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The Impact of Organizational Structure and Lending Technology on Banking Competition

Abstract: Recent theoretical models argue that a bank's organizational structure reflects its lending technology. A hierarchically organized bank will employ mainly hard information, whereas a decentralized bank will rely more on soft information. We investigate theoretically and empirically how bank organization shapes banking competition. Our theoretical model illustrates how a bank's geographical reach and loan pricing strategy is determined not only by its own organizational structure but also by organizational choices made by its rivals. We take our model to the data by estimating the impact of the rival banks' organization on the geographical reach and loan pricing of a singular, large bank in Belgium. We employ detailed contract information from more than 15,000 bank loans granted to small firms, comprising the entire loan portfolio of this large bank, and information on the organizational structure of all rival banks located in the vicinity of the borrower. We find that the organizational structure of the close rival banks matters for both branch reach and loan pricing. The geographical footprint of the lending bank is smaller when the close rival banks are large, hierarchically organized, and technologically advanced. Such rival banks may rely more on hard information. Large rival banks in the vicinity also lower the degree of spatial pricing. We also find that the effects on spatial pricing are more pronounced for firms that generate less hard information, such as small firms. In short, size and hierarchy of rival banks in the vicinity influences both branch reach and loan pricing of the lender.

Keywords: banking sector, bank size, competition, and mode of organization.

JEL: G21, L11, L14.

Introduction

The allocation of control within organizations shapes agents' incentives (see e.g. Hart (1995)). Stein (2002), for example, shows that a centralized hierarchical bank offers greater incentives to employ information that is easy to communicate and store within an organization – i.e., "hard" information – whereas, in contrast, a decentralized bank provides an environment advantageous to "soft" information. And Petersen and Rajan (2002) document that banks that rely more on hard information communicate in more impersonal ways with their borrowers. Hence, the bank's mode of organization influences the lending technology employed.

We present a stylized model that embeds these findings to explain geographical reach and spatial pricing in lending. We build a spatial discrimination model, starting from a Hotelling (1929) – framework, to show how the bank's own organization and its rivals' organizational choices may shape banking competition. In particular, we incorporate how bank hierarchy influences distance-related transportation costs incurred by either borrowers or banks. Our model shows that when rival banks are more hierarchically layered, the bank's own geographical reach shrinks and spatial pricing softens. The underlying rationale is simply that hierarchically organized rival banks employ more hard information in reaching their loan decisions, reducing either the borrowers' or their own transportation costs.

To test key hypotheses emanating from our theory, we combine two unique data sets that contain detailed loan contract, firm, branch and bank information (including organizational form). The first data set contains detailed contract information, including firm and lending branch location, for more than 15,000 loans to (mainly) small businesses. The second data set includes comprehensive information on all 145 banks operating in Belgium, detailing for 7,477 branches: (1) physical location, (2) organizational position and status, and (3)

communication technology. Consequently, the combined dataset encompasses information on the complete set of loans granted to small and medium-sized business borrowers by a single large bank in Belgium and the organization structure of all the branches of rival banks in the vicinity of the borrower's location, resulting in around 250,000 borrower – rival bank branch combinations.

We exploit the heterogeneity in the competing banks' organizational structure to identify the impact lending technology has on the geographical reach and spatial pricing at bank branches. Our empirical proxies for organizational complexity of the closest rival financial institutions are bank size, country affiliation, the degree of organizational hierarchy, and the presence of a fax.

We find that the organizational form of the closest rivals matters for branch reach as well as for the degree of spatial pricing. The presence of a large, more hierarchically organized, and technologically advanced rival bank in the vicinity shrinks the geographical reach of the lending branch, as lending decisions of large banks possibly become more driven by hard information. In line with out theoretical predictions, we also find that the negative effect on branch reach of the presence of a large, more hierarchically organized, or technologically advanced competing bank is less negatively affected for small opaque firms. The presence in the vicinity of the borrower of a large rival bank also attenuates spatial pricing. Hence size and hierarchy of rival banks in the vicinity of a borrower determine both geographical reach and loan pricing.

Empirical work analyzing how the nature of a bank's organization affects the way it does business typically suffers from a lack of data on the organizational form of the banks. Existing work typically uses the size of the bank as a proxy for organizational complexity. Berger, Miller, Petersen, Rajan and Stein (2005), for example, show that small banks are

indeed better able to collect and act on soft information. They also report that large banks lend at greater distance and in a more impersonal way than small banks do. Liberti (2004) examines how a change in the organizational form *within* a large bank affects incentives. He finds that the reliance on soft information is higher under decentralized than centralized structures. Liberti (2005) analyzes how information flows *within* the organization both across layers (vertically) and horizontally (number of branch officers reporting to a supervisor). He demonstrates that loan applications that need to pass more organizational layers for approval are based more on hard information. This internal 'hardening' of the information requirements however is mitigated when direct contact between the bottom and top organizational layer is possible. Also loans granted directly by the branch, as well as branches with 'leaner' horizontal organization can employ more soft information.

We contribute to this empirical literature by constructing and analyzing a novel dataset that contains information on the hierarchical structure of all competing banks in a particular locality in Belgium, and by highlighting the role of rival banks' organizational form.

We organize the rest of the paper as follows. Section II introduces a stylized model of banking competition. Section III introduces the data and variables employed in the empirical analysis. Section IV presents our empirical results. Section V concludes.

I. Theory

Recent theoretical and empirical work highlights the importance of geographical distance for the mode of interaction between banks and firms and for pricing of bank loans. In this section we model and explore the impact of bank heterogeneity on bank branch reach and loan pricing. We develop a stylized model in which firms can borrow from different banks. Banks themselves may have a different organizational form creating a different specialization in dealing with hard or soft information. We take the organizational form as exogenously

given. We then formulate testable hypotheses about the impact of bank type on branch reach and loan pricing. In particular, our model identifies how distance-related costs that are bank specific further increase the economic relevancy of geography and spatial pricing.

A. Literature

Our main point of departure is that lending conditions not only depend on the distance between the borrower and the lender and the distance between the borrower and the closest competing bank, but also on the characteristics of the banks involved. Our stylized framework finds its inspiration in location differentiation models following Hotelling (1929)(see Armstrong (2005) for a review). In these models, customers, *in casu* borrowers, are typically assumed to incur identical (per unit of distance) transportation costs when visiting a firm, i.e. a bank branch. An alternative, but for our purposes strikingly similar, interpretation is developed in Sussman and Zeira (1995). They model spatial pricing based on distance-related monitoring costs faced by the banks. In their model the banks also face identical per unit of distance monitoring costs. While we will formally derive our hypotheses placing the (differential) transportation costs with the borrower, as is done in most models, we also acknowledge the equivalent interpretation in which, as said, it is the lenders that face the distance-related monitoring costs.

Why would borrower or lender transportation costs depend on the type or organizational form of banks involved? One straightforward explanation consists in the number of visits the borrower has to make to the bank branch to obtain and service a loan (or the number of visits the lender makes to screen and monitor the borrower). For example, if a borrower knows her loan officer at the branch will insist on three face-to-face visits before granting the loan (say one visit to file the loan application, one visit to negotiate the loan conditions, and one visit to sign the final loan contract), her expected transportation costs will be three times the costs

visiting a one-stop bank branch were loan applications are approved on the spot (or by mail afterwards). Alternatively, the borrower may know that loan officers from one bank show up three times a year to check on their borrowers' business, while another bank may have a hands-off approach (entailing no monitoring). In both cases borrower and bank *ex ante* know how many screening and/or monitoring visits are required to fully bridge their informational asymmetries.

Recent theoretical work explains why loan officers working for different banks may handle loan applications differently, causing the number of required visits to vary. Stein (2002) for example models the collection and transfer of information within hierarchical versus decentralized financial institutions. Stein shows that centralization motivates loan officers located in the branches to compile and transfer hard information (e.g., accounting numbers) to support their demand for internal capital. Decentralization of decision-making on the other hand provides loan officers incentives to collect and rely more on soft information (e.g., impressions of borrower character), information that is by nature more difficult to obtain and to transfer in an internal funding request.

If loan officers rely mostly on hard information, face-to-face contact with the borrower becomes less important and more impersonal ways of communicating (such as telephone, fax, or email) will gain ground (Petersen and Rajan (2002)).[1] The number of personal visits that is necessary to arrive at a loan decision or to monitor the borrower will become smaller. On the other hand, when more soft information is employed, loan officers may want to meet the applicant or visit her professional premises at least a few times to screen and monitor the loan

[1] Petersen and Rajan (2002) show that in the case of the US, where credit scoring of small business borrowers has become common practice among banks, the distance between small firms and their lenders has been increasing and banks and firms started to communicate in more impersonal ways. In Belgium, however, credit scoring of small firms was virtually non-existent during our sample period (1995-1997), and hence distance still plays an important role for the firms in our sample.

application. As a result, distance related costs per loan in the latter ("soft") case will be higher than in the former ("hard") case.

Our stylized framework assumes that when the transportation costs are incurred, bank officers perfectly solve the asymmetric information problem. We therefore assume that loans are repaid with probability one (as long as the probability of repayment is identical across borrowers and banks, qualitatively the same results hold). Hauswald and Marquez (2006), on the other hand, specify a model where the quality of information decreases with distance and informational problems linger. In particular in their model the informational signal the bank receives from close borrowers is more precise than the signal from far borrowers. As a consequence the winner's curse problem exacerbates when the bank engages a borrower close to the rival bank. Banks also decide on the level of information acquisition in Hauswald and Marquez (2006). More information acquisition aggravates the winner's curse problem and increases (in absolute value) the association between distance and the loan rate. However their model only deals with symmetric equilibria in which banks invest an equal amount in information acquisition. As a result their "transportation costs" are identical, while we, in admittedly a much more stylized setup, allow for differences in transportation costs.

B. Model

We now introduce the different transportation costs into the stylized framework to explore its impact on bank branch reach and loan pricing. As discussed previously, different transportation costs capture the differences in the number of visits borrowers or lenders make, possibly as a result of the varying bank organizational structure influencing the banks' usage of hard and soft information. We analyze first branch reach and loan pricing when firms differ only in terms of location (subsections 1-3), but where banks differ in their usage of hard

and soft information. Afterwards we turn to the case where firms are also heterogeneous in the availability of hard and soft information in their loan application (subsection 4).

1. Non-Linear Transportation Costs

Formally we assume there are two bank branches from two different banks, denoted *A* and *B*, at opposite ends of a line of length L. We interchangeably employ bank and branch as they coincide in our theoretical setup. Borrowers are uniformly distributed across the line with density one. We assume that a borrower located at x faces non-linear transportation costs $t_A x^\alpha$ and $t_B (L-x)^\alpha$ in visiting bank *A* and *B* respectively. The slope parameters t_A and t_B are associated with the impact of distance to reach bank *A* and *B*, respectively. Bhaskar and To (2004) derive the solution to this non-linear transportation problem for the case where the slope parameters are equal; $t_A = t_B$. We study the more general case $t_A \neq t_B$, with the difference capturing (as already indicated) the fact that banks may have different screening and monitoring technologies and may rely on a different mix of hard and soft information.

In taking a loan at bank *A*, a borrower located at x incurs a cost:

$$r_{Ax} + t_A x^\alpha ,$$

with r_{Ax} the (net of repayment of the initial investment) loan rate charged by bank *A* to a borrower located at x. Similarly, borrowing from bank *B* implies a cost:

$$r_{Bx} + t_B (L-x)^\alpha .$$

A borrower located at x is indifferent between borrowing from *A* or *B* when:

$$r_{Ax} + t_A x^\alpha = r_{Bx} + t_B (L-x)^\alpha .$$

We assume that borrowers cannot arbitrage among each other in order to benefit from lower loan rates and that their willingness to pay is high enough to guarantee they take a loan in

equilibrium. We further assume that both banks have information about the borrower's location before pricing the loan and that both banks have information about the transportation costs the borrowers face to visit either bank, such that banks perfectly price discriminate based upon borrower's location and the difference in transportation costs to visit either bank branch (as in Thisse and Vives (1988)).

For a borrower close by, i.e., $x = 0$, bank *A* enjoys some local market power, as from the borrower's perspective bank *B*'s best loan rate offer is its marginal cost of obtaining funds plus her own transportation costs to *B*. We normalize marginal costs for both banks to zero. It is clear then that branch *A* can charge $r_{A0} = t_B L^{\alpha}$. That is, branch *A* can appropriate the borrower's transportation cost to branch *B*. Similarly, for $x = L$, branch *B* charges $r_{BL} = t_A L^{\alpha}$ and appropriates that borrower's transportation cost to branch A.

Let y be the borrower that receives a perfectly competitive loan rate $r_{Ay} = r_{By} = 0$, as:

$$t_A y^{\alpha} = t_B (L - y)^{\alpha}.$$

All borrowers x to the left of y ($0 \le x \le y \le L$) are being serviced by branch *A* at a loan rate:

$$r_{Ax} = t_B (L - x)^{\alpha} - t_A x^{\alpha}.$$

That is, bank *A* charges a borrower at x the savings in transportation costs it makes from borrowing at *A* rather than *B*.

Bank *A*'s total borrower portfolio y or geographical reach is determined by $r_{Ay} = 0$, such that:

$$\frac{y}{L-y}=\left(\frac{t_B}{t_A}\right)^{1/\alpha}, \text{ or } \quad y=\frac{L\left(\frac{t_B}{t_A}\right)^{1/\alpha}}{1+\left(\frac{t_B}{t_A}\right)^{1/\alpha}}.$$

For changes in x, the change in interest rate equals[2]:

$$\frac{dr_{Ax}}{dx}=-t_B\alpha(L-x)^{\alpha-1}-t_A\alpha x^{\alpha-1}.$$

Hence, our stylized model yields two testable hypotheses: (1) the geographical reach y of branch *A* depend on t_A and on t_B, and (2) the slope of spatial pricing $\frac{dr_{Ax}}{dx}$ is negative and depends on t_A and t_B. While bank *A*'s reach increases in the rival's transportation costs t_B but decreases in the own transportation cost t_A, the degree of spatial pricing measured by the absolute value of the slope increases in t_A and t_B.

2. Linear Transportation Costs

To illustrate the main intuition in our model we set $L=1$ and $\alpha=1$. In this case the borrower receiving the perfect competitive loan rate $r_{Ay}=r_{By}=0$ is located at:

$$y=\frac{t_B}{t_A+t_B}.$$

All borrowers "to the left" of *y* ($0\le x\le y\le 1$) are served by branch *A* at a loan rate:

$$r_{Ax}=t_B(1-x)-t_Ax=t_B-(t_A+t_B)x.$$

The other borrowers ($0\le y\le x\le 1$) are served by branch *B* at loan rate:

$$r_{Bx}=t_Ax-t_B(1-x)=-t_B+(t_A+t_B)x.$$

[2] In our empirical investigation, we assume logarithmic transportation costs. This yields similar predictions.

Figure 1 displays the resulting linear loan rate schedules for borrowers of both *A* and *B*. The figure further highlights the two testable implications of our model. First, market shares y of branches *A* and *B* equal $\frac{t_B}{t_A + t_B}$ and $\frac{t_A}{t_A + t_B}$, respectively. Hence a decrease in transportation cost to the rival branch reduces the own market share. The opposite result holds for the own transportation cost (notice that a uniform distribution of borrowers further implies that market share equals branch size; since the length of the line is normalized to one, branch size equals in this case geographical reach). Second, the rate at which both branches discriminate in distance (i.e., the absolute value of the slopes of both schedules) equals $t_A + t_B$, hence increases in t_A and t_B.

To conclude, differential transportation costs determine branch geographical reach and loan pricing. In particular relatively lower transportation costs to a rival bank branch will limit the geographical reach of the own branch and the slope of spatial pricing. Before we turn to testing these two predictions, we analyze how branch-specific marginal costs and borrower-specific transportation costs enrich this picture.

3. Differences in Bank-Specific Marginal Cost

Assume for example that the marginal cost for bank *B* equals $\mu > 0$, while the marginal cost for bank *A* equals zero. With appropriate modifications, μ could also reflect the differential repayment probabilities to the two branches. Bank *A* now appropriates the close borrower's transportation cost to bank *B* plus the marginal cost differential. Hence, for $x = 0$, bank *A* charges $r_{A0} = t_B + \mu$. Bank *B* can only charge $r_{B0} = t_A$ to the close borrower. Let y again be the borrower that receives the most competitive loan rate from both *A* and *B*, i.e. $r_{Ay} = 0$ and $r_{By} = \mu$, then $t_A y = t_B(1 - y) + \mu$ and:

$$y = \frac{t_B + \mu}{t_A + t_B}.$$

All borrowers "to the left" of y ($0 \le x \le y \le 1$) are served by bank A at a loan rate:

$$r_{Ax} = t_B(1-x) + \mu - t_A x = t_B + \mu - (t_A + t_B)x.$$

The other borrowers ($0 \le y \le x \le 1$) are served by bank B at loan rate:

$$r_{Bx} = t_A x - t_B(1-x) = -t_B + (t_A + t_B)x.$$

To conclude, the market reach (and share) of bank A increases in the marginal cost differential μ. However the rate at which both banks discriminate remains unaltered and equal to $t_A + t_B$.

4. "Soft Firm – Hard Firm" and "Soft Bank – Hard Bank"

Borrower-specific transportation costs may stem from borrowers differing in the soft and hard information they can provide when applying for a loan. We consider an "informational portfolio" with two components: soft and hard information. Let δ describe the "value" of the soft information in the borrower's portfolio, while $(1-\delta)$ is the corresponding value of the hard information, with $\delta \in [0,1]$. Borrowers differ in the relevancy of soft and hard information they can employ in their loan applications; that is borrowers differ in their δ. For example, larger and older firms may generate no relevant soft information (as there are many decision makers operating in a professional and objectified environment, for example) but possess a lot of hard information and therefore may have a δ close to zero. These are "hard firms". In contrast, small and young firms may lack verifiable and relevant hard information such that loan decisions are based mostly on soft information, implying a δ close to one; i.e. these firms will be "soft firms". We model borrower-specific transportation

costs to branch *i* to equal (and again assuming for simplicity that $\alpha = 1$ and $L = 1$, and that marginal costs equal zero for both banks):

$$t_i = s_i^{\delta} h_i^{1-\delta},$$

with s_i and h_i the transportation costs of the borrower to bank *i* associated with hard and soft information, respectively.

The market share of bank *A* then simply equals:

$$y = \frac{s_B^{\delta} h_B^{1-\delta}}{s_A^{\delta} h_A^{1-\delta} + s_B^{\delta} h_B^{1-\delta}} = \frac{\left(\frac{s_B}{h_B}\right)^{\delta} h_B}{\left(\frac{s_A}{h_A}\right)^{\delta} h_A + \left(\frac{s_B}{h_B}\right)^{\delta} h_B},$$

All borrowers "to the left" of *y* ($0 \le x \le y \le 1$) are served by branch *A* at a loan rate:

$$r_{Ax} = s_B^{\delta} h_B^{1-\delta} - (s_A^{\delta} h_A^{1-\delta} + s_B^{\delta} h_B^{1-\delta}) x.$$

The other borrowers ($0 \le y \le x \le 1$) are served by branch *B* at loan rate:

$$r_{Bx} = -s_B^{\delta} h_B^{1-\delta} + (s_A^{\delta} h_A^{1-\delta} + s_B^{\delta} h_B^{1-\delta}) x.$$

In order to identify the implications for market shares and spatial pricing, we introduce some facilitating notation. First, we define a parameter η as:

$$\eta = \frac{h_A}{h_B}.$$

This parameter η captures the cost of using hard information when going to bank *A* relative to the cost of going to bank *B*. We call bank *B* "hard" when $\eta \ge 1$. η is larger than one, for example, if bank *B* is larger or more hierarchical than bank A and as a result handles hard

information more effectively than bank *A*. Alternatively bank *B* may have invested more in new information technology than bank *A*. Second, we define a parameter β for which:

$$\frac{s_A}{h_A} = \beta \frac{s_B}{h_B}.$$

Bank *A* has a *comparative* advantage in handling soft information if $\beta \leq 1$. By definition:

$$\frac{s_A}{s_B} = \beta\eta,$$

hence bank *A* may also have an *absolute* advantage in handling soft information if $\beta\eta < 1$. Finally, we define a parameter τ as:

$$\tau = \frac{s_B}{h_B}.$$

This parameter captures the relative cost of using soft versus hard information when going to the (rival) bank and we assume $\tau > 1$. Hence τ captures the "technology" that is available to relay soft versus hard information and may increase, for example, when transmitting hard information using new communication technology becomes relatively easier. Using this new notation the market share of *A* equals:

$$y = \frac{1}{\eta\beta^{\delta} + 1}.$$

This simple expression can be analyzed quite easily. We find that bank A's market share y increases in δ (i.e. in firm's employing more soft information), when bank A has a comparative advantage, or $0 \leq \beta \leq 1$. Figure 2 displays the market share of both banks *A* and B (on the horizontal axis) as a function of η (on the vertical axis). If firms use only hard information ($\delta = 0$):

$$y = \frac{1}{\eta + 1}.$$

The figure displays this schedule in bold. Bank's *A* market share is clearly a decreasing function of the hardness of bank *B*. On the other hand, if firms use only soft information ($\delta = 1$):

$$y = \frac{1}{\eta\beta + 1},$$

and if bank *A* has a comparative advantage in handling soft information, i.e. $\beta < 1$, this latter "soft firm schedule" is situated to the right of the former "hard firm schedule". If bank A does not have this comparative advantage, i.e. if $\beta > 1$, its market share is further reduced and the "soft firm schedule" is situated to the left of the "hard firm schedule". Even in that case however, it is still possible for bank *A* to have a larger market share than bank *B* if η is small enough for $\beta\eta < 1$. To conclude, *A*'s market share decreases in the hardness of *B*, but this effect is partly mitigated for soft firms in case *A* has a comparative advantage in handling soft information.[3]

Next we analyze the degree of spatial pricing. For borrowers "to the left" of *y* ($0 \le x \le y \le 1$) served by branch *A* the slope at which the loan rate varies with distance equals:

$$\frac{dr_{Ax}}{dx} = -\left(s_A{}^{\delta} h_A{}^{1-\delta} + s_B{}^{\delta} h_B{}^{1-\delta}\right) = -\tau^{\delta} h_B(\beta^{\delta}\eta + 1).$$

[3] Interestingly, each bank's market share or reach y remains positive for all type of firms, irrespective of the importance of soft information, δ, in the loan applications (for all non-zero transportation costs). The product differentiation literature has labeled this phenomenon "horizontal dominance": location dominates other heterogeneity in firm characteristics (see Neven and Thisse (1990) and Degryse (1996), for example). We find that horizontal dominance always arises in environments characterized by spatial price discrimination (but not in models with uniform pricing), as a bank enjoys a comparative advantage for its closest borrowers independent of the per-unit transportation cost differential between the two banks.

Hence: $\frac{dr_{Ax}^{\ 2}}{dxds_A} = -\delta(\frac{1}{\beta\tau})^{1-\delta} \leq 0$, $\frac{dr_{Ax}^{\ 2}}{dxdh_A} = -(1-\delta)(\frac{1}{\beta\tau})^{\delta} \leq 0$, $\frac{dr_{Ax}^{\ 2}}{dxds_B} = -\delta(\frac{1}{\tau})^{1-\delta} \leq 0$, and

$\frac{dr_{Ax}^{\ 2}}{dxdh_B} = -(1-\delta)(\frac{1}{\tau})^{\delta} \leq 0$.

A decrease in hard transportation costs to bank *B* (h_B), for example, will result in a softening of spatial pricing practiced by *A*, especially if hard transportation costs are high compared to soft information transportation costs ($\tau = 1$) and for hard firms ($\delta = 0$).

To conclude, the differential reliance by borrowers in their loan applications on soft and hard information introduces an interesting heterogeneity in the transportation costs in the loan granting and monitoring process. This heterogeneity also determines bank geographical reach and loan pricing. If relaying soft information entails higher transportation costs than reporting hard information, borrowers with difficulties producing hard information are more likely to be engaged by the bank with the cost advantage in dealing with soft information. The "soft bank" obtains a larger market share and spatial pricing is sharper for "soft borrowers", while the "hard" bank will serve firms having more hard information available. As such, "soft banks" specialize in "soft firms" whereas "hard banks" specialize in "hard firms". We test these additional predictions in the empirical section.

II. Data and Variables

The dataset we analyze consists of 15,044 loans made to independents or single-person businesses, and small-, medium-, and large-sized firms by an important Belgian bank that operates throughout Belgium. The sample encompasses all existing small and medium enterprise loans granted by this bank as of August 10, 1997 that were initiated or repriced after January 1, 1995. The bank is one out a few truly national and general-purpose banks operating in Belgium in 1997. It lends to firms located in most postal zones, and is active in

49 different industries. Around 83% of the firms in its portfolio are single-person businesses and most borrowers obtain just one (relatively small) loan from this bank.

Degryse and Van Cayseele (2000) first employed the bank-firm relationships data set. Degryse and Ongena (2005) added distance variables and show that two distance-variables play a role in loan pricing: distance to lender and distance to closest competitor. For each borrower we calculate the distance to the lending bank's branch. We take the natural log of 1 + Distance to Lender (ln(1+Distance to Lender)) to accommodate for potential fixed costs in transportation. To identify the impact of the closest competitor, we also compute the distance between the borrower and the branches of all other competing banks located in the same postal zone as the borrower, and effectively take the 25th percentile. We label this variable as ln(1+Distance to Closest Competitor). As of December 31st, 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 region, which we call "postal area" and which in most cases coincides with one of the ten Provinces in Belgium. A postal zone covers on average 26 sq km, and contains on average approximately six bank branches. A postal area covers 3,359 sq km, on average. Not surprisingly, borrowers are often located in more densely banked areas, with on average more than 17 bank branches per postal zone, resulting in around 250,000 possible borrower – bank branch pairs. Degryse and Ongena (2005) provide more details on computational issues related to our distance-variables as well as other minor sample selection issues.

Table 1 provides summary statistics for the 15,044 contracts of our variables, broken down into eight sets of characteristics: (1) dependent variables, (2) transportation cost drivers, (3) geographical distance, (4) relationship characteristics, (5) loan contract characteristics, (6)

loan purpose, (7) firm characteristics, and (8) interest rate variables. The distance to the lender for the median borrower is around 4 minutes and 20 seconds. The distance to the quartile closest competitors for the median borrower in our sample is 3 minutes and 50 seconds 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.

Our theoretical model suggests that the mode of organization of the closest competitor matters for the degree of spatial pricing. The Belgian financial landscape shows substantial heterogeneity in rival banks. In addition to other large banks, a number of smaller (savings) banks are present. To address the impact of organizational structure (labeled as "transportation cost drivers"), we combine the loan information data set employed by Degryse and Ongena (2005) with a new data set on the type and organizational structure of all bank branches in Belgium. First, we employ a variable "Large Bank", which measures the relative size in terms of total assets of the geographically closest bank relative to the largest bank. Large Bank ranges between 0 and 1, and equals 1 when the closest competitor is the largest bank.[4] We obtain data on the total assets of all banks in Belgium from the *Documenten en Aspecten* (Documents and Aspects) published by the *Belgische Vereniging van Banken* (Belgian Bankers Association). Summary statistics reported in Table 1 show that Large Bank is on average 0.62.

Second, we measure the Hierarchy of the closest competitor, both at the bank ("Hierarchy Bank") and at the branch level ("Hierarchy Branch"). These two variables proxy for the degree of hierarchy of the closest competitor and are constructed on the basis of information from the 1994 annual report *Bankkantoren in België* (Bank Branches in Belgium) published

[4] In computing Large Bank, we actually employ information on the 25% geographically closest competitors. To illustrate this procedure, suppose there are twelve banks in the postal zone. Then the 25th percentile includes the three closest banks. When 1 of them is the largest and the two other have half of the size of the largest, then Large Bank equals 2/3.

by the *Belgische Vereniging van Banken* (Belgian Bankers Association). This document lists to which branch higher up in the hierarchy of the bank each of the 7,477 branches reports. For each branch in the bank we follow this 'chain of command' all the way up to the top and count the layers traveled. This is our branch-specific measure of hierarchy. Hierarchy Branch ranges between zero and five. We also average across the branches of each bank. We then take the value of this measure for the closest competitor,[5] and scale by the maximum across banks (which is around 4). This constitutes our measure of hierarchy for each bank "Hierarchy Bank". By construction Hierarchy Bank ranges between zero and one. The average is 0.366 indicating that the competing bank branch has around 1.5 levels of organizational layers above it.

In addition to bank size and hierarchy, we also focus on whether the closest competitor is a Foreign Bank or not. This variable also ranges between zero and one and would equal one when the closest competing branch is a branch of a foreign bank. The mean of Foreign Bank is about 0.035 suggesting that only occasionally the closest competing branch is a branch of a foreign bank. The reasoning for distinguishing foreign banks from others is that foreign banks may focus more on hard information in their decision-making (Mian (2006)).

Our last-but-one variable computes the fraction of closest competitors that have a Fax number listed in the 1994 annual report *Bankkantoren in België* (Bank Branches in Belgium) published by the *Belgische Vereniging van Banken* (Belgian Bankers Association). The presence of a fax allows for a more impersonal mode of communication and introduces greater possibilities to transfer hard information between borrower and bank (Petersen and Rajan, 2002) as well as within the bank. About two thirds of competing banks had a fax at the end of 1994. Finally, we include an Urban dummy that equals one if the borrower is located

[5] As for the other relevant variables we actually average across the 25% geographically closest competitors.

in an agglomeration with more than 250,000 inhabitants, and is zero otherwise. Borrowers in an urban setting may face more congestion when traveling to their banks.

Our theoretical model suggests employing two different dependent variables. The first is Branch Reach. We distinguish *Quartile Reach*, computed as the log of one plus the traveling time of the branch's quartile most remote borrower and the branch itself, in minutes, and *Maximum Reach*, representing the log of one plus the maximum distance between the most remote borrower and the branch. The mean across all branches for Quartile (Maximum) Reach is 2.60 (3.52), translating into approximately 14 (40) minutes traveling time to the remote borrower (see Table 1).

The second dependent variable is the *Loan Rate*, 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 employ basis points throughout the paper). The loan rate varies widely not only nationally (the standard deviation is 236 basis points), but also at the branch level (the average standard deviation at the branch level is still 217 basis points).

Our dataset further includes postal zone variables, relationship characteristics, loan characteristics and purpose, firm characteristics, and interest rate variables. We calculate both the HHI (Herfindahl-Hirschman Index), as the summed squares of bank market shares by number of branches in borrower's postal zone, and the Number of Firms registered in the borrower's postal zone (in thousands). The HHI equals 0.17 on average while the Number of Firms is around 0.75 (i.e. 750 firms) on average in each postal zone.

Our dataset further includes two relationship characteristics, Main Bank and Duration of Relationship. Main Bank indicates whether this bank considers itself to be the main bank of

that firm or not. The bank's definition in determining whether it is the main bank or not is "having a monthly 'turnover' on the current account of at least BEF 100,000 (U.S. Dollar 2,500), and buying at least two products from the bank". More than half of all borrowers are classified as Main Bank customers. Main Bank captures the scope of the relationship. The Duration of the Relationship measures the number of years the firm has had a relationship 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.

Our loan contract characteristics encompass four dummies capturing the effect of the "revisability" of the loan, as some loan contracts allow resetting the loan rate at fixed dates subject to contractual terms. Other loan characteristics are Collateral and Repayment Duration of Loan. The variable Collateral indicates whether the loan is collateralized or not. Approximately 26% of the loans are collateralized. We assume, as in Berger and Udell (1995) 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.

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 repayment duration of a loan. We include the natural logarithm of (one plus) 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 loan purpose. We have seven types of loans in our sample. While we cannot reveal the relative importance of the types of loans, we include the seven loan purpose dummies in Table 1 for convenient reference. We further include a

separate Rollover dummy (also listed in the Loan Purpose category), which takes a value of one if the loan is given to prepay another loan, and is zero otherwise.

The firm characteristics include both proxies for the size and legal form of the firm. In terms of firm size, a distinction can be made between Single-Person Businesses (82.98% of the sample), Small (15.99%), Medium (0.89%), and Large (0.14%) Firms; and in terms of legal form of organization, a distinction is made between Sole Proprietorships (82.22%), Limited Partnerships (11.97%), Limited Partnerships with Equal Sharing (1.18%), Corporations (3.78%), and Temporary Arrangements (0.85%). In the regressions, we exclude the dummies for Single-Person Businesses and Sole Proprietorships. We include 49 two-digit NACE code dummies to capture industry characteristics.

The interest rate variables are incorporated to control for the underlying cost of capital in the economy. The first is the interest rate on a Belgian Government Security with the same repayment duration as the loan granted 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-month Treasury bill. Finally, we incorporate two year dummies for 1996 and 1997 (with 1995 the base case) to control for business cycle effects.

III. Empirical Results

A. Organizational Structure and Branch Reach

1. Control Variables

We now turn to the first implication of our theoretical model developed in Section II: the geographical reach of branches and the role of the competing banks' organizational structure. We employ two indicators of branch reach. *Quartile Reach* captures the distance to the

quartile most remote borrower (Models I to VII in Table 2 and Models I to VI in Table 3). *Maximum Reach* measures the distance to the most remote borrower of the branch (Models VIII and IX in Table 2 and Models VII and VIII in Table 3).

As most control variables remain virtually unaltered throughout the exercises in this paper, we only discuss them once. We tabulate key coefficients in Table 2 and a complete set of coefficients for selected specifications in an Appendix. In Table 2 we include the HHI to control for banking competition. As already indicated we resort to using the number of bank branches of each bank in the postal zone to construct market shares. The estimate of the coefficient on HHI (0.12) 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 reach by less than 0.5 percent. A doubling from the Number of Firms registered in the borrower's postal zone, at the mean, would increase reach by 1.25 percent.

The impact of the bank-firm *relationship characteristics* is captured by *Main Bank* and the *ln(1+Duration of Relationship*). The coefficient on Main Bank is mostly insignificant, while the coefficient on Duration is negative and significant but economically quite small. The *loan contract characteristics* include whether the loan is collateralized, its repayment duration, and the loan revisability options (these coefficients are tabulated in the Appendix). Only the coefficient on collateral is significant but economically close-to irrelevant. To conclude, our control variables reveal that in less concentrated banking markets and when more firms are in the postal zone, geographical reach increases somewhat.

2. Rivals' Organizational Structure

In addition to the set of control variables, the regression models include our five indicators of the rivals' organizational structure, Large Bank, Hierarchy Bank, Hierarchy Branch, Foreign Bank, and Fax. In some specifications we also control for Urban location. Almost

all organizational coefficients are negative and are statistically significant throughout Models I to IX, in particular the coefficients on both the Hierarchy and Fax variables. Branch reach is substantially curtailed when the closest competitors are hierarchical or have a fax. *Quartile Reach* in Model VII, for example, decreases by almost 30 percent at its mean, from 13.5 to 9.5 minutes, when the branches of the closest competitor are situated below a pyramidal structure (Hierarchy Branch = 5) versus when the branches are reporting to a flat upper deck (Hierarchy Branch = 0). Similarly, when the closest competitors have a fax but the own branch does not, then the quartile branch reach drops by almost 25 percent. These results are further robust to using the *Maximum Reach* (Models VIII and IX) as dependent variable. In addition, facing a Foreign Bank now also shrinks the maximum reach. All in all, we find these results in line with the predictions of our model, suggesting that when rivals' organizational structure is such that transportation costs are lower, the bank's geographical reach reduces.

To test the "soft-hard hypothesis" of our model, we interact our hierarchy variables with the Small Firm dummy in Table 3. Our findings indicate that while reach is negatively affected by the presence of "hard" rivals, i.e. (large) hierarchical rivals with faxes, the effects are partly mitigated when firms are "soft", i.e. small. This result indicates that the reach of banks that specialize in collecting and processing soft information is less affected by rival competition than those specializing in hard information.

B. Organizational Structure and Loan Pricing

Next we analyze the determinants of the loan rate by regressing the Loan Rate (in basis points) on our "transportation cost drivers", relationship, competition, and control variables, which as already indicated include loan contract characteristics, loan purpose, firm characteristics, and interest rates. We use ordinary least squares estimation. Our first model

in Table 4 highlights a parsimonious fixed-effects specification containing only distance and control variables and then we turn to specifications containing also the interactions between distance and bank organization variables in Models II to VI.

1. Control Variables

As most control variables remain virtually unaltered throughout the exercises in this paper, we again only discuss them once (tabulated in Column III in the Appendix). The impact of the bank-firm *relationship characteristics* is captured by *Main Bank* and the *ln(1+Duration of Relationship*). Main bank captures the *scope* of the bank-firm relationship. The loan rate decreases 55 basis points when the scope of the relationship is sufficiently broad (Main bank = 1). The Appendix also shows that the loan rate increases with the duration of the relationship (see also Degryse and Van Cayseele (2000)). For example, an increase in duration from the median (7.5 years) to the median plus one standard deviation (13 years) increases the loan rate by around 10 basis points.

The *loan contract characteristics* include whether the loan is collateralized, its repayment duration, and the loan revisability options. A collateralized loan carries a loan rate that is approximately 38 basis points lower. This result is in line with the sorting-by-private-information paradigm, which predicts that safer borrowers pledge more collateral (e.g., Besanko and Thakor (1987)), but differs from the empirical findings of Berger and Udell (1990) and Berger and Udell (1995), and with 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(1+Repayment Duration of Loan) is significantly negative at a 1% level: An increase in duration from say five to six years reduces the loan rate by 17 basis points. We also include four loan revisability dummies (but do not tabulate these coefficients to

conserve space). However, we can reject (at a 1% significance level) the hypothesis of the joint equality to zero of the coefficients of the four loan revisability dummies. The coefficient on the Rollover dummy indicates that if a loan is given to prepay another loan, the loan rate increases by approximately 15 basis points. Term, Bridge, and Consumer Credit loans carry a significantly lower loan rate. However, again we can report the rejection, at a 1% significance level, of the hypothesis of the joint equality to zero of the coefficients of the six Loan Purpose dummies.

The Appendix also shows that Small Firms pay a higher interest rate, while Medium and Large Firms pay a significantly lower interest rate than do Single-Person Businesses (the base case). This non-monotonicity is due to differences in legal exposure. Almost all Single-Person Businesses are Sole Proprietors, and owners thus face unlimited liability for their business debts. On the other hand, all Small Firms are Partnerships, Corporations, or Temporary Arrangements; their owners for the most part face only limited liability. Diversification and reputation effects (due to increased firm size) eventually overwhelm the impact of limited liability, however, and lower the loan rate for the average Medium and Large Firms. Corporations and Limited Partnerships with Equal Sharing pay a significantly lower interest rate than do Sole Proprietorships, possibly reflecting both the effects of limited liability and increased firm size. While few individual coefficients on either the eight postal area or the 49 industry dummies are significant, both sets of coefficients are highly significant as a group.

The *interest rate variables* are important in explaining the variation of the loan rate. 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 0.34. This coefficient suggests sluggishness in loan rate adjustments, possibly due to the implicit interest rate insurance

offered by banks (e.g., Berlin and Mester (1998)), credit rationing (e.g., Fried and Howitt (1980) and Berger and Udell (1992)), or the downward drift in Belgian interest rates during our sample period. This decrease in interest rates is actually reflected in our sample loan rates, as the (non-tabulated) coefficients on the two year dummies indicate that the average 1995 (1996) loan rate is a significant 127 (18) basis points above the average 1997 loan rate, *ceteris paribus*. A basis point parallel shift of the Term Spread implies a positive 0.57 basis point shift in the loan rate.

2. Rivals' Organization and Communication Technology

We now turn to the coefficients on the distance variables, and their relation with organizational structure. We employ for each of our distance measures the log of (one plus) the distance, as we conjecture the marginal impact on the loan rate to decrease with distance. Model I in Table 4 is the fixed-effects equivalent of a specification in Degryse and Ongena (2005)(their Table V, Model III), which we will use as benchmark. The negative and significant coefficients on ln(1+Distance to Lender) reveal that borrowers located farther away from the lender pay a lower loan rate at the lending bank; an increase of one standard deviation in the distance between the borrower and the lender (i.e. an increase from 0 of 7.3 minutes) decrease the loan rate with 20 basis points. The positive and significant coefficient on the variable ln(1+Distance to Closest Competitors) shows that the lender's market power increases with the distance between the borrower and the closest competitors; an increase of one standard deviation between the borrower and the closest competitor (i.e. an increase of 2.3 minutes) increases the loan rate with 17 basis points.[6]

[6] The correlation between the variables ln(1+Distance to Lender) and ln(1+Distance to Closest Competitor) is low, 0.16, suggesting that these are independent effects.

Our theoretical model suggests that the organizational form of the closest competitors, and the associated implementation of lending technology, matters for the degree of spatial pricing. In Model II, we investigate whether the size of the closest competitor influences the severity of spatial pricing. The results are displayed in the second column of Table 4. We interact *Large Bank* with ln(1+Distance to Lender) and ln(1+Distance to Closest Competitor). We expect that larger banks employ more hard information, implying that the degree of spatial pricing should be substantially lower. Our results are in line with this expectation; the interaction term *ln(1+Distance to Lender) * Large Bank* is significantly positive while the interaction term *ln(1+Distance to Closest Competitor) * Large Bank* is significantly negative. This suggests that the degree of spatial pricing is lower when the closest competitor is a large bank. Actually, when the closest (quartile) competitor is the largest bank (Large Bank = 1), then the degree of spatial pricing becomes close to zero as the sum of the coefficients on our distance variables and distance variables * Large Bank reveals. In particular, the sum of the coefficients of *ln(1+Distance to Lender)* and *ln(1+Distance to Lender) * Large Bank* becomes -0.4 , and the sum of the coefficients on *ln(1+Distance to Closest Competitor)* and *ln(1+Distance to Closest Competitor) * Large Bank* becomes 6.8. In contrast, the degree of spatial pricing when a small bank is the closest rival (Large Bank = 0) becomes substantially larger, as the coefficients on *ln(1+Distance to Lender)* and *ln(1+Distance to Closest Competitor)* tell us. A one standard deviation increase of the distance to lender (from 0 to 7.3 minutes) implies a drop in the loan rate of about 50 basis points and an increase of one standard deviation in the distance to closest competitor (0 to 2.3 minutes) yields an increase in the loan rate of about 35 basis points. In the bottom rows of Table 4 we add the respective coefficients and test their equality to zero, to highlight the differential intensity of spatial pricing when rival banks are small (soft) or large (hard). When rivals are hard, the bank does not practice spatial pricing; in contrast to when rivals are soft, the bank does.

Models III and IV in Table 4 deal with the *Hierarchy* at the closest competitor, at the bank and branch level respectively. We expect that more hierarchically organized banks employ more hard information. This seems to be the case when we employ the Hierarchy Bank measure. Again when rivals are hierarchical, the own bank does not practice spatial pricing; in contrast to when rivals are soft, the bank does. On the other hand, when we employ the Hierarchy Branch measure there is no evidence of spatial pricing in either case (but note that in this case we can no longer include the full set of control variables).

Model V of Table 4 investigates whether the presence of a *Foreign Bank* in the neighborhood shapes spatial pricing. As before, we include an interaction term between our distance variables and Foreign Bank. Again, though the interaction terms *ln(1+Distance to Lender) * Foreign Bank* and *ln(1+Distance to Closest Competitor) * Foreign Bank* themselves are not statistically significantly different from zero, we can reject the null hypothesis that the bank practices spatial pricing when competitors are foreign (this result is reported in the bottom row of the table).

Model VI of Table 4 includes Fax. There is again no evidence of spatial pricing (but also in this case we can no longer include the full set of control variables). Finally in Model VII, we include an interaction variable between our distance variables and *Urban*. We find that the coefficient on *ln(1+Distance to lender) * Urban* is statistically negative; the severity of spatial pricing is sharper in urban areas possibly due to congestion.

3. Rivals' Organization and Differential Pricing for Small Firms

In Table 5, we assess whether the impact of rival banks' organizational structure differently affects the severity of spatial pricing of "soft" borrowers. We deal with this question by including interactions between the variables used in Table 4 and a dummy variable Small

Firm that equals one if the borrower is a small firm, and equals zero otherwise.[7] Our theoretical model predicts that spatial pricing becomes less sharp when large, hard or technologically advanced rivals are the closest competitors. This effect, however, should be less pronounced for "soft" borrowers as "soft" banks have a comparative advantage for this group of firms. We use small firms to proxy for "soft" borrowers, because small firms generally have less hard information than large firms. The bank organizational variables used before (Large Bank, Hierarchy Bank, Hierarchy Branch, Foreign Bank, and Fax) capture the degree to which the rival is a "hard" bank, i.e., whether rivals are better equipped to process hard information. As before, the dependent variable is the loan rate until the next revision (in basis points).

In Model I of Table 5, we include the interactions with Small Firm but do not yet differentiate between different modes of bank organizational structure. We find that spatial pricing is more pronounced for small firms, consistent with the notion that small firms do not generate as much hard information as medium-sized and large firms do. Small borrowers located farther away from the lender pay a lower loan rate at the lending bank. Although small firms exhibit larger spatial pricing, the effect is statistically not different relative to medium and large borrowers (the default category) as shown by the coefficient on the interaction term ln (1+ distance to lender)*small firm. Similarly, we do not find a differential effect for small firms of the variable ln(1+Distance to Closest Competitors) on loan pricing.

In Models II to V of Table 5, we also introduce the organizational structure of the closest competitor banks. In Model II, we include interactions with Large Bank. We find a positive and statistically significant coefficient for the variable ln(1+Distance to Lender) * Large Bank * Small Firms and a negative coefficient for the variable ln(1+Distance to Closest

[7] The default category includes Medium and Large firms, as well as Single-Person Businesses.

Competitor) * Large Bank * Small Firms, consistent with our hypothesis that large banks are better equipped to process hard information. The bottom rows of Table 4 further detail this finding: the difference in spatial pricing between small and large firms is more pronounced when a soft rival is the closest competitor (sum of coefficients –75,75*** versus –24,34**). Overall, we do not find any significant spatial pricing when large banks are the closest competitors.

In Model III, we include Hierarchy Bank. Since this variable is constructed such that hierarchies with more layers (i.e., more complex hierarchies) obtain higher scores, we expect a positive coefficient for the variable ln(1+Distance to Lender) * Hierarchy Bank * Small Firm and a negative coefficient for the variable ln(1+Distance to Closest Competitor) * Hierarchy Bank * Small Firms. This is indeed what we find, although the effects are not statistically significant.

Model IV shows the results when using Hierarchy Branch as measure of organizational structure. We again find a statistically significant differential effect of organizational structure and firm size on loan pricing for bank. Consistent with our hypothesis, we find a positive significant coefficient on ln(1+Distance to Lender) * Hierarchy Branch * Small Firm and a negative and significant coefficient for the variable ln(1+Distance to Closest Competitor) * Hierarchy Branch * Small Firm.

Finally, in model V we include interactions with the variable Fax. We do not find that the presence of a fax has a differential effect on spatial pricing of small firms.

Overall, we find supporting evidence that the organizational structure of competing banks has implications for the loan pricing of banks. Spatial pricing towards small firms is more pronounced especially when the closest competitor is a “soft” bank. The effect thus varies across firms of different size, consistent with our hypothesis that the bank’s mode of

organization influences the lending technology employed and determines whether the bank has a comparative advantage in "soft" or "hard" information.

IV. Conclusions

Recent theory highlights that the mode of firm organization determines agents' incentives. Centralized hierarchical firms employ hard information whereas flat decentralized firms exploit soft information. We present a stylized banking competition model incorporating the role of own and rivals' organizational structure on lending technology employed, geographical reach and spatial pricing. Our theoretical model predicts that when rival banks are more hierarchically organized, a bank's geographical reach decreases, and the degree of spatial pricing reduces.

Our empirical analysis employs two unique data sets, allowing us to combine information on firms', lenders', and rival banks' locations, as well as the organizational structure of rival banks. We find that the organizational form of the closest competitors matters for loan pricing. In particular, the geographical reach and degree of spatial pricing of the bank branch hinge on the rivals' organizational form. Branch reach is lower when the closest competitors are large, foreign, hierarchical and technological advanced. Large rival banks imply substantially lower spatial price discrimination. This effect is more pronounced for small firms. Also, the presence of a foreign bank in the vicinity of a borrower decreases the impact of geography on loan pricing. To summarize, we show that the size and hierarchy of the closest bank rivals in the vicinity of a borrower determine geographical reach, spatial pricing, and banking competition.

FIGURE 1. BRANCH SPATIAL PRICING, BRANCH REACH, AND PROFITABILITY

The figure displays the impact of differential transportation costs on branch spatial pricing and branch reach. The transportation cost to branch A and B are t_A and t_B, respectively.

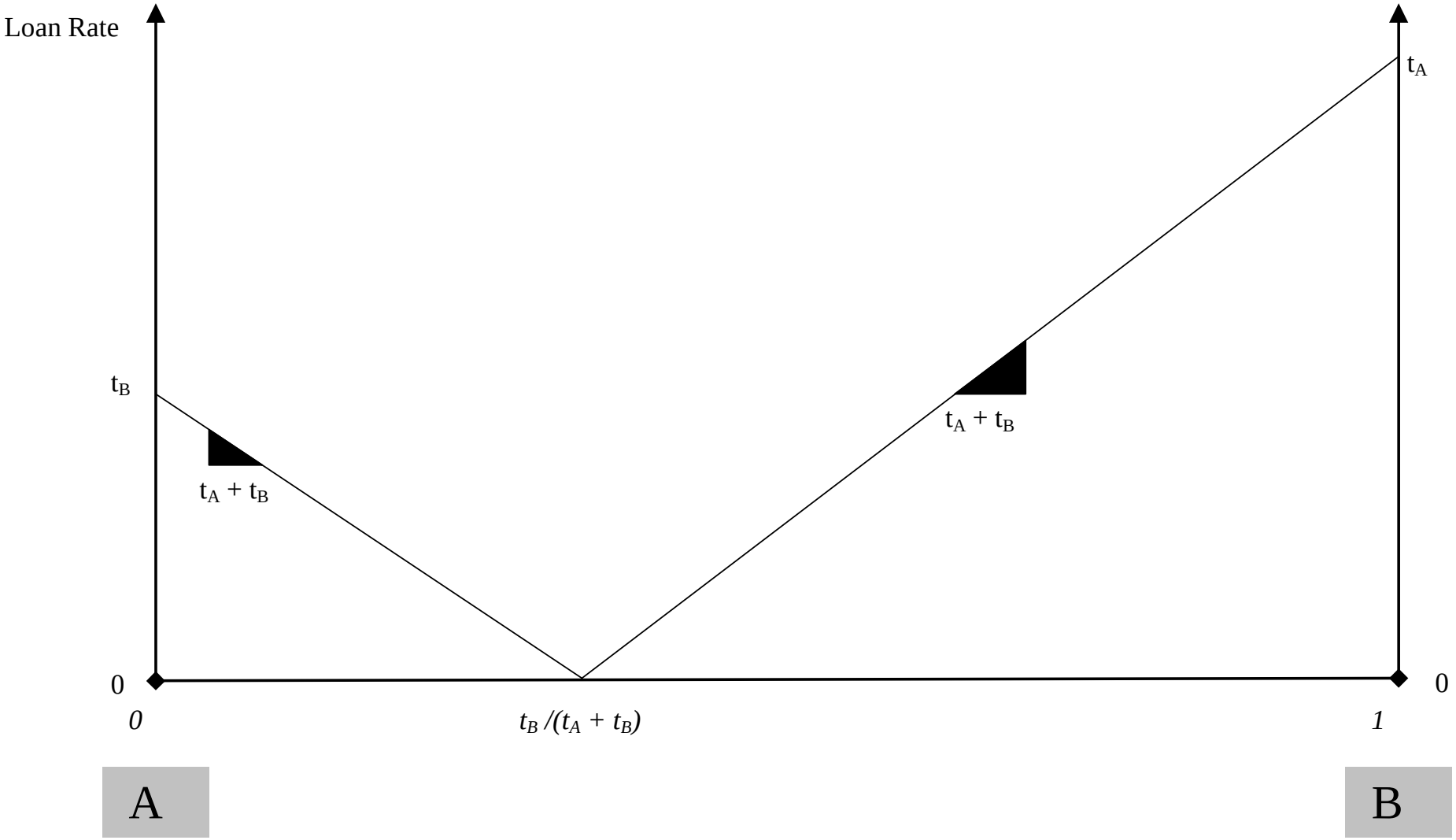

FIGURE 2. BRANCH REACH

The figure displays the market share of *A* (on the horizontal axis) as a function of the hardness of the rival (on the vertical axis).

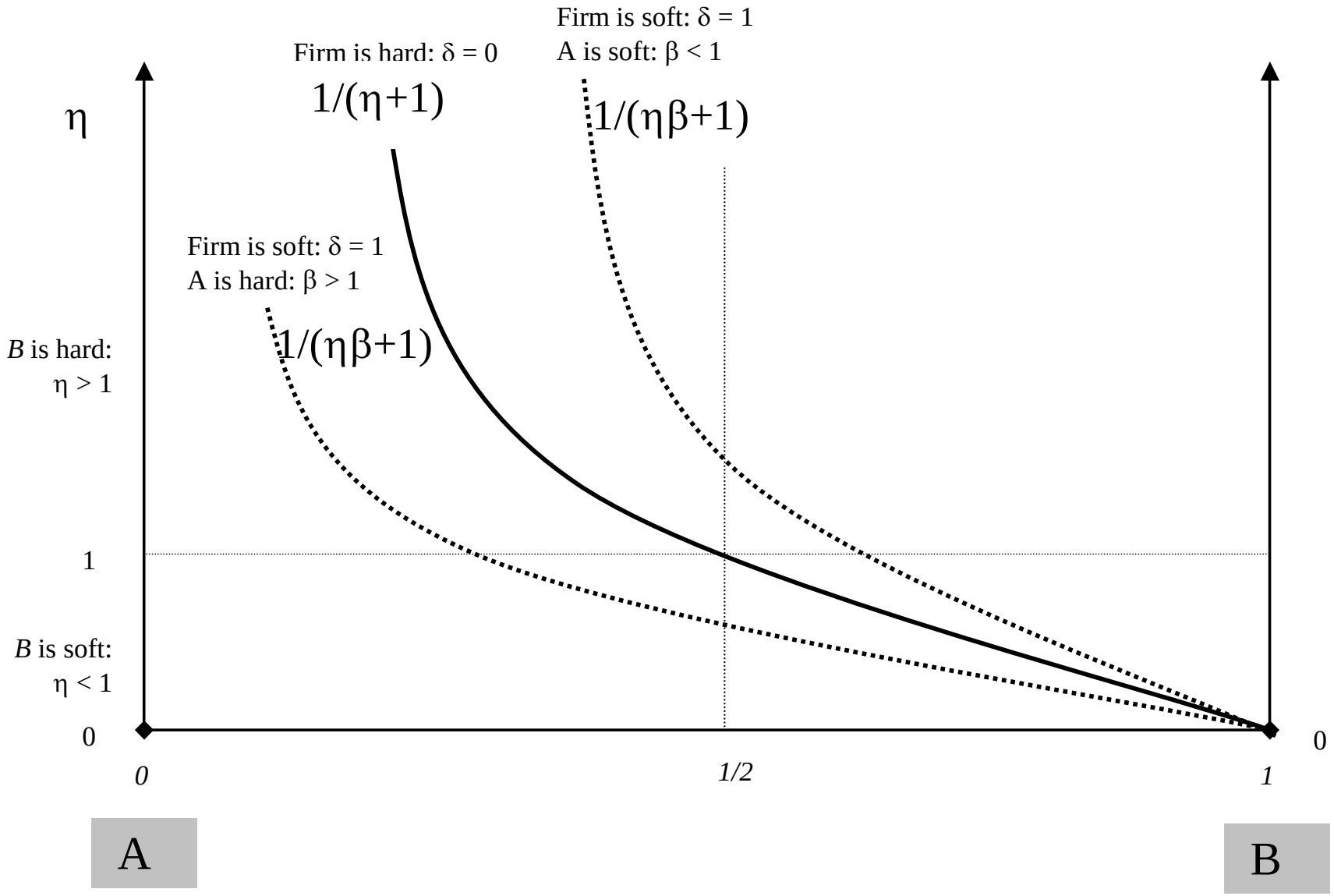

TABLE 1. DATA DESCRIPTION

The table defines the variables employed in the empirical specifications and provides their mean, median, minimum, maximum, and standard deviation. 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, these 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$ during the sample period. The data sources (S) include Degryse and Ongena (2005) (D), *Documenten en Aspecten* (Documents and Aspects) published by the *Belgische Vereniging van Banken* (Belgian Bankers Association) (A), *Bankkantoren in België* (Bank Branches in Belgium) published by the *Belgische Vereniging van Banken* (Belgian Bankers Association) (B), and *BelFirst* (F).

Variables	Definition	S	Mean	Median	Min.	Max.	St. Dev
Dependent variables							
Quartile Reach	Shortest traveling time to the quartile remote borrower of the branch, in minutes	D	14.06	13	1	87	7.67
Maximum Reach	Shortest traveling time to the most remote borrower of the branch, in minutes	D	40.05	34	1	186	27.81
Loan Rate	Interest rate on loan until next revision, in basis points	D	812	782	200	2,200	236
Variables of interest							
Bank organization							
Large Bank	Asset size of the quartile closest competitors relative to the asset size of the largest bank	A	0.617	0.678	0	1	0.174
Hierarchy Bank	The number of layers of the quartile closest competitors relative to the bank that is the most hierarchically organized	B	0.366	0.395	0	1	0.204
Hierarchy Branch	The number of layers to the headquarters from the quartile closest competitors' branches	B	1.5	1.5	0	5	0.4
Foreign Bank	Proportion of foreign banks among the quartile closest competitors	A	0.035	0	0	1	0.101
Technology							
Fax	Relative proportion of the quartile closest competitors that has a fax number	B	0.511	0.444	0	1	0.270

Variables	Definition	S	Mean	Median	Min.	Max.	St. Dev
Urban	= 1 if borrower is located in agglomeration with > 250,000 inhabitants	D	0.093	0	0	1	0.296
Geographical distance							
Distance to Lender	Shortest traveling time, in minutes	D	6.90	4.29	0.00	51.00	7.30
Distance to Closest Competitors	Shortest traveling time to the quartile closest competitor in the borrower's postal zone, in minutes	D	3.82	3.27	0.00	24.00	2.33
Control variables							
Postal zone	*Including 8 Postal Area Dummies*						
Herfindahl-Hirschman Index	The summed squares of bank market shares by number of branches in borrower's postal zone	B	0.17	0.15	0.05	1.00	0.11
Number of Firms	Number of registered firms in the borrower's postal zone, in thousands	F	0.747	0.448	0.002	6.10	0.888
Relationship characteristics							
Main bank	= 1 if bank considers itself as main bank,[a] in percent	D	58.82	100	0	100	49.22
Duration of Relationship	Length of relationship with current lender, in years	D	7.93	7.47	0.00	26.39	5.44
Contract characteristics	*Including 4 Loan Revisability Dummies*	D					
Collateral	= 1 if loan is secured via collateral, in percent	D	26.40	0	0	100	44.08
Repayment Duration of Loan	Repayment duration of loan, in years	D	2.35	0.55	0.00	20.00	3.26
Loan purpose							
Mortgage	= 1 if loan is a business mortgage loan	D	n/a[b]				
Term	= 1 if loan is a business term loan (investment credit)	D	n/a[b]				
Securitizable term	= 1 if loan is a securitizable business term loan (investment credit)	D	n/a[b]				

Variables	Definition	S	Mean	Median	Min.	Max.	St. Dev
Bridge	= 1 if loan is a bridge loan	D	n/a[b]				
Prepay taxes	= 1 if loan is credit to prepay taxes	D	n/a[b]				
Consumer credit	= 1 if loan is a consumer credit loan (capturing installment loans)	D	n/a[b]				
Other	= 1 if loan is given for another purpose or its purpose is not specified	D	n/a[b]				
Rollover	= 1 if loan is given to prepay another loan, in percent	D	10.20	0	0	100	30.27
Firm characteristics	*Including 49 Industry Dummies*						
Small firm	= 1 if < 10 employees and turnover < 250 mln. BEF,[c] in percent	D	15.99	0	0	100	36.64
Medium firm	= 1 if > 10 employees or turnover > 250 mln. BEF,[c] in percent	D	0.89	0	0	100	9.40
Large firm	= 1 if turnover > 1 bln. BEF,[c] in percent	D	0.14	0	0	100	3.73
Limited Partnership	= 1 if firm is limited partnership, in percent	D	11.97	0	0	100	32.46
Limited Partnership w/ ES	= 1 if firm is limited partnership with equal sharing, in percent	D	1.18	0	0	100	10.78
Corporation	= 1 if firm is corporation, in percent	D	3.78	0	0	100	19.07
Temporary Arrangement	= 1 if firm is a temporary arrangement, in percent	D	0.85	0	0	100	9.18
Interest rate variables	*Including 2 Year Dummies*						
Government Security	Interest rate on a Belgian government security with equal repayment duration as loan to firm, in basis points	D	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	D	179	177	100	268	31

TABLE 2. IMPACT OF ORGANIZATIONAL STRUCTURE ON BRANCH REACH

The table lists the coefficients from regressions with the indicated dependent variable. *Quartile* (*Maximum*) *Reach* is the log of one plus the shortest traveling time to the quartile most remote borrower of the branch, in minutes. *Large Bank* is the relative asset size of the closest quartile competitors. *Hierarchy Branch* is the average number of layers to headquarters at the closest quartile competing competitors. *Hierarchy Bank* is the average relative hierarchical bank complexity of the closest quartile competitors. *Foreign bank* is the proportion of foreign banks among the closest quartile competitors. *Fax* measures the relative proportion of the quartile closest competitors that has a fax number. *Urban* equals one if the borrower is located in an urban area, and equals zero otherwise. *Herfindahl-Hirschman Index* is the summed squares of bank market shares by number of branches in borrower's postal zone. *Number of firms* is the number of registered firms in the borrower's postal zone, in thousands. The *other control variables* are listed in Table 1 and for some specifications their coefficients are listed in an Appendix. We employ ordinary least squares estimation. The number of observations equals 15,044. *, **, and *** indicate significance at the 10%, 5%, and 1% level, two-tailed.

Model	I	II	III	IV	V	VI	VII	VIII	IX
Dependent Variable	Quartile Reach	Quartile Reach	Quartile Reach	Quartile Reach	Quartile Reach	Quartile Reach	Quartile Reach	Maximum Reach	Maximum Reach
Large Bank	-0.09 ***					0.00	0.01	-0.03	-0.03
	(0.02)					(0.02)	(0.02)	(0.04)	(0.04)
Hierarchy Bank		-0.10 ***				-0.09 ***		-0.16 ***	
		(0.02)				(0.02)		(0.03)	
Hierarchy Branch			-0.07 ***				-0.07 ***		-0.10 ***
			(0.01)				(0.01)		(0.02)
Foreign Bank				0.03		-0.02	-0.01	-0.18 ***	-0.15 **
				(0.03)		(0.04)	(0.04)	(0.06)	(0.06)
Fax					-0.27 ***	-0.27 ***	-0.27 ***	-0.50 ***	-0.49 ***
					(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
Urban						0.00	0.00	0.04 *	0.04 **
						(0.01)	(0.01)	(0.02)	(0.02)
Herfindahl-Hirschman Index	0.12 ***	0.11 ***	0.11 ***	0.12 ***	0.05 *	0.04	0.05	-0.12 **	-0.10 **
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.05)	(0.05)
Number of Firms	0.06 ***	0.06 ***	0.06 ***	0.06 ***	0.06 ***	0.06 ***	0.06 ***	0.08 ***	0.08 ***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)
Main Bank	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Duration of Relationship	-0.02 ***	-0.02 ***	-0.02 ***	-0.02 ***	-0.01 ***	-0.02 ***	-0.02 ***	-0.02 ***	-0.02 ***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)
Constant	2.45 ***	2.44 ***	2.50 ***	2.39 ***	2.73 ***	2.78 ***	2.86 ***	4.06 ***	4.18 ***
	(0.23)	(0.23)	(0.23)	(0.23)	(0.28)	(0.28)	(0.28)	(0.42)	(0.42)
Other Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.25	0.25	0.25	0.25	0.27	0.27	0.27	0.18	0.18

TABLE 3. IMPACT OF ORGANIZATIONAL STRUCTURE ON BRANCH REACH FOR SMALL FIRMS

The table lists the coefficients from regressions with the indicated dependent variable. *Quartile* (*Maximum*) *Reach* is the log of one plus the shortest traveling time to the quartile most remote borrower of the branch, in minutes. *Small Firm* equals one if the borrower is a small firm, and equals zero otherwise. *Large Bank* is the relative asset size of the closest quartile competitors. *Hierarchy Branch* is the average number of layers to headquarters at the closest quartile competing competitors. *Hierarchy Bank* is the average relative hierarchical bank complexity of the closest quartile competitors. *Fax* measures the relative proportion of the quartile closest competitors that has a fax number. The *other control variables* are listed in Table 1 and for some specifications their coefficients are listed in an Appendix. We employ ordinary least squares estimation. The number of observations equals 15,044. *, **, and *** indicate significance at the 10%, 5%, and 1% level, two-tailed.

Model	I	II	III	IV	V	VI	VII	VIII
Dependent Variable	Quartile Reach	Quartile Reach	Quartile Reach	Quartile Reach	Quartile Reach	Quartile Reach	Maximum Reach	Maximum Reach
Large Bank	-0.11 **				-0.03	-0.04	-0.04	-0.04
	(0.04)				(0.05)	(0.05)	(0.08)	(0.07)
Large Bank * Small Firm	0.02				0.04	0.06	0.06	0.05
	(0.05)				(0.05)	(0.05)	(0.08)	(0.08)
Hierarchy Bank		-0.18 ***			-0.16 ***		-0.18 ***	
		(0.04)			(0.04)		(0.07)	
Hierarchy Bank * Small Firm		0.10 **			0.08 *		0.03	
		(0.04)			(0.05)		(0.07)	
Hierarchy Branch			-0.09 ***			-0.08 ***		-0.13 ***
			(0.02)			(0.02)		(0.04)
Hierarchy Branch * Small Firm			0.02			0.02		0.03
			(0.02)			(0.03)		(0.04)
Fax				-0.35 ***	-0.35 ***	-0.35 ***	-0.57 ***	-0.57 ***
				(0.03)	(0.03)	(0.03)	(0.05)	(0.05)
Fax * Small Firm				0.09 ***	0.09 ***	0.10 ***	0.08	0.08
				(0.03)	(0.03)	(0.03)	(0.05)	(0.05)
Small Firm	-0.08	-0.10	-0.09	-0.06	-0.12 ***	-0.13 ***	-0.13 **	-0.16 **
	(0.16)	(0.15)	(0.16)	(0.16)	(0.04)	(0.05)	(0.06)	(0.07)
Constant and Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.25	0.25	0.25	0.27	0.27	0.27	0.18	0.18

TABLE 4. COMPETING BANKS' ORGANIZATIONAL STRUCTURE AND THE SEVERITY OF SPATIAL PRICING

The table lists the coefficients from regressions with the *loan rate* until the next revision, in basis points, as the dependent variable. *Distance to lender* is the shortest traveling time to the lender, in minutes. *Distance to closest competitor* is the shortest traveling time to the closest quartile competitor, in minutes. *Large Bank* is the relative asset size of the closest quartile competitors. *Hierarchy Branch* is the average number of layers to headquarters at the closest quartile competing competitors. *Hierarchy Bank* is the average relative hierarchical bank complexity of the closest quartile competitors. *Foreign bank* is the proportion of foreign banks among the closest quartile competitors. *Fax* measures the relative proportion of the quartile closest competitors that has a fax number. *Urban* equals one if the borrower is located in an urban area, and equals zero otherwise. The *other control variables* are listed in Table 1 and for some specifications their coefficients are listed in an Appendix. We employ ordinary least squares estimation. The number of observations equals 15,044. *, **, and *** indicate significance at the 10%, 5%, and 1% level, two-tailed.

Model	I	II	III	IV	V	VI	VII
(Independent) Variable		***Large Bank***	***Hierarchy Bank***	***Hierarchy Branch***	***Foreign Bank***	***Fax***	***Urban***
ln (1 + Distance to Lender)	-9.98 ***	-25.62 ***	-12.50 **	-10.65	-10.38 ***	-4.84	-7.88 **
	(2.99)	(9.55)	(5.30)	(11.92)	(3.16)	(9.19)	(3.19)
ln(1 + Distance to Lender) * ***Variable***		25.18 *	6.91	-2.16	9.11	-6.14	-16.37 *
		(14.68)	(11.98)	(7.53)	(23.55)	(5.86)	(8.87)
ln(1 + Distance to Closest Competitor)	20.37 ***	43.17 ***	23.52 ***	11.38	20.56 ***	17.87	19.33 ***
	(4.35)	(12.17)	(6.91)	(15.73)	(4.45)	(11.34)	(4.50)
ln(1 + Distance to Closest Competitor) * ***Variable***		-36.42 **	-8.68	3.73	1.89	0.40	7.68
		(18.14)	(14.84)	(9.73)	(27.90)	(7.23)	(17.93)
Relationship Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other Control Variables	Yes	Yes	Yes	No	Yes	No	Yes
Fixed Postal Zone Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.17	0.17	0.17	0.07	0.17	0.07	0.17
Spatial Pricing							
Soft Rival		-25.62 ***	-12.50 **	-10.65	-10.38 ***	-4.84	
Hard Rival		-0.44	-5.59	-21.45	-1.27	-10.98	

TABLE 5. COMPETING BANKS' ORGANIZATIONAL STRUCTURE AND THE SEVERITY OF SPATIAL PRICING FOR SMALL FIRMS

The table lists the coefficients from regressions with the *loan rate* until the next revision, in basis points, as the dependent variable. *Distance to lender* is the shortest traveling time to the lender, in minutes. *Distance to closest competitor* is the shortest traveling time to the closest quartile competitor, in minutes. *Small Firm* equals one if the borrower is a small firm, and equals zero otherwise. *Large Bank* is the relative asset size of the closest quartile competitors. *Hierarchy Branch* is the average number of layers to headquarters at the closest quartile competing competitors. *Hierarchy Bank* is the average relative hierarchical bank complexity of the closest quartile competitors. *Foreign bank* is the proportion of foreign banks among the closest quartile competitors. *Fax* measures the relative proportion of the quartile closest competitors that has a fax number. *Urban* equals one if the borrower is located in an urban area, and equals zero otherwise. The *other control variables* are listed in Table 1 and for some specifications their coefficients are listed in an Appendix. We employ ordinary least squares estimation. The number of observations equals 15,044. *, **, and *** indicate significance at the 10%, 5%, and 1% level, two-tailed.

Model	I	II	III	IV	V
(Independent) Variable		***Large Bank***	***Hierarchy Bank***	***Hierarchy Branch***	***Fax***
ln (1 + Distance to Lender)	-11.82 ***	-24.34 **	-12.98 **	4.03	-5.54
	(3.39)	(11.80)	(6.45)	(14.69)	(10.74)
ln(1 + Distance to Lender) * Small Firm	-9.96	-51.41 **	-24.27 *	-58.03 **	17.04
	(7.32)	(24.77)	(13.97)	(28.16)	(24.04)
ln(1 + Distance to Lender) * ***Variable***		20.22	3.52	-10.48	-4.59
		(18.33)	(15.12)	(9.37)	(7.01)
ln(1 + Distance to Lender) * ***Variable*** * Small Firm		65.61 *	37.48	30.18 *	-17.54
		(38.41)	(34.25)	(17.86)	(15.38)
ln(1 + Distance to Closest Competitor)	15.84 ***	33.29 *	24.83 ***	4.09	27.14 *
	(4.95)	(17.73)	(9.56)	(20.06)	(15.60)
ln(1 + Distance to Closest Competitor) * Small Firm	5.81	61.52 *	16.55	79.87 **	-35.50
	(11.36)	(31.88)	(17.99)	(36.45)	(27.83)
ln(1 + Distance to Closest Competitor) * ***Variable***		-28.02	-24.56	8.19	-6.71
		(27.42)	(23.03)	(12.60)	(10.26)
ln(1 + Distance to Closest Competitor) * ***Variable*** * Small Firm		-88.71 *	-29.90	-49.90 **	28.48
		(50.75)	(47.31)	(23.38)	(19.05)
Variable		-9.92	24.71	11.05	6.91
		(44.35)	(38.60)	(20.89)	(18.12)
Variable * Small Firm		15.31	29.56	10.13	3.32
		(29.62)	(45.82)	(12.20)	(13.61)
Relationship Characteristics	Yes	Yes	Yes	Yes	Yes
Fixed Postal Zone Effects	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.07	0.07	0.07	0.07	0.07
Spatial Pricing					
Large Firm	-11.82 ***				
Small Firm	-21.78 ***				
Large Firm, Soft Rival		-24.34 **	-12.98 **	4.03	-5.54
Large Firm, Hard Rival		-4.13	-9.45 *	-48.35 **	-10.13 **
Small Firm, Soft Rival		-75.75 ***	-37.25 ***	-54.01 *	11.50
Small Firm, Hard Rival		10.08	3.75	44.53	-10.63

APPENDIX.

The table lists the coefficients from regressions with the indicated dependent variable. All *variables* are defined in Table 1. Gray cells were already reported in the other tables. We employ ordinary least squares estimation. The number of observations equals 15,044. *, **, and *** indicate significance at the 10%, 5%, and 1% level, two-tailed.

Column		I	II	III
Table		2	3	4
Model		VI	V	I
Dependent Variable		Quartile Reach	Quartile Reach	Loan Rate
Large Bank		0.00	-0.03	
Large Bank	* Small Firm		0.04	
Hierarchy Bank		-0.09 ***	-0.16 ***	
Hierarchy Bank	* Small Firm		0.08 *	
Hierarchy Branch				
Hierarchy Branch	* Small Firm			
Foreign Bank		-0.02		
Fax		-0.27 ***	-0.35 ***	
Fax	* Small Firm		0.09 ***	
Urban		0.00	0.00	
Herfindahl-Hirschman Index		0.04	0.04	
Number of Firms		0.06 ***	0.06 ***	
ln (1 + Distance to Lender)				-9.98 ***
ln (1 + Distance to Lender)	* Small Firm			
ln(1 + Distance to Closest Competitor)				20.37 ***
ln(1 + Distance to Closest Competitor)	* Small Firm			
Main bank		0.00	0.00	-55.01 ***
Duration of Relationship		-0.02 ***	-0.01 ***	23.51 ***
Collateral		0.05 ***	0.05 ***	-38.26 ***
ln(1 + Repayment Duration of Loan)		0.03	0.03	-95.40 ***
Mortgage		-0.04	-0.03	-29.43
Term		-0.04	-0.05	-115.98 ***
Securitizable term		-0.07	-0.07	7.02
Bridge		-0.07	-0.06	-199.80 ***
Prepay taxes		-0.44	-0.42	-104.35
Consumer credit		-0.02	-0.02	-80.40 ***
Rollover		0.02	0.02	15.47 **
Small firm				11.81
Medium firm				-106.73 ***
Large firm				-279.93 ***
Limited Partnership				1.55
Limited Partnership w/ ES				10.50
Corporation				-64.42 ***
Temporary Arrangement				-40.40
Government Security				34.04 ***
Term Spread		-0.03 ***	-0.03 ***	57.57 ***
Constant		2.78 ***	2.87 ***	
Postal Zone Fixed Effects		No	No	Yes
8 Postal Area Dummies		Yes	Yes	No
4 Loan Revisability Dummies		Yes	Yes	Yes
49 Industry Dummies		Yes	Yes	No
2 Year Dummies		Yes	Yes	Yes

REFERENCES

Armstrong, M., 2005, Recent Developments in the Economics of Price Discrimination, (University of London, London).

Berger, A. N., N. M. Miller, M. A. Petersen, R. G. Rajan, and J. C. Stein, 2005, Does Function Follow Organizational Form? Evidence From the Lending Practices of Large and Small Banks, *Journal of Financial Economics* 76, 237-269.

Berger, A. N., and G. F. Udell, 1990, Collateral, Loan Quality and Bank Risk, *Journal of Monetary Economics* 25, 21-42.

Berger, A. N., and G. F. Udell, 1992, Some Evidence on the Empirical Significance of Credit Rationing, *Journal of Political Economy* 100, 1047-1077.

Berger, A. N., and G. F. Udell, 1995, Relationship Lending and Lines of Credit in Small Firm Finance, *Journal of Business* 68, 351-381.

Berlin, M., and L. J. Mester, 1998, On the Profitability and Cost of Relationship Lending, *Journal of Banking and Finance* 22, 873-897.

Besanko, D., and A. V. Thakor, 1987, Collateral and Rationing: Sorting Equilibria in Monopolistic and Competitive Credit Markets, *International Economic Review* 28, 671-689.

Bhaskar, V., and T. To, 2004, Is Perfect Price Discrimination Really Efficient? An Analysis of Free Entry, *RAND Journal of Economics* 35, 762-776.

Degryse, H., 1996, On the Interaction between Vertical and Horizontal Product Differentiation: An Application to Banking, *Journal of Industrial Economics* 44, 169-186.

Degryse, H., and S. Ongena, 2005, Distance, Lending Relationships, and Competition, *Journal of Finance* 60, 231-266.

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

Elsas, R., and J. P. Krahnen, 1998, Is Relationship Lending Special? Evidence from Credit-File Data in Germany, *Journal of Banking and Finance* 22, 1283-1316.

Fried, J., and P. Howitt, 1980, Credit Rationing and Implicit Contract Theory, *Journal of Money, Credit and Banking* 12, 471-487.

Hart, O. D., 1995. *Firms, Contracts, and Financial Structure* (Oxford University Press, Oxford).

Hauswald, R., and R. Marquez, 2006, Competition and Strategic Information Acquisition in Credit Markets, *Review of Financial Studies* Forthcoming.

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

Liberti, J. M., 2004, Initiative, Incentives and Soft Information: How Does Delegation Impact the Role of Bank Relationship Managers?, (Kellogg School of Management Northwestern, Chicago IL).

Liberti, J. M., 2005, How Does Organizational Form Matter?, (Kellogg School of Management Northwestern, Chicago IL).

Machauer, A., and M. Weber, 1998, Bank Behavior Based on Internal Credit Ratings of Borrowers, *Journal of Banking and Finance* 22, 1355-1383.

Mian, A., 2006, Distance Constraints: The Limits of Foreign Lending in Poor Economies, *Journal of Finance* 61, Forthcoming.

Neven, D., and J. F. Thisse, 1990, On Quality and Variety Competition, in J. J. Gabszewicz, J. F. Richard, and L. Wolsey, eds.: *Economic Decision Making: Games, Econometrics and Optimization. Contributions in Honour of J. Dreze* (North-Holland, Amsterdam).

Petersen, M. A., and R. G. Rajan, 2002, Does Distance Still Matter? The Information Revolution in Small Business Lending, *Journal of Finance* 57, 2533-2570.

Stein, J., 2002, Information Production and Capital Allocation: Decentralized versus Hierarchical Firms, *Journal of Finance* 57, 1891-1922.

Sussman, O., and J. Zeira, 1995, Banking and Development, (CEPR, London).

Thisse, J. F., and X. Vives, 1988, On the Strategic Choice of Spatial Price Policy, *American Economic Review* 78, 122-137.