Press. See also http://www.deathofdistance.com/.