

## DISTANCE AND COMPETITION

Hans Degryse  
Catholic University Of Leuven

Steven Ongena  
Tilburg University

I. 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

**Hans Degryse** is an associate professor in financial economics at the Catholic University of Leuven. **Steven Ongena** is an assistant professor in finance at Center at Tilburg University in The Netherlands. In the interests of brevity and simplicity, **this working paper** reports only some of the details of the research findings. A more comprehensive paper containing more **details of** the data, methodology, variables, and results, as well as additional references is available as a Center and CES **Working Paper**. The authors are especially indebted to Robert Hauswald and Robert Marquez for many insightful comments. We also received valuable comments from Mam Ashcraft, Allen **Berger**, Clive Bell, Arnoud Boot, Jan Bouckaert, Jurgen Eichberger, Robert **Elsink**, Hans Gersbach, Reint Gropp, Tulio Jappelli, Marco Pagano, Nagpurnanand Prabhala, Joao Santos, Elmer Sterken, Linda Toolsema, Greg Udell, Frank Verboven, Jurgen **Weigand**, and Gunther Wuyts, and participants at the Federal Reserve **Bank** of Chicago's 38th Annual Conference on Bank Structure and Competition, Copenhagen Business School, CSEF-Salerno, the Federal Reserve Bank of New York, Koblenz Business **School**, Norwegian School of Management **BI**, Center-Tilburg University, and the Universities of Amsterdam, Groningen, Heidelberg, Maryland, and Rotterdam. The authors are **grateful** to Dirk Rober for providing extraordinary programming assistance and to Ivonne Eltink and Nancy Kanters for **offering** valuable research support. Degryse received financial support from the Fund for Scientific Research-Flanders (FBO) and the TMR-Network on the Industrial Organization of Banking and Financial Markets. Ongena benefited from financial support from The Netherlands Organization for Scientific Research (NBO).

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.

Fetersen and Rajan (2002) and Berger et al. (2001a) 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, Miller, Petersen, Rajan and Stein (2001a) 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 et al. (2001b), Buch (2001), Hondroyannis 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 (Fortes 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)). He 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.

-V' We organize the **rest of** the paper as **follows**: Section II--reviews the literature on **distance, lending relationships/ and competition**; Section III **introduces** the data and discusses the methodology used in **our paper**; Section IV displays and discusses the empirical **results**; Section V concludes, :

## II. Literature Review

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. In traditional location differentiation models (Hotelling (1929), Salop (1979)), borrowers incur transportation costs **visiting** their bank branch. 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-a-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 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 (Hong and Chah (1993)).

**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'Araccia

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.

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 et al, (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.

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. 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.

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, do not necessarily patronize the closest one. . . . Vs. . . .

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 do not always visit the bank branch located closest when another bank's product exhibits other, more preferred, characteristics. 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.

### III- Data and Event Study Methodology

#### 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), 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.

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 31, 1994, we identify 7,477 branches, operated by 145 different banks and located in 837 different postal zones. 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, 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 25t),G06 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, 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, mapping problems, and non-standard borrowing motives and business arrangements are 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 1 provides summary statistics for the remaining 15,044 contracts. Table 1 shows the definition, mean, median, minimum, maximum, and standard deviation of selected variables.

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). In contrast, Petersen and Rajan (2002) find that the median distance between lending banks and small OS firms covered by the 1993 National Survey of Small Business Finance (KSSBF) is more than double, i.e. 4 miles. However, the median firm in the NSSBF employs 2 to 4 employees, while the median firm in our sample is a sole proprietorship. In addition, costs of driving may differ substantially between Belgium and the U.S., and Belgian businesses may be limited by the size of the country in their choice of domestically located banks. 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, 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. 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.

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.

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. 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). 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. He will nevertheless control for possible changes over time in lending technology in robustness exercises.

#### Distance to Closest Competitor

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 25th 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 25th 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 25th 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 do not seem overly constrained by geographical proximity. 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.

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. 52,500), 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. This includes 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. 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.

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. A cursory look on the map suggests many postal zones are roughly equal in size. 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. He includes 8 postal area dummies (which cover around 10 zones each) in addition to the base case to control for these differences in welfare size. He will also introduce postal zone and bank branch effects in robustness exercises.

#### Other Variables

The rest of the variables are also discussed at length in Degryse and Van Cayseele (2000) and in our working paper, so we abridge the write-up here. Consider the loan contract characteristics. The first is the interest rate on the loan until the next revision. 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 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 Korting (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. He also include dummies capturing the type of loan the firm is taking; 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, because a large part of our loans are of the Prepay Taxes and Consumer Credit type. He 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. He 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,

tie exclude the dummy for Sole Proprietorships. We include 49 two-digit Nomenclature Generale des Activites Economiques dans l'Union Europeenne (MACE) code dummies to capture industry characteristics.

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 base case) to control for business cycle effects.

#### IV. Empirical Results

##### 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 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. The other coefficients remain virtually unaltered, both as a departure from Degryse and Van Cayseele (2000) and throughout the exercises in this paper; hence we therefore neither discuss, nor tabulate the estimated coefficients in this version of our working paper.

##### Relationship Characteristics

We first discuss 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 in Table 2 show that a firm pays 41 basis points less when the scope of a relationship is sufficiently broad,

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 7.5 (median) to 13 (median plus one standard deviation) years increases the loan rate by around 40 basis points,

### Competition

We incorporate in Table 2 Models I, II\* and III both our **measures** of banking competition (and the **resulting** market power of the lending bank) and geographical distance. 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 **-1 regression**, and report the results in Model I. The coefficient on  $\ln(\text{Number of Competitors})$  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.

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. 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, would increase the loan **rate** by only 3.5 basis points.

; 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 (1976) 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.

### Distance

; We now turn to our distance variables of interest. We **take** the log of both distance measures. In  $\ln(\text{Distance to Closest Competitors})$  and  $\ln(\text{Distance to Lender})$ , 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  $\ln(\text{Distance to Closest Competitors})$  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  $\ln(\text{Distance to Lender})$ .

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 (U.S. \$1.80) per extra minute of traveling to the lender. Belgian entrepreneurs and (bank) managers made around BEF 20 / minute in 1995, while the operating costs for a car (gas, maintenance, tires) may have amounted to around BEF 3 / minute of driving. 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.

We **subject** our main results reported in Table 2 to a battery of robustness checks with respect to, for example, variable definition and model specification. As all results remain virtually unaffected, we chose neither to tabulate nor to discuss the results in this working paper.



### V. Conclusion

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.

; - , 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 et al. (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.

### References

- Aharony, J. and Swary, I. "Additional Evidence on the Information-Based Contagion Effects of Bank Failures." *Journal of Banking and Finance*, 1996, 20, pp. 57-69.
- Berger, A. N. and DeYoung, R. "The Effects of Geographic Expansion on Bank Efficiency." *Journal of Financial Services Research*, 2001, 19(2), pp. 163-84.

Berger, A. N.; Miller, N. M.; Petersen, M. A.; Rajan, R. G. and Stein, J. C. "Does Function Follow Organizational Form? Evidence from the Lending Practices of Large and Small Banks," Washington DC: Board of Governors of the Federal Reserve System, 2001a.

Berger, A. N.; Dai, Q.; Ongena, S. and Smith, D.C. "To What Extent Will the Banking Industry Be Globalized? A Study of Bank Nationality and Reach in 20 European Nations," Tilburg: Tilburg University, 2001b.

Berger, A.N. and Udell, G.F. "Relationship Lending and Line of Credit in Small Firm Finance" *Journal of Business*, 1995, 68, pp 351-81.

Bester, H. and Petrakie, E. "Price Competition and Advertising in Oligopoly." *European Economic Review*, 1995, 39, pp. 1075-88.

Broecker, T. "Credit-Worthiness Tests, and Interbank Competition" *Econometrics*, 1990, 58 (2), pp. 429-52.

Brunner, A.; Krahen, J. P. and Weber, M. "Information Production in Credit Relationships: On the Role of Internal Rating: in Commercial Banking" Frankfurt: Center for Financial Studies, 2000.

Buch, C. M. "Distance and International Banking," Kiel Institute of World Economics, 2001.

Cao, M. and Shi, S. "Screening, Bidding, and the Loan Market Tightness." *European Finance Review*, 2001, 5(1) pp. 21-61.

Coval, J. D. and Moskowitz, T. 3. "The Geography of Investment: Informed Trading and Asset Prices" *Journal of Political Economy*, 2001, 109, Forthcoming.

Degryse, H. and Van Cayseele, P., "Relationship Lending within a Bank-Based System: Evidence from European Small Business Data." *Journal of Financial Intermediation*, 2000, 9(1) pp. 90-109.

\_\_\_\_\_. "Relationship Lending within a Bank-Based System: Evidence from European Small Business Data," Tilburg NL: Center Tilburg University, 1998.

Dell'Ariccia, G. "Asymmetric Information and the Market Structure of the Banking Industry." *European Economic Review*, 2001\* Forthcoming\*;

Elsas, R. and Krahen, J. P. "Is Relationship Lending Special? Evidence from Credit-File Data in Germany." *Journal of Banking and Finance*, 1998, 22, pp. 1283-316.

Grinblatt, M. and Keloharju, M. "How Distance, Language, and Culture Influence Stockholdings and Trades." *Journal of Finance*, 2001, 56(3), pp. 1053-73.

Grosse, R. and Goldberg, I. G. "Foreign Bank Activity in the United States: An Analysis by Country of Origin." *Journal of Banking and Finance* 1991, 15, pp. 1093-112.

Grossman, G. and Shapiro, C. "Informative Advertising with Differentiated Products." *Review of Economic Studies*, 1964, 31, pp. 63-82.

Harhoff, D. and Körting, T. "Lending Relationships in Germany - Empirical Evidence from Survey Data." *Journal of Banking and Finance*, 1998, 22, pp. 1317-53.

Harrison, P.; Sussman, O. and Zeira, J. "Finance and Growth: Theory and New Evidence," Washington DC: Federal Reserve Board, 1999.

Hau, H. "Location Matters: An Examination of Trading Profits." *Journal of Finance*, 2001, 56(5), Forthcoming.

Hausman, J. "Specification Tests in Econometrics." *Econometrica*, 1978, 46, pp. 1251-71.

Hauswald, R. and Harguez, R. "Competition and Strategic Focus in Lending Relationships," Bloomington IN: Indiana University, 2000

Hondroyannis, G. and Papapetrou, E. "International Banking Activity in Greece: The Recent Experience." *Journal of Economics and Business*, 1996, 48, pp. 207-15.

Hotelling, H. "Stability in Competition." *Economic Journal*, 1929, 39, pp. 41-45.

Lederer, P. and Hurter, A. "Competition of Firms: Discriminatory Pricing and Location." *Econometrica*, 1936, 54, pp. 623-40.

Lerner, J. "Venture Capitalists and the Oversight of Private Firms." *Journal of Finance*, 1995, 50(1), pp. 301-18.

Phelan, M.A. and Rajan, R.G. "Does Distance Still Matter? The Information Revolution in Small Business Lending." *Journal of Finance*, 2002.

\_\_\_\_\_. "The Effect of Credit Market Competition on Lending Relationships." *Quarterly Journal of Economics*, 1995, 110, pp. 406-43.

Portes, R. and Key, H. "The Determinants of Cross Border Equity Flows: The Geography of Information," National Bureau for Economic Research, 2001.

Salp, S. "Monopolistic competition with Outside Goods." *Bell Journal of Economics*, 1979, 10(1), pp. 141-56.

Stein, J. "information Production and Capital Allocation  
Decentralized Versus Hierarchical firms." Journal of Fin 2002,  
Forthcoming.

Sussman, and Zeira, J "Bankin and Development," CEP 199!

Tirol *The Theory of Industria OrganizatiL* Boston MA MIT  
Press 198!

Wong, K.P. and Chan, D. K. "A Simple Model of Spatia Banting  
Competition." *Economics Letters*, 1993, 42(4), pp. 39 97.





TABLE 2

## Borrowing Costs and the Role of Distance

Independent Variables	I		v III	7- * -
In (Distance to Lender)	-4.3*	-5.4*	-10.3***	-8.3***
	(2.5)	(2.5)	(2.7)	(2.2)
<b>ln(Distance to Closest Competitors)</b>	16.1"	<b>16.6***</b>	18.5***-	.1-3"*
	(3.8)	(3.6)	(4.0)	(2.2)
Main Bank	>40.9***	-41.1***	<b>-53.0***</b>	<b>-41.0***</b>
	(3.7)	(12.7)	(3.8),	(3.7)
In (Duration of Relationship)	18.8***	<.»***	23-9***	-1\$.6** *
	(2.3)	(2.3)	(2.4)	v (2.3)
<b>ln(Number of Competitors)</b>	-0.4			
	(2.6)			
Herfindahl - Hirschman Index		<b>35.3**</b>		37.6««
		(15.2)		(15.2)
Postal Zone Random Effects			Yes <sup>d</sup>	
Loan Contract* and <b>Firm Characteristics</b> , <sup>b</sup> <b>Interest</b> Kate	Yea	Yes	Yea"	Yes
<b>Variable</b> , <sup>c</sup> and intercept				
Equality Restriction(s), F-statistic				8.645
Adjusted R <sup>a</sup>	0.227	0.323	0.143	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()** is the natural log of **on\*** plus the respective variables. Including: " four loan revisability dummies, \* eight postal area and 49 industry dummies, and <sup>c</sup> two year dummies. <sup>d</sup>Lagrange multiplier test of **Effects versus Ho Effects** < 390.1\*\*\*, and Hausman (1978) test of Fixed versus Random Effects > 35.0. <sup>e</sup> Excluding: postal area and industry dummies.