COMPETITION BETWEEN ARM'S LENGTH AND RELATIONAL LENDERS: WHO WINS THE CONTEST?

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Abstract

Using geo-coded data with precise location of bank branches and commercial borrowers we are able to study the effect of local bank competition on lending. We find that the impact of competition varies a great deal depending on the incumbent's and the entrant's lending technologies. The opening of a branch by a relational lender reduces the size of loans issued by both relational and arm's length incumbents, while the opening of a branch by an arm's length lender only reduces the size of loans granted by arm's length incumbents. We believe relational lenders can use their soft information to retain their best borrowers. Knowing that, arm's length lenders prefer to look elsewhere rather than getting a bite of the relational lender's worse borrowers only.

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1 Introduction

Over the past decades we have observed a significant transformation of the banking sector with proliferation of automated teller machines, on-line banking activity and non-bank financial services. Despite arguments proposing that the developments in information technology provide a natural substitution for the services offered at local brick-and-mortar bank branches, trends in the banking sector and findings of recent research suggest that distance still plays an important role in the credit market. For instance, the number of bank branches in the US experienced a growing expansion up until the onset of the great recession rising from 53,000 in 1980 to 90,000 in 2008.[1] On the other hand, the extent of branch openings in developing economies has showed much steeper increase, producing almost 13 bank branches per 100,000 population as of 2015 from slightly above 9 in 2004. Moreover, several studies have repeatedly confirmed that a significant proportion of financial operations remains local and proximity have profound effects on local credit supply ranging from small business lending to housing credit (Brevoort and Hannan 2006, Gilje et al. 2016, Nguyen 2017). This persistent observation is often attributed to informational asymmetries in the credit market, where institutions still rely on soft information and form special relations with the customers.

The local characteristic of credit has been extensively used to study the connection between financial markets and household borrowing (Celerier and Matray 2017), mortgages and housing (Favara and Imbs 2015), entrepreneurship (Cetorelli and Strahan 2006), and overall economic development (Jayaratne and Strahan 1996, Guiso et al. 2004, Rajan and Ramcharan 2011). Most of these studies rely on differences in the value of relevant variables *between* firms[2] in different geographical areas. This approach relies on relatively strong assumptions about the similarity of the firms or locations being compared, and does not successfully disentangle the effect of changes in the provision of credit from the effect of changes in other unobserved variables that might be affecting firms' behavior. Moreover, implications of branch extension

[1] Recent report by Federal Deposit and Insurance Corporation documents that although there is an increase in branch closings after 2009, per capita density of banking offices remained high even in rural counties (Breitenstein and McGee 2015).

[2] Or other subjects such as households etc.

on local competition and access to finance are yet to be tested.

This study makes use of detailed transactional data from the Dominican Republic and assesses the effect of local bank competition on commercial borrowers by studying differences *within* firms in the same geographical area. We rely on the distances between bank branches to measure bank competition and use the entrance of new bank branches as the source of variation to these distances. While the location of the entrant is an endogenous choice, the relative distance between the entrant and the incumbent is exogenous from the perspective of existing bank branches. Therefore, we rely on the less stringent assumptions that existing branches do not relocate after a new branch entrance (which we clearly observe in the data), and that closer bank branches compete more intensively. This is an important contribution to existing literature that relies on strong assumption about the characteristics of the firms, locations, or banks being studied.

We build upon recent work about the effect of distance on the interaction between economic agents (see, e.g., Dam and Koetter (2012) for an analysis in banking or Rossi-Hansberg et al. (2010) for an analysis of the housing market), and measure the intensity of competition between two branches as a function of their distance. The total competition for a given branch is estimated as the summation of the intensity of competition with each branch in the economy. Identification is possible because new entrants affect the incumbents' total competition depending on their distance. We use an exponential decay function, where the decay parameter indicates how quickly competition fades with distance. The decay parameter is estimated as an additional parameter in our estimation. We expect the decay to be slower in rural areas because for a given distance there are much fewer competitors. Our estimations are consistent with this view. A 1 km distance in our setup reduces competition intensity in urban areas by 72 percent, while it only reduces competition intensity in rural areas by 3 percent.

We find that on average the opening of a new bank branch reduces lending by existing banks. This result is especially strong when we consider openings of branches with relational lending technology, i.e., that make lending decisions based on soft information collected by trained loan officers at the business site (Stein

2002), as opposed to arm's length lenders that make lending decisions based mostly on hard information obtained from the credit bureau. In the benchmark model, an additional relational branch opening in urban locations reduces the incumbent bank's lending in the close vicinity by up to 15.5 percent. This effect fades out as the entrant's location becomes further away from the incumbent branch: a relational lender entrance at a 1 km distance from the incumbent reduces the lending by 4.4 percent.[3] In rural locations, the decay is slower and therefore the effect is more persistent: a relational lender entry at the close vicinity reduces the incumbent's lending by 3.6 percent and this effect drops to 3.5 (3.1) percent for a relational lender entrant at 1 (5) km's. In the case of arm's length lender entries, the effect on lending is statistically insignificant and economically close to zero.

What is more interesting and constitutes, to the best of our knowledge, a novel finding in the finance literature is that the effect of competition depends on both the lending technology of the entrant *and* the lending technology of the incumbent. We find that informationally less captured borrowers at arm's length lenders receive up to 17.8 percent smaller loans in urban firm locations in case of branch openings by arm's length lenders. Borrowers at relational lenders don't suffer credit cuts after the opening of an arm's length bank branch.[4] In contrast, the entry of a relational lender reduces the loan amount for borrowers at both types of incumbents by up to 8.8 percent in rural locations. These results suggest that relational lenders are able to protect themselves from the competition by uninformed lenders but cannot protect their lending amount from banks that can obtain similar soft information from potential borrowers.

In addition, we analyze the impact of changes in local competition on the firm's default likelihood. We find that entries of relational lenders increase the likelihood to become overdue in the case of borrowers at arm's length incumbents, while borrowers at relational lenders can be mostly isolated. When we repeat the baseline exercise at the extensive margin of any credit relation between a bank and a firm, we find that the

[3]The effect becomes virtually 0 at a 5 km distance.

[4]These results could also be explained by the maintained credit supply of relational lender during recessions, see, e.g., evidence in Bolton et al. (2016) and Beck et al. (2018a).

effect of competition is economically small and statistically insignificant.

We also study the interaction between firm-branch distance and branch-branch distance. Our hypothesis is that if the effect of competition is (at least in part) caused by substitution, the magnitude of the increase in lending after an increase in competition should be larger for borrowers located closer to the entrant. However, incumbent branches could offer their existing borrowers additional credit until they reach full debt capacity to deter the entrant from extending credit to these clients. We analyze which of the two opposing effects dominate and whether this depends on the entrant's lending technology. Consistent with the substitution hypothesis, we find that the magnitude of the reduction in credit after the entrance of a relational lender is larger for urban borrowers located closer to the entrant. In contrast and thus supporting the opposing hypothesis, there is evidence of an increase in credit after the entrance of an arm's length lender close to a commercial borrower.

This paper contributes to the expanding literature on the role of distance in banking. Petersen and Rajan (2002) report that the development in information technology increases the distance between banks and borrowers and dwindles the role of physical banking. However, Brevoort and Hannan (2006) argue that the increase in firm to branch distance is only happening at the high end of the distribution; for small banks and with small businesses distance still plays an important role in lending. As shown in Degryse and Ongena (2005) and Agarwal and Hauswald (2010) access to bank credit, particularly for small businesses, declines and the loan rates increase as the distance between the bank and borrower grows.[5] In addition, Herpfer et al. (2017) takes advantage of the construction of new infrastructure and find that the resulting reduction in distance increases the likelihood of initiating a new borrowing relationship.[6] We complement these papers by introducing the distances between bank branches as an additional variable into this analysis. It turns out that this distance is crucial in explaining lending pattern.

[5] Moreover, Ergungor (2006) and Gilje et al. (2016) demonstrate that physical bank presence also matters for real estate finance.

[6] Beck et al. (2018b) show that the probability for a firm to connect to a bank substantially decreases in distance, but that in the case of an Islamic bank, distance plays a less important role.

Our paper also relates to a series of papers that study the effect of competition in local credit markets. For example, it complements the analysis in Guiso et al. (2004) about the effect of bank concentration on financial outcomes by introducing a dynamic measure of competition. Documenting the effect of competition strongly depends on the incumbents' and entrants' lending technologies also complements theoretical and empirical work about the link between competition and bank-borrowers' information asymmetry (Stein 2002, Petersen and Rajan 1995, Hauswald and Marquez 2006), Gropp and Guettler (2018), de Haas et al. (2018). This literature finds relational lenders seem to invest more into soft information generation in more competitive banking markets and more intense local bilateral competition increases credit constraints of small firms. We contribute to this literature by documenting that the effect of competition strongly depends on both the lending technology of the incumbent *and* the lending technology of the entrant. Studying the interaction between competition and lending technology also contributes to the understanding of existing literature about the impact of changes in competition due to deregulation (Jayaratne and Strahan 1996, Bertrand et al. 2007, Gropp et al. 2014), mergers (Garmaise and Moskowitz 2006), or bank closures (Nguyen 2017, Bonfim et al. 2017).

2 Institutional Setting

We study the effect of changes in local bank competition in the Dominican Republic between the years 2008 and 2012. The Dominican Republic represents a well-suited natural laboratory for the study of competition given the steady development of its economy and banking system. Between 2006 and 2012 the number of registered bank branches increased from 598 to 816, which constitutes a 36 percent increase. The GDP figure during the same period draws a similar line, which highlights that the growth in the number of bank branches is the natural consequence of steady economic growth.

We compile the openings of new bank branches one year before the estimation time interval, to avoid any sort of simultaneity that could occur with the outcome. We are able to map the geographic location

of existing bank branches of all 27 banks that are regulated by the central bank as well as the geographic location of each new branch opening.[7] This makes 192 new branch openings within the period of interest. This information is particularly suitable to investigate spatial competition between banks, as we observe exactly when and where banks decided to expand their operations. Our measure of competition consists of the number of competing bank branches around a given branch b. We use a weighting approach, which we explain in more detail in Section 4, to account for the fact that closer branches compete more intensively.

By exploiting the institutional details of the Dominican Republic's banking system, we are also able to determine whether banks (and their branches) are relational or arm's length lenders. Specifically, there are two types of banks in the country; "Bancos de Ahorro y Crédito" and "Bancos Múltiples". The former make lending decisions based on soft information collected by trained loan officers at the business site; we denote this type of lender as *Relational lender* throughout the paper. The latter make lending decisions based mostly on hard information obtained from the credit bureau; we denote this second type of lender as *Arm's length lender*. Anecdotal information obtained from the central bank and managers of "Bancos de Ahorro y Crédito" and "Bancos Múltiples" confirm the lending technology of these banks is as described. In our heterogeneous treatment effects analysis below, we measure the extent to which the lending technology of the incumbent and the lending technology of the entrant affect bank competition.

The Dominican Republic presents a large variation in the density of the bank branch network in different regions of the country. Table A1 provides available bank branches for each city as the end of 2006. Santo Domingo is the major exception in this sample, accounting for almost half the total size of the branching network across the country. The second most dense banking market is Santiago that still has a considerably high number of branches compared to other cities. In 2006, several cities are close to being a banking desert in terms of branching activity. We use this variation when we compare the overall effect in urban (Santo Domingo and Santiago) versus rural (the rest) regions. As we explain in more detail in Section 4, we use a

[7] Smaller and less formal financial institutions exist but represent only 20% of the banking activity.

more pronounced weighting scheme for urban than for rural firm locations.

3 Data

The sample consists of all the borrowers of ADOPEM, the largest lender to small and medium sized enterprises in the Dominican Republic in terms of number of borrowers. ADOPEM has 300,000 borrowers and US$84 million in total lending in year 2012. The data comes from ADOPEM's administrative information system, from the Dominican Republic's Credit Bureau, and from the Dominican Republic Office of Free Access to Public Information. ADOPEM provides comprehensive administrative information for all the borrowers including all loans sanctioned by the bank as well as the repayment performance of overdue borrowers. ADOPEM also provides the exact address information of borrowers. The domestic credit bureau provides detailed information on the financial activities of the borrowers in other financial institutions including their repayment performance. The Dominican Republic Office of Free Access to Public Information provides detailed information about the geographic location of existing branches as well as the date and location of new branch openings for all 27 regulated financial institutions operating in the country.

3.1 Sampling Restrictions

We cover the period from 2008 to 2012 and rely on new loan initiations between a firm and a bank at the yearly level. In order for our estimation procedure to work we restrict our attention to firms that have a borrowing relationship with a particular bank in at least two consecutive years and that those years also coincide with another borrowing relationship with at least one bank. This is the most important sampling restriction as there are lots of firms with just one bank relationship at this whole time period. We then match this sub-sample with the ADOPEM address files that has unique city and address information for each firm.

The second part of the sampling comes from the firm-branch matching. Since our data only identifies firm-bank relationships, we infer the corresponding branch based on proximity. We first identify loan re-

lationships with only one available branch of the corresponding bank at that particular year in branch b's city. We are able to match about 35 percent of the observations this way.[8] For the rest of the firms we use geocoding algorithms to obtain the exact firm location in order to calculate the distances to all branches of the corresponding bank. We drop those firms for which we do not have reliable address information or firms for which we only obtain city level locations. Finally, we drop those banks who have less than 1,000 observations over the full sampling period. Because we use an extensive set of fixed effects, this restriction ensures that our identification does not come from few observations within a subset of infrequent banks.[9] This leaves us with 5,614 firms borrowing from the 6 biggest banks with 326 branches adding up to 25,043 observations at the firm-bank-year level.

3.2 Descriptive Statistics

Table 1 presents the descriptive statistics for the intensive margin analysis, which uses the natural logarithm of the initially granted loan amount of borrower i at branch b in year t in Dominican Pesos. Throughout the paper, we always split the overall sample by firm location to capture the spatial differences in bank competition. Panel A provides data for rural firm locations. For all types of lender, the average log loan amount is 10.45, which corresponds to 34,610 Dominican Pesos or 1,005 US-Dollars using the average exchange rate during the observation period. The total number of firm observations located in rural areas account to 11,646. 85.2 percent of these observations correspond to relationship lending, because our sample comes from the database of a relational lender (ADOPEM). Since large companies usually borrow only from arm's length lenders, our sample includes mostly small and medium sized firms. This notion is also evident from the loan amount statistics of arm's length lenders: the mean amount and overall distribution suggest that they provide larger loans.

Panel B provides descriptive statistics for 13,397 firm observations in urban locations. The latter com-

[8] Most of the banks used in our analysis have more than one branch in Santo Domingo and Santiago. Therefore this type of matching is predominantly used in rural regions.

[9] We obtain qualitatively similar results if we do not drop these observations from the sample.

prises observations form the two largest cities: Santo Domingo and Santiago. The sample split is undertaken at the city level to obtain as close to 50 percent of the observations in each sample as possible. Average loan volumes tend to be smaller compared to rural locations and the fraction of relational lending compared to arm's length lending (80.2 percent) is smaller than in rural firm locations given that arm's length lenders tend to concentrate on urban locations.

4 Identification Strategy

The challenge of identifying the impact of local bank competition on credit is that changes in competition are not exogenous. For example, increases in competition due to new bank branches' openings usually happen in areas of high economic or demographic growth.

In this work we address this challenge by using a measure of competition that captures variation beyond changes in economic conditions. Our measure relies on the distance between the incumbent (existing) branches and the entrant branches. While the location of the entrant branches depends on competition, the relative distances with existing branches, which we use to estimate the intensity of competition, might not. An example illustrated in Figure 1 helps to clarify this idea: Assume there are three existing branches of different banks in an homogeneous commercial area. The branches are located in a straight line 1 kilometer from each other and organized as A-B-C. A new branch D of a different bank opens equidistant from A and B, but 1.5 kilometers from C. The distance between D and A or D and B is much smaller (0.5 km) than the distance between D and C (1.5 km). If we assume that the intensity of competition depends on distance we would expect that D competes more intensively with A and B than with C, although economic conditions are similar for all branches.

In addition to using this competition measure, we include a rich set of fixed effects that control for a firm's aggregate demand for credit in each period, for example those related with investment opportunities, bank's supply of credit in each period, such as shocks to its balance sheet, and firm-bank level heterogeneity,

for example length of the relationship between the firm's management and the bank's loan officer.[10] This leads to the following specification:

$$Y_{ibt} = \alpha_{it} + \alpha_{Bt} + \alpha_{iB} + \beta_1 Comp_{bt-1} + \varepsilon_{ibt} \tag{1}$$

The outcome variables Y_{ibt} are the natural logarithm of the initial loan amount of borrower i at branch b in year t, ln(*Loan volume*), and a default dummy, $Default$, that equals one if borrower i was overdue with its loan at branch b in year t for more than 90 days, (α_{it}) are firm-time fixed effects, (α_{Bt}) are bank-time fixed effects, (α_{iB}) are firm-bank fixed effects, and $Comp_{bt-1}$ is our measure of competition.

We assume that the competition decreases in distance exponentially, which is a common assumption in economics.[11] More specifically we measure the competition between two branches of the incumbent bank b and the competitor bank b_n using the function $e^{\theta * distance_{b,b_n}}$, where θ is the decay parameter that indicates how quickly the degree of competition increases when the distance between branches decreases.[12] The decay parameter θ has a value of -0.03 for rural areas and -1.27 for urban areas. The methodology to estimate these values, and some intuition on their magnitudes, are presented below.

We compute the total competition for bank branch b with a set of competitors $b_1, b_2, b_3, ..., b_N$ as the summation of the competition with each branch:

$$Comp_{bt-1} = \sum_{n=1}^{N_{t-1}} \exp^{\theta * distance_{b,b_n}} \tag{2}$$

The time-series variation in our measure of competition described in equation (2) is driven by openings of new branches during our observation period. In the regressions, the competition intensity is measured at

[10] See for instance, empirical evidence in Hertzberg et al. (2010) about loan officer rotation.

[11] Exponential weighting via distance has been extensively used in the literature to address trade costs, innovation spillovers, housing externalities, and commuting costs etc.

[12] This parameter is, for example, small in absolute value (low decay) in models of trade, and large in absolute value (high decay) in models of housing. Rossi-Hansberg et al. (2010) pick a decay parameter of -2.3 when they model the effect of housing price changes in the nearby neighborhood, while Dam and Koetter (2012) use a decay parameter of -0.04 to incorporate spillover effects of German cities.

$t-1$ while the outcome variables are computed at time t respectively, i.e., we capture changes in outcome variables one year after changes in competition. Table 2 provides descriptive statistics for $Comp_{bt-1}$ using a decay parameter of -0.03 for rural and -1.27 for urban firm locations. Panel A shows the large variation of this measure for all branches in rural areas: the competition measure varies between 4.2 and 223.6. Due to the low decay, the competition measure is larger in levels for rural compared to urban firm locations (see panel B).

Decay Parameter Estimation

An important consideration in our setup is that two branches located K kilometers apart compete more intensively in low density areas. For example, in a highly populated city an incumbent bank branch experiences relatively small competition from a branch located 5 kilometers away, since there are usually many other competing branches located closer than that. However, a branch in the countryside might experience strong competition from a bank branch located 5 kilometers away, if that branch is the closest competitor. For this reason we assume the decay parameters for urban and rural areas to be different.

It is evident from equation 2 that the decay parameter, θ, enters non-linearly into our baseline specification. Consequently, this requires a joint estimation of θ together with the rest of the parameters via non-linear least squares (NLS) using equation 1.[13] Consistent with our intuition, this estimation produces a much faster decay parameter for urban areas (-1.27) than for rural areas (-0.03). This means that a distance of 1 kilometer reduces the intensity of competition in urban areas by 72 percent, while it reduces the intensity of competition in rural areas by only 3 percent, that is 24 times smaller. This difference is reasonable considering that rural areas are on average at least one order of magnitude less densely populated compared with urban areas.

The decay parameter, in principle, is different for each regression. For example, it is possible that the

[13] See Davidson and MacKinnon (2004) for details.

degree of competition in the intensive margin decays faster with distance than the competition in the extensive margin. However, using different decay values for different variables makes the comparison between different results less intuitive. For this reason we only estimate the decay parameters for the baseline specifications of the intensive margin analysis via NLS for rural and urban areas and keep the parameters constant throughout the paper. Specifically, we plug in the NLS-decay parameter in equation 2 and use the resulting competition measure, $Comp_{bt-1}$, for fixed effects estimations of equation 1.

5 Empirical Results

5.1 Intensive Margin

We first investigate the effect of competition on incumbent branches with respect to the intensive margin using equation 1 with data on the firm-bank-year level. The outcome variable, $ln(Loan\ volume)$, is the natural logarithm of the newly granted loan amount at branch b in year t. Table 3 provides the results. The first three columns show results for rural firm locations while the last three columns provide results for urban firm locations. Column 1 provides evidence of a negative impact of branch openings for the incumbent's loan amount. Interpretation of coefficients need to take the exponentially weighted distance between incumbent and entrant into account: while an entrant at the exact same location as the incumbent (weight of 100 percent) reduces the newly granted loan amount by 3.64 percent on average, the reduction declines to 3.53 percent (.0364*.9704) for a distance of 1 kilometer or to 3.13 percent (.0364*.8607) for a distance of 5 kilometer. Column 4 shows the coefficient estimate for branch openings in urban firm locations. The coefficient suggests a reduction of 6.98 percent for an entrant at the same location as the incumbent. However, given the stronger spatial decay in this market, the effect fades away faster. The reduction declines to more modest 1.96 percent (.0689*.2808) for a distance of 1 kilometer or to negligible 0.01 percent (.0689*.0017) for a distance of 5 kilometer.

We further break down results according to the lending technology of the newly opened branch using only openings by relational (columns 2 and 5) or arm's length lenders (columns 3 and 6) to construct the competition measures of equation 2. The results in column 2 suggest that this effect is mainly driven by branch openings of relation lenders. The coefficient is minus 8.25 percent and statistically significant at the 1 percent level. The effect declines to 8.01 percent for a distance of 1 kilometer or to 7.10 percent for a distance of 5 kilometer. On the other hand, the coefficient for openings by arm's length lenders (column 3) is minus 1.37 percent and statistically insignificant. Column 5 shows the coefficient estimate for openings of relational lender in urban firm locations. The coefficient is in line with a reduction of 15.49 percent for an entrant at the same location as the incumbent. The reduction declines to 4.35 percent for a distance of 1 kilometer or to negligible 0.03 percent for a distance of 5 kilometer. As in the case of rural firm locations, openings by arm's length lenders have no effect in urban areas (column 6).

Overall, we find a reduction in the newly granted loan amount at the incumbent for close entrants of relational lender. These first results are not surprising given that a firm will shift some of its loan demand from the incumbent to the entrant.

We next investigate the impact of the incumbent's lending technology in combination with the entrant's lending technology by interacting the competition measure with a dummy variable, *Relational lender*, that equals one if the incumbent is a relational lender. Table 4 shows the results. Results in column 2 suggest that a relational entrant is reducing the newly granted loan amount for both types of incumbents in rural areas. In contrast, branch openings of arm's length lenders in rural areas do not significantly reduce the newly granted loan amount for both types of incumbents (column 3). In urban firm locations, openings by arm's length lenders seem to diminish the newly granted loan amount for arm's length incumbents, while relational incumbents can isolate their borrowers (column 6). The latter result is likely to be driven by the informational advantage of relational lenders in contrast to their arm's length competitors. We observe a similar though less pronounced effect in rural areas (column 3). This effect is likely to be smaller in rural

than in urban firm locations because arm's length lenders are more active in the latter.

5.2 Loan Performance

We furthermore analyze the impact of the reported changes in lending volume on loan performance using again equation 1 with the same data. We are still able to use the triplet data on the firm-bank-time level because firms can be overdue on loans from one bank but not on loans from other banks. This behavior can be explained by strategic motives to maintain at least one performing bank relationship during weak financial periods. For this analysis, we replace the outcome variable and use a dummy variable for loan performance, $Default$, which equals one if a firm was overdue for more than 90 days on a loan at branch b in year t. The average default frequency is 3.86 percent per year for rural and 3.37 percent per year for urban firm locations. Table 5 is providing the regression results. Overall, across all six regressions we do not find any significant effects on loan performance. Regardless of the type of lending technology of the entrant, increased competition and the subsequent reduction in lending from the incumbent that we document above do not seem to impact loan performance.

In order to enable a more detailed analysis with respect to the lending technology of the incumbent, we again interact the competition measure with the dummy variable for relational lenders. Results in column 2 of Table 6 suggest that the reduction in lending in case of openings of relational lenders in rural areas (irrespective of the incumbent type), does not yield any changes in loan performance of the affected firms. In contrast, entries of relational lenders increase the likelihood to become overdue in the case of borrowers at arm's length incumbents, while borrowers at relational lenders can be mostly isolated in urban areas (column 5). Results in column 6 also indicate reduced risk levels for borrowers at relational lenders in case of entries by arm's length lenders.

5.3 Extensive Margin

We complement the intensive margin and loan performance analyses with a test of the extensive margin. Here, we relax the sample restrictions to an extent that we include every firm that has loan relationships with at least two banks over the course of the sampling period. We condition that a firm could potentially borrow from a set of banks and match any actual and potential firm-branch pair. For every firm we initiate the estimation a year before the first borrowing relationship.[14] As in the case of the intensive margin analysis, we use the six major banks as potential lenders and match firm-branch pairs based on 2008 branch information. Specifically, we match the closest available branch of each bank to the firm of interest. This way, we are able to assess the effect of local competition on the formation of new loan relationships within the set of potential lenders.

This relaxed sampling restriction allows us to use information from 50,301 firms that have 188,490 loans over the course of 5 years. Table 7 summarizes the extended sample based on the number of potential and actual loan relationships via location and lender type, and share of credit in the sample. Panel A provides the descriptive statistics for rural firm locations. Across both lender types, we observe 446,801 potential and actual lending relationships while the share of actual loans is 19.2 percent. Since our main data provider is a relational lender, the majority of the actual lending relationship happens through relational lenders. Panel B provides the same information for urban firm locations. We find 729,245 potential and actual lending relationships with a share of actual loans of 14.1 percent. The ratio of actual loans is lower in urban than in rural firm locations because there are more banks operating in the former and we are thus able to match more firms to bank branches and because relational lenders including the data provider ADOPEM are more active in rural areas.

Next, we perform the same set of baseline regressions using equation 1 with firm-time, bank-time, and bank-firm fixed effects. As outcome variable we use a dummy that equals one in case of an actual loan and

[14] Results are qualitatively similar if we use a more comprehensive sample of firms with at least one lending relationship.

zero if there was no loan granted by branch b to firm i in year t. Therefore, the results shown in Table 8 represent the effect of competition on the likelihood of receiving a new loan. Overall, we do not find any substantial evidence for the extensive margin. In line with intuition, coefficients are negative in all six cases but only statistically significant at the 10 percent level for all branch openings in urban areas (column 4). We thus conclude from this exercise that the effect of an increase in local bank competition seems to affect the intensive margin and loan performance, while its effect on the likelihood of receiving a loan is rather limited. That being said, we have to stress that the findings in this subsection are only suggestive due to data limitations. Ideally, analysis at the extensive margin should be done conditional on loan applications (e.g., as in Jimenez et al. (2014)).

5.4 Substitution Analysis

In addition to the exponentially weighted branch-branch distance, *Comp*, our empirical setup can also incorporate firm-branch distance using a subsample of firms with precise location information. Conceptually, the firm-branch distance captures transportation costs as well as costs for soft information generation and monitoring (Degryse and Ongena, 2005). For the former, the closer the distance, the smaller the transportation costs for the firm, i.e., if a firm visits the branch to apply for a new loan. For the latter, banks face higher monitoring costs once the commercial borrower is more distant. It also becomes more costly to gather soft information in the case of relational lending.

To illustrate this setting, we modify the simple example introduced in the previous section. We now have 2 firms located in the opposite direction from bank branches and 1 kilometer away from each other on a straight line. The distance between firm 1 (firm 2) and the closest incumbent bank branch, A, is 1 (2) kilometers (see Figure 1 for illustration). If firms 1 and 2 are having lending relationships with branches A and C, then firm 1 should be more likely than firm 2 to substitute some proportion of its credit with loans from the new entrant (branch D) because of lower transportation costs. Branch D should also be more

willing to start a lending relationship with firm 1 than with firm 2 because monitoring (and soft information generation in case of a relational lender) is easier because of shorter distance. As a reaction to this potential threat, the existing branches A and C could offer firms 1 and 2 additional credit until commercial borrowers reach full debt capacity to deter the entrant from extending credit to these clients. At the end it is an empirical question which of the two effects dominate and whether it depends on the banks' lending technology and the region a firm is located in.

To test for substitution and potential reactions by the incumbent, we construct a measure at the firm-branch level using distance information between the firm and the competitor branches with respect to the incumbent branch based on the same construction principle used for the branch-branch competition measure. Specifically, we compute a substitution measure between a firm and the incumbent bank branch b with a set of competitors $b_1, b_2, b_3, ..., b_N$ as the summation of the weighted distance between firm i with each competitor branch b_n in year $t-1$:

$$Subst_{ibt-1} = \sum_{n=1}^{N_{t-1}} \exp^{\theta * distance_{i,b_n}} \tag{3}$$

Note that we have variation in $Subst_{ibt-1}$ at the branch level, because the measure depends on the incumbent branch b (we only consider all competitor branches excluding all branches from branch b's bank). This measure allows for the possibility to have two firms with loan relationship with the same incumbent bank branch to be affected differently based on the locations of the competitor branch and these firms. In the example with branches A to D and firms 1 and 2 (see Figure 1), we have a stronger increase in $Subst_{ibt-1}$ for firm 1 compared to firm 2 because the entering branch D is located 1.5 (2.5) kilometer from firm 1 (2).

We construct the substitution measure using the same decay parameters for urban and rural locations used in the previous subsections to facilitate the comparison and interpretation of results. Table A2 provides summary statistics for our measure, $Subst_{ibt-1}$. Note that the sample size is reduced for the rural firm locations because for our measure we need to rely on those firms with precise location information. For the

rural firm locations, this reduces sample size from 11,646 to 7,749.[15] For urban firm locations, the sample size remains unchanged. The substitution measures are relatively similar to the competition measures. The slightly larger values for the substitution measures for rural firm locations seem to be driven by the different sample. The substitution measures are smaller than the competition measures for the urban firm locations. This finding indicates that branches are located closer to other branches than to firms.

Adding the substitution measure to the baseline model with the branch-branch competition measure yields the following equation:

$$Y_{ibt} = \alpha_{it} + \alpha_{Bt} + \alpha_{iB} + \beta_1 Comp_{bt-1} + \beta_2 Subst_{ibt-1} + \varepsilon_{ibt} \tag{4}$$

As discussed above, the expected direction of β_2 is not clear. A negative (positive) sign would indicate that the substitution effect is stronger (weaker) than the defense from the incumbent. Table 9 shows regression results for equation (4). We find evidence that there is substitution from the incumbent to competitors in case of relational branch openings in urban firm locations. The coefficient of -40.9 percent can be interpreted as follows: a relational branch opening one (two, five) kilometers apart from the firm thus yields a reduction in lending from the incumbent of 11.5 (3.2, 0.1) percent. Hence, relational competitors seem to be able to steal away clients from incumbents in urban areas if they are opened close enough to the firm. The competition measures remain relatively unchanged in the urban firm locations while they fade away for the rural firm locations, in which more observations are dropped because of the geocoding restrictions.

In contrast, branch openings of arm's length lenders seem to trigger defensive actions by incumbents. In columns 3 and 6 of Table 9 we find positive coefficients for the substitution measures. In rural firm locations, the positive coefficient of 13.7 percent indicates an increased loan volume of 13 (12.9, 11.8) percent for openings that are one (two, five) kilometer apart from the firm. For urban areas, the positive

[15] This decrease is driven by our matching approach to include firms in our sample if there is only one branch per bank active in the firm's city even though we are not able to exactly geocode the firm location. See Section 3 for details.

coefficient of 84.1 percent translates into an increased loan volume of 23.6 (6.6, 0.1) percent for openings that are one (two, five) kilometer apart from the firm. We thus find evidence of substantial additional credit to deter arm's length lenders from issuing credit to their borrowers.

Table A3 presents results for a simplified specification that only includes the substitution measure in equation (4). Omitting the competition measures is addressing the potential multicollinearity issue between $Comp_{bt-1}$ and $Subst_{ibt-1}$; note that the correlation is around 91 percent for rural and 55 percent for urban firm locations. The table shows that results are relatively stable for the urban firm locations, where correlations are lower. We see some slight changes for the rural firm locations, where the substitution coefficient for relational lender openings becomes significant in column 2, while in column 3 the substitution coefficient for arm's length lender openings becomes insignificant.

Finally, we complement the results of intensive margin substitution with an analysis at the extensive margin introduced in the previous subsection. It is possible that a new branch close to a firm is more likely to steal the firm than it is for a distant firm. On the other hand, existing branches may respond to this increase in competition by offering new loans to close firms. Our extensive margin setup with actual and potential loan relationships may distinguish these opposing forces. Here we use matched firm-branch pairs introduced in the extensive margin section and compute substitution measures accordingly.[16] We then, perform the same of set of regressions as laid out in Table 9 with substitution and competition measures. The outcome variable becomes a dummy variable which is equal to 1 in case of an actual loan and zero if there is no loan relationship between branch b and firm i in year t.

Table 10 presents results of substitution analysis at the extensive margin. As in the case of the intensive margin analysis, we find significant substitution in urban firm locations. An opening of a new branch one kilometer away from a firm decreases the likelihood of a new loan from the incumbent branch by 2.5 percent (column 4). This effect fades out fast and becomes virtually 0 for a distance of 5 kilometers. In the case

[16]For each firm-branch pair we compute the summation of the weighted distance between the firm with precise location information and the competitor branches as explained above.

of a relational lender opening at one (two) kilometer away from a firm, the likelihood of a new loan by the incumbent branch decreases by 3.2 (0.9) percent (column 5). Although we have a positive coefficient for the arm's length lender openings which suggests some defense by competitors, the coefficient is so small that even at a 1 kilometer distance the effect is less than 1 percent (column 6). We have qualitatively similar results for the rural locations with smaller coefficients and reduced significance levels (columns 1-3). However, due to slower decay in rural firm locations the effect is more persistent. In column 2, an opening of a new relational lender branch one (two, five) kilometers away from a firm decreases the likelihood of a new loan from the incumbent branch by 3.5 (3.4, 3.1) percent.

5.5 Robustness Tests

We investigate the robustness of our baseline intensive margin results in various ways. First, we introduce a non-parametric measure of competition intensity based on the number of bank branches located in a circular region around the incumbent branch. While our baseline measure of competition intensity is well established in the literature, one may question the parametric assumptions behind the exponential function. To address this concern, we compute the number of competitor branches around the incumbent branch using three circular regions. The radii of each circular regions are computed such that in each region we have 10, 20, and 50 thousand inhabitants respectively.[17]

Results in Table A4 suggest that in rural areas having an additional relational bank branch in the close vicinity (first circular region) reduces the loan volume by 19 percent (column 2). This negative effect is also present in the second circular region and becomes positive and insignificant in the last circular region. In urban areas, we again find that more relational lender competitors in the close vicinity reduces the incumbent lending (column 5). This effect is not present for the branch openings that are further away (i.e., 2nd and the 3rd circular regions). We conclude that a non-parametric measure of spatial bank competition also supports

[17]Note that, by imposing population density based circles we address the possibility that competition due to new entrants might behave differently in urban vs rural regions.

our finding.

Second, we conduct a placebo test for the baseline intensive margin analysis. We randomize the opening year of branch *b* by using a placebo branch opening drawn from actual branch openings that took place between the years 2000 and 2012 and calculate the placebo bank competition measures of interest. Table A5 provides the regression results based on 500 repetitions. We find consistently lower coefficients in case of the four statistically significant coefficients of the original Table 3 and none of the placebo estimates is statistically significant.

Third, we check whether our results are driven by a change of credit lines. For this test we add the available credit lines that we approximate with credit card limits. Table A6 replicates the baseline intensive margin results using the sum of the newly granted loan amount and the existing credit line as outcome variable (using again the natural logarithm of the resulting sum). We find qualitatively similar results as in Table 3. Untabulated results further show that the interaction effects for the lending technology of the incumbent also remain qualitatively unchanged.

Fourth, we use a stronger decay parameter for rural firm locations in order to match the descriptive statistics of the competition measure of urban firm locations in Table 2. We increase the decay parameter from -0.03 to -0.64 an re-run equation 1 for the sample from rural firm locations. We still find that branch openings of relational lenders decrease the newly granted loan amounts (Table A7). The more pronounced coefficient of minus 22.08 percent needs to be taken in context of the stronger decay: the reduction declines to 11.64 percent (.2208*.5273) for a distance of 1 kilometer between the entrant and the incumbent or to 0.9 percent (.2208*.0408) for a distance of 5 kilometer. Besides that, we find higher standard errors for all three estimates which underlines the importance of using a well-chosen decay parameter. We undertake the same exercise for urban firm locations by decreasing and increasing the decay parameter by 50 percent (to -0.64 and -1.91). Table A8 provides evidence that results remain qualitatively similar for these parameter choices.

5.6 Aggregate Analysis on the Firm-level

sFinally, we analyze the impact of an increase of local bank competition from the firm's perspective. For this analysis we have to aggregate the firm-bank-time panel to the firm-time level. Doing so prevents us from running the saturated regression specifications that we use throughout the paper. Specifically, we include firm and city-year fixed effects in the aggregate analysis. The latter aims to control for changes in loan demand from the firm's perspective but we admit that there is likely to remain unobserved heterogeneity within cities. We repeat intensive margin, loan performance and extensive margin analysis at the firm level. The outcome variables for these analyses are the natural logarithm of the sum of newly granted loans from all six major banks to firm i in year t, a dummy variable for if a firm was overdue for more than 90 days on any of its loans in year t, and a dummy variable for any new credit extended for that firm respectively. The competition measures are also aggregated on the firm level by using the maximum competition measure for firm i in year t. We chose the maximum across existing lenders in order to concentrate on the most competitive bank relationship which is likely to offer the most favorite loan conditions.

Table 11 provides results for the sample of firms in the intensive margin analysis. In line with intuition, we find positive coefficients across all regressions. This result is particularly driven by openings of relational lenders. In rural areas, the coefficient is 10.93 percent (column 2), while it is 16.44 percent in urban firm locations (column 5); both are statistically significant at the 1 percent level. Overall, this result suggests that an increase in local bank competition is increasing the amount of newly granted loans if this is driven by openings of relational lenders. If we extend this analysis to any new credit extension over the same period we find even more robust findings in line with our intuition. The results in Table A9 suggest that increased competition, for almost every specification, increases the likelihood of a firm to obtain new loan. On the other hand, this new credit extension is not without costs: in Table A10 we find that increased competition due to new branch openings tend to deteriorate loan performance.

6 Conclusion

We use detailed transactional data and assess the effect of local bank competition on commercial borrowers and incumbent banks by studying differences within firms in the same geographical area. Our identification does not rely on any assumption about the characteristics of the firms, locations or banks being studied. We characterize the effect of competition by the exponentially weighted distance of all competing branches around the incumbent branch, putting more weight on closer competing branches than on more distant ones. Furthermore, our weighting scheme is less pronounced in rural firm locations, where there are fewer bank branches available and a firm may travel farther to apply for a new loan.

We find that an entry due to a relational lender significantly reduces the incumbent's lending. The effect amounts to minus 15.5 percent in urban locations for an entry in close vicinity and it fades away at 5 km distance. In rural locations, we find that an entry of a relational lender in close vicinity reduces the incumbent's lending by 3.6 percent and this effect is quite persistent even at a 5 km distance. We do not find any significant and economically sizable effects for arm's length lender entries.

Moreover, our results suggest that relational lenders are able to keep their customers in case of an increased competition due to entrants by arm's length lenders. This result is stronger in urban locations which contributes to the claim that relational lenders use their soft information as an advantage in highly competitive banking markets. Our evidence supports the notion that the relational lenders' specific lending technology helps them to cope with competitive pressure from arm's length lenders. Overall, it seems as if relational lenders can win the contest against arm's length lenders.

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Figure 1: Illustrative Example

The figure provides an illustrative example. There are three existing branches of different banks in an homogeneous commercial area. The branches are located in a straight line 1 kilometer from each other and organized as A-B-C. A new branch D of a different bank opens 0.5 kilometers from A and B, but 1.5 kilometers from C. In addition, firm 1 (2) is located 1 (2) kilometer apart from branch A on the same straight line but in the opposite direction to the other branches. In the figure, the distances are centered at branch A.

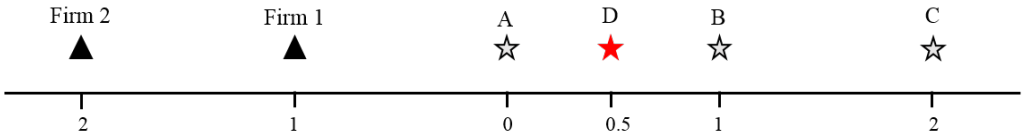

Table 1: Initial loan amount: Descriptive statistics

The table shows the descriptive statistics for the initial loan amount, which serves as the main dependent variable. It is used as the natural logarithm of the initial loan amount of borrower *i* at branch *b* in year *t* in Dominican Pesos. Panel A provides data for rural firm locations and Panel B for urban firm locations. This split is undertaken at the city level to obtain as close to 50 percent of the observations in each sample as possible. *Relational lenders* are those that use soft information to make their lending decisions, while *Arm's length lenders* concentrate on hard and verifiable information.

	Mean	N	S.D.	Min.	p10	Median	p90	Max.
Panel A: Rural firm locations								
All lenders	10.45	11,646	0.83	7.78	9.90	10.35	10.92	15.90
Relational lenders	10.38	9,917	0.77	7.78	9.90	10.31	10.82	15.90
Arm's length lenders	10.84	1,729	1.03	7.91	10.13	10.82	11.51	15.37
Panel B: Urban firm locations								
All lenders	10.22	13,397	0.89	6.68	9.62	10.24	10.82	15.13
Relational lenders	10.13	10,746	0.86	7.82	9.62	10.13	10.71	14.35
Arm's length lenders	10.55	2,651	0.94	6.68	9.90	10.46	11.16	15.13

Table 2: Bank competition measure: Descriptive statistics

The table shows the descriptive statistics for the bank competition measure, which is applying an exponential weight of the distance in kilometers between branch b in year $t-1$ and all competitor branches. The decay parameter depends on the firm location: for rural locations, the parameter is -0.03 while for urban locations it is -1.27. Panel A provides data for rural and Panel B for urban firm locations.

	Mean	N	S.D.	Min.	p10	Median	p90	Max.
Panel A: Rural firm locations								
All branches	57.50	11,646	48.70	4.17	24.32	38.98	72.48	223.63
Branches by relational lenders	7.54	11,646	5.74	0.74	3.55	6.00	9.74	38.63
Branches by arm's length lenders	49.96	11,646	43.44	1.79	20.64	33.21	62.81	196.08
Panel B: Urban firm locations								
All branches	4.79	13,397	3.25	0.00	2.16	4.97	6.46	14.27
Branches by relational lenders	0.60	13,397	0.59	0.00	0.07	0.46	0.98	2.95
Branches by arm's length lenders	4.20	13,397	2.94	0.00	1.80	4.25	5.31	13.28

Table 3: Intensive margin analysis: Baseline results

The table shows baseline results for the intensive margin analysis. The outcome variable, $ln(Loan\ volume)$, is the natural logarithm of the newly granted loan amount at branch b in year t. The bank competition measure, *Comp - All branches*, is applying an exponential weight of the distance in kilometers between branch b in year $t-1$ and all competitor branches. The decay parameter depends on the firm location: for rural locations, the parameter is -0.03 while for urban locations it is -1.27. The competition measures are also calculated separately for all branches by relational, denoted by *Comp - Branches by relational lenders*, and arm's length lenders, *Comp - Branches by arm's length lenders*. The standard errors in parentheses are clustered at the branch level. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Firm location:	Rural	Rural	Rural	Urban	Urban	Urban
Comp - All branches	-0.0364**			-0.0698**		
	(0.0168)			(0.0351)		
Comp - Branches by relational lenders		-0.0825***			-0.1549***	
		(0.0234)			(0.0558)	
Comp - Branches by arm's length lenders			0.0137			-0.0105
			(0.0407)			(0.0406)
Firm-Time FE	Y	Y	Y	Y	Y	Y
Bank-Time FE	Y	Y	Y	Y	Y	Y
Bank-Firm FE	Y	Y	Y	Y	Y	Y
N	11,646	11,646	11,646	13,397	13,397	13,397

Table 4: Intensive margin analysis: Interaction effects by the incumbent's lending technology

The table shows intensive margin results with interaction effects by the incumbent's lending technology. The outcome variable, $ln(Loan\ volume)$, is the natural logarithm of the newly granted loan amount at branch b in year t. The bank competition measure, *Comp - All branches*, is applying an exponential weight of the distance in kilometers between branch b in year $t-1$ and all competitor branches. The decay parameter depends on the firm location: for rural locations, the parameter is -0.03 while for urban locations it is -1.27. The competition measures are also calculated separately for all branches by relational, denoted by *Comp - Branches by relational lenders*, and arm's length lenders, *Comp - Branches by arm's length lenders*. We further interact these competition measures with a dummy variable, *Relational lender*, that equals one if the incumbent is a relational lender. The standard errors in parentheses are clustered at the branch level. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Firm location:	Rural	Rural	Rural	Urban	Urban	Urban
Comp - All branches	-0.0498***			-0.1734***		
	(0.0170)			(0.0665)		
Comp - All branches	0.0154*			0.1474**		
* Relational lender	(0.0087)			(0.0739)		
Comp - Branches by relational lenders		-0.0881***			-0.1121	
		(0.0253)			(0.1261)	
Comp - Branches by relational lenders		0.0131			-0.0521	
* Relational lender		(0.0199)			(0.1194)	
Comp - Branches by arm's length lenders			-0.0425			-0.1775***
			(0.0337)			(0.0668)
Comp - Branches by arm's length lenders			0.0269**			0.2545***
* Relational lender			(0.0128)			(0.0896)
Firm-Time FE	Y	Y	Y	Y	Y	Y
Bank-Time FE	Y	Y	Y	Y	Y	Y
Bank-Firm FE	Y	Y	Y	Y	Y	Y
N	11,646	11,646	11,646	13,397	13,397	13,397

Table 5: Loan performance: Baseline results

The table shows baseline results for loan performance. The outcome variable, $Default$, is a dummy that equals one if a firm was overdue for more than 90 days on a loan at branch b in year t. The bank competition measure, *Comp - All branches*, is applying an exponential weight of the distance in kilometers between branch b in year $t-1$ and all competitor branches. The decay parameter depends on the firm location: for rural locations, the parameter is -0.03 while for urban locations it is -1.27. The competition measures are also calculated separately for all branches by relational, denoted by *Comp - Branches by relational lenders*, and arm's length lenders, *Comp - Branches by arm's length lenders*. The standard errors in parentheses are clustered at the branch level. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Firm location:	Rural	Rural	Rural	Urban	Urban	Urban
Comp - All branches	0.0064			-0.0129		
	(0.0085)			(0.0151)		
Comp - Branches by relational lenders		0.0094			0.0089	
		(0.0104)			(0.0264)	
Comp - Branches by arm's length lenders			0.0055			-0.021
			(0.0158)			(0.0173)
Firm-Time FE	Y	Y	Y	Y	Y	Y
Bank-Time FE	Y	Y	Y	Y	Y	Y
Bank-Firm FE	Y	Y	Y	Y	Y	Y
N	11,646	11,646	11,646	13,397	13,397	13,397

Table 6: Loan performance: Interaction effects by the incumbent's lending technology

The table shows loan performance results with interaction effects by the incumbent's lending technology. The outcome variable, *Default*, is a dummy that equals one if a firm was overdue for more than 90 days on a loan at branch b in year t. The bank competition measure, *Comp - All branches*, is applying an exponential weight of the distance in kilometers between branch b in year $t-1$ and all competitor branches. The decay parameter depends on the firm location: for rural locations, the parameter is -0.03 while for urban locations it is -1.27. The competition measures are also calculated separately for all branches by relational, denoted by *Comp - Branches by relational lenders*, and arm's length lenders, *Comp - Branches by arm's length lenders*. We further interact these competition measures with a dummy variable, *Relational lender*, that equals one if the incumbent is a relational lender. The standard errors in parentheses are clustered at the branch level. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Firm location:	Rural	Rural	Rural	Urban	Urban	Urban
Comp - All branches	0.0055			0.0670***		
	(0.0081)			(0.0212)		
Comp - All branches	0.0009			-0.0590***		
* Relational lender	(0.0019)			(0.0221)		
Comp - Branches by relational lenders		0.0056			0.1230***	
		(0.0091)			(0.0398)	
Comp - Branches by relational lenders		0.0088			-0.0775**	
* Relational lender		(0.0068)			(0.0387)	
Comp - Branches by arm's length lenders			0.0081			0.0366
			(0.0195)			(0.0262)
Comp - Branches by arm's length lenders			-0.0012			-0.0517**
* Relational lender			(0.0032)			(0.0234)
Firm-Time FE	Y	Y	Y	Y	Y	Y
Bank-Time FE	Y	Y	Y	Y	Y	Y
Bank-Firm FE	Y	Y	Y	Y	Y	Y
N	11,646	11,646	11,646	13,397	13,397	13,397

Table 7: Extensive margin analysis: Descriptive statistics

The table shows observations of every potential borrower-lender match and the share of credit observations over the sampling period. We include every firm the year before it established borrowing relationships with at least two banks in the sampling period. Panel A provides data for rural and Panel B for urban firm locations. This split is undertaken at the city level to obtain as close to 50 percent of the observations in each sample as possible.

	Mean	N
Panel A: Rural firm locations		
All lenders	0.192	446,801
Relational lenders	0.325	203,312
Arm's length lenders	0.081	243,489
Panel B: Urban firm locations		
All lenders	0.141	729,245
Relational lenders	0.205	359,864
Arm's length lenders	0.078	369,381

Table 8: Extensive margin analysis: Baseline regression results

The table shows baseline results for the extensive margin analysis. The outcome variable is a dummy that equals one if branch *b* granted a new loan to firm *i* in year *t*. The bank competition measure, *Comp - All branches*, is applying an exponential weight of the distance in kilometers between branch *b* in year $t-1$ and all competitor branches. The decay parameter depends on the firm location: for rural locations, the parameter is -0.03 while for urban locations it is -1.27. The competition measures are also calculated separately for all branches by relational, denoted by *Comp - Branches by relational lenders*, and arm's length lenders, *Comp - Branches by arm's length lenders*. We include every firm the year before it established the first borrowing relationship in the sampling period. The standard errors in parentheses are clustered at the branch level. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Firm location:	Rural	Rural	Rural	Urban	Urban	Urban
Comp - All branches	-0.0075			-0.0073*		
	(0.0050)			(0.0042)		
Comp - Branches by relational lenders		-0.0032			-0.0193	
		(0.0122)			(0.0119)	
Comp - Branches by arm's length lenders			-0.0085			-0.0026
			(0.0076)			(0.0033)
Firm-Time FE	Y	Y	Y	Y	Y	Y
Bank-Time FE	Y	Y	Y	Y	Y	Y
Bank-Firm FE	Y	Y	Y	Y	Y	Y
N	446,801	446,801	446,801	729,245	729,245	729,245

Table 9: Intensive margin analysis: Competition and substitution results

The table shows substitution results for the intensive margin analysis. The outcome variable, $ln(Loan\ volume)$, is the natural logarithm of the newly granted loan amount at branch b in year t. The substitution measure, *Subst - All branches*, is applying an exponential weight of the distance in kilometers between firm i's branch b and the corresponding competitor branches. The decay parameter depends on the firm location: for rural locations, the parameter is -0.03 while for urban locations it is -1.27. The branch-branch and substitution measures are also calculated separately for all branches by relational and arm's length lenders. The branch-branch competition measures are defined as in previous tables. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Firm location:	Rural	Rural	Rural	Urban	Urban	Urban
Comp - All branches	-0.0266			-0.0677*		
	(0.0244)			(0.0345)		
Subst - All branches	-0.0132			-0.1555		
	(0.0486)			(0.1697)		
Comp - Branches by relational lenders		-0.0054			-0.1241**	
		(0.0604)			(0.0572)	
Subst - Branches by relational lenders		-0.0979			-0.4089***	
		(0.0672)			(0.1528)	
Comp - Branches by arm's length lenders			-0.0452			-0.0042
			(0.0314)			(0.0411)
Subst - Branches by arm's length lenders			0.1374**			0.8414***
			(0.0644)			(0.3076)
Firm-Time FE	Y	Y	Y	Y	Y	Y
Bank-Time FE	Y	Y	Y	Y	Y	Y
Bank-Firm FE	Y	Y	Y	Y	Y	Y
N	7,746	7,746	7,746	13,397	13,397	13,397

Table 10: Extensive margin analysis: Competition and substitution results

The table shows substitution results for the extensive margin analysis. The outcome variable is a dummy that equals one if there is a credit from branch b in year t. The substitution measure, *Subst - All branches*, is applying an exponential weight of the distance in kilometers between firm i's branch b and the corresponding competitor branches. The decay parameter depends on the firm location: for rural locations, the parameter is -0.03 while for urban locations it is -1.27. The branch-branch and substitution measures are also calculated separately for all branches by relational and arm's length lenders. The branch-branch competition measures are defined as in previous tables. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Firm location:	Rural	Rural	Rural	Urban	Urban	Urban
Comp - All branches	-0.0018			-0.0035		
	(0.0037)			(0.0026)		
Subst - All branches	-0.0076			-0.0676***		
	(0.0073)			(0.0244)		
Comp - Branches by relational lenders		0.0255			-0.0013	
		(0.0184)			(0.0063)	
Subst - Branches by relational lenders		-0.0365**			-0.1145***	
		(0.0153)			(0.0114)	
Comp - Branches by arm's length lenders			-0.0129			-0.0025
			(0.0108)			(0.0034)
Subst - Branches by arm's length lenders			0.0119			0.0255*
			(0.0090)			(0.0148)
Firm-Time FE	Y	Y	Y	Y	Y	Y
Bank-Time FE	Y	Y	Y	Y	Y	Y
Bank-Firm FE	Y	Y	Y	Y	Y	Y
N	348,134	348,134	348,134	722,660	722,660	722,660

Table 11: Aggregate analysis on the firm-year level

The table shows intensive margin results that are aggregated on the firm-year level. The outcome variable is the natural logarithm of the sum of new loans granted by all major banks to firm *i* in year *t*. The bank competition measure, *Comp - All branches*, is applying an exponential weight of the distance in kilometers between branch *b* in year $t-1$ and all competitor branches. The decay parameter depends on the firm location: for rural locations, the parameter is -0.03 while for urban locations it is -1.27. The competition measures are also calculated separately for all branches by relational, denoted by *Comp - Branches by relational lenders*, and arm's length lenders, *Comp - Branches by arm's length lenders*. For the aggregation on the firm-year level, we use the maximum competition measure across all branches serving firm *i* in year $t-1$. The standard errors in parentheses are clustered at the firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Firm location:	Rural	Rural	Rural	Urban	Urban	Urban
Comp - All branches	0.0182			0.0351*		
	(0.0169)			(0.0188)		
Comp - Branches by relational lenders		0.1093***			0.1644***	
		(0.0175)			(0.0436)	
Comp - Branches by arm's length lenders			0.0202			0.0158
			(0.0131)			(0.0197)
Firm FE	Y	Y	Y	Y	Y	Y
City-Time FE	Y	Y	Y	Y	Y	Y
N	5,758	5,758	5,758	6,609	6,609	6,609

Internet Appendix

Table A1: Number of bank branches in cities as of 2006

City	Number of bank branches in 2006
Azua	6
Bani	10
Barahona	5
Bonao	9
El Seibo	2
Hato Mayor	7
Higuey	24
Jimani	1
La Romana	17
La Vega	22
Mao	5
Moca	10
Monte Plata	3
Neyba	2
Ocoa	3
Salcedo	2
San Cristobal	15
San Francisco de Macoris	16
San Pedro Macoris	13
Santiago	83
Santo Domingo	276
Villa Altagracia	2

Table A2: Substitution measure: Descriptive statistics

The table shows the descriptive statistics for the substitution measure, which is applying an exponential weight of the distance in kilometers between firm *i*'s branch *b* and the corresponding competitor branches. The decay parameter depends on the firm location: for rural locations, the parameter is -0.03 while for urban locations it is -1.27. The substitution measures are also calculated separately for all branches by relational and arm's length lenders. Panel A provides data for rural and Panel B for urban firm locations.

	Mean	N	S.D.	Min.	p10	Median	p90	Max.
Panel A: Rural firm locations								
All branches	63.96	7,749	54.32	1.77	10.81	49.96	160.24	294.90
Branches by relational lenders	8.31	7,749	6.39	0.24	2.56	6.37	17.97	45.18
Branches by arm's length lenders	55.66	7,749	48.46	1.42	9.02	42.55	141.43	256.99
Panel B: Urban firm locations								
All branches	2.91	13,397	3.18	0.00	0.02	1.83	8.18	18.79
Branches by relational lenders	0.39	13,397	0.49	0.00	0.00	0.16	1.06	3.16
Branches by arm's length lenders	2.53	13,397	2.84	0.00	0.02	1.58	7.32	17.20

Table A3: Intensive margin analysis: Substitution results

The table shows baseline substitution results for the intensive margin analysis. The outcome variable, $ln(Loan\ volume)$, is the natural logarithm of the newly granted loan amount at branch b in year t. The substitution measures are defined as in previous tables. The standard errors in parentheses are clustered at the branch level. The standard errors in parentheses are clustered at the branch level. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Firm location:	Rural	Rural	Rural	Urban	Urban	Urban
Subst - All branches	-0.0471			-0.1756		
	(0.0318)			(0.1780)		
Subst - Branches by relational lenders		-0.1039***			-0.5145***	
		(0.0288)			(0.1469)	
Subst - Branches by arm's length lenders			0.0969			0.8434***
			(0.0689)			(0.3009)
Firm-Time FE	Y	Y	Y	Y	Y	Y
Bank-Time FE	Y	Y	Y	Y	Y	Y
Bank-Firm FE	Y	Y	Y	Y	Y	Y
N	7,746	7,746	7,746	13,397	13,397	13,397

Table A4: Intensive margin analysis: Non-parametric approach

The table shows the baseline intensive margin regressions based on non-parametric circular regions around the incumbent branch. The outcome variable, $ln(Loan\ volume)$, is the natural logarithm of the newly granted loan amount at branch b in year t. Each circle radii are calculated to contain 10,000, 20,000 and 50,000 population respectively. Competition measure in each circle is the summation of the number of competitor branches for each year. The first column represents results based on circles with full set of lenders in rural locations. 2nd and the 3rd regressions present results using circles with relational lenders and arm's length lenders respectively. The last 3 columns present corresponding results for urban locations. The standard errors in parentheses are clustered at the branch level. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Firm location:	Rural	Rural	Rural	Urban	Urban	Urban
N banks 1 - All branches	-0.0598			-0.004		
	(0.0562)			(0.0120)		
N banks 2 - All branches	-0.0827			-0.0074		
	(0.0878)			(0.0099)		
N banks 3 - All branches	-0.0447			0.0026		
	(0.0745)			(0.0094)		
N banks 1 - Branches by relational lender		-0.1887***			-0.0493***	
		(0.0561)			(0.0152)	
N banks 2 - Branches by relational lender		-0.2677***			-0.0182	
		(0.0839)			(0.0235)	
N banks 3 - Branches by relational lender		0.0871			-0.0223	
		(0.0778)			(0.0196)	
N banks 1 - Branches by arm's length lender			0.0395			0.0221*
			(0.0970)			(0.0115)
N banks 2 - Branches by arm's length lender			-0.0104			-0.0085
			(0.1191)			(0.0110)
N banks 3 - Branches by arm's length lender			-0.0264			0.0114
			(0.1028)			(0.0106)
Firm-Time FE	Y	Y	Y	Y	Y	Y
Bank-Time FE	Y	Y	Y	Y	Y	Y
Bank-Firm FE	Y	Y	Y	Y	Y	Y
N	11,646	11,646	11,646	13,397	13,397	13,397

Table A5: Intensive margin analysis: Placebo test

The table shows a placebo test for the baseline intensive margin analysis. The outcome variable, $ln(Loan\ volume)$, is the natural logarithm of the newly granted loan amount at branch b in year t. We randomize the opening year of branch b by using a placebo branch opening drawn from actual branch openings that took place between the years 2000 and 2012 and calculate the placebo bank competition measure, *Comp - All branches (Placebo)*, by applying an exponential weight of the distance in kilometers between branch b in placebo year t_p and all competitor branches. The decay parameter depends on the firm location: for rural locations, the parameter is -0.03 while for urban locations it is -1.27. The placebo competition measures are also calculated separately for all branches by relational, denoted by *Comp - Branches by relational lender (Placebo)*, and arm's length lender, *Comp - Branches by arm's length lender (Placebo)*. We run 500 simulations and cluster the standard errors (in parentheses) at the branch level. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Firm location:	Rural	Rural	Rural	Urban	Urban	Urban
Comp - All branches (Placebo)	-0.0132			-0.0309		
	(0.0192)			(0.0360)		
Comp - Branches by relational lenders (Placebo)		-0.0442			-0.0713	
		(0.0370)			(0.0897)	
Comp - Branches by arm's length lenders (Placebo)			0.0125			-0.0212
			(0.0171)			(0.0406)
Firm-Time FE	Y	Y	Y	Y	Y	Y
Bank-Time FE	Y	Y	Y	Y	Y	Y
Bank-Firm FE	Y	Y	Y	Y	Y	Y
N	11,646	11,646	11,646	13,397	13,397	13,397

Table A6: Intensive margin analysis: Robustness check including credit lines

The table shows results for the intensive margin analysis that is using a more comprehensive loan amount including credit lines. The outcome variable is the natural logarithm of the sum of newly granted loan amounts and existing credit lines at branch b in year t. Credit lines are approximated by using credit card limits. The bank competition measure, *Comp - All branches*, is applying an exponential weight of the distance in kilometers between branch b in year $t-1$ and all competitor branches. The decay parameter depends on the firm location: for rural locations, the parameter is -0.03 while for urban locations it is -1.27. The competition measures are also calculated separately for all branches by relational, denoted by *Comp - Branches by relational lenders*, and arm's length lenders, *Comp - Branches by arm's length lenders*. The standard errors in parentheses are clustered at the branch level. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Firm location:	Rural	Rural	Rural	Urban	Urban	Urban
Comp - All branches	-0.0369**			-0.0773**		
	(0.0171)			(0.0354)		
Comp - Branches by relational lender		-0.0820***			-0.1534***	
		(0.0238)			(0.0543)	
Comp - Branches by arm's length lender			0.0114			-0.0208
			(0.0388)			(0.0421)
Firm-Time FE	Y	Y	Y	Y	Y	Y
Bank-Time FE	Y	Y	Y	Y	Y	Y
Bank-Firm FE	Y	Y	Y	Y	Y	Y
N	11,646	11,646	11,646	13,397	13,397	13,397

Table A7: Intensive margin analysis: Higher decay for rural firm locations

The table shows results for the intensive margin analysis using a stronger decay parameter for rural firm locations. The bank competition measure, *Comp - All branches*, is applying an exponential weight of the distance in kilometers between branch b in year $t-1$ and all competitor branches. The decay parameter is increased in absolute terms from -0.03 to -0.64 in order to match the descriptive statistics of the competition measure of urban firm locations in Table 2. The competition measures are also calculated separately for all branches by relational, denoted by *Comp - Branches by relational lenders*, and arm's length lenders, *Comp - Branches by arm's length lenders*. The outcome variable, $ln(Loan\ volume)$, is the natural logarithm of the newly granted loan amount at branch b in year t. The standard errors in parentheses are clustered at the branch level. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Firm location:	Rural	Rural	Rural
Comp - All branches	-0.0823		
	(0.0523)		
Comp - Branches by relational lenders		-0.2208***	
		(0.0821)	
Comp - Branches by arm's length lenders			-0.0232
			(0.0708)
Firm-Time FE	Y	Y	Y
Bank-Time FE	Y	Y	Y
Bank-Firm FE	Y	Y	Y
N	11,646	11,646	11,646

Table A8: Intensive margin analysis: Lower and higher decay for urban firm locations

The table shows results for the intensive margin analysis using a lower and higher decay for rural firm locations. The outcome variable, $ln(Loan\ volume)$, is the natural logarithm of the newly granted loan amount at branch b in year t. The decay parameter is decreased (increased) by 50 percent in absolute terms from -1.27 to -0.64 (-1.91) in columns 1 to 3 (4 to 6). The competition measures are also calculated separately for all branches by relational, denoted by *Comp - Branches by relational lenders*, and arm's length lenders, *Comp - Branches by arm's length lenders*. The standard errors in parentheses are clustered at the branch level. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Decay parameter:	-0.64	-0.64	-0.64	-1.91	-1.91	-1.91
Comp - All branches	-0.0336**			-0.0976*		
	(0.0148)			(0.0522)		
Comp - Branches by relational lenders		-0.0956***			-0.1677**	
		(0.0305)			(0.0744)	
Comp - Branches by arm's length lenders			-0.0032			-0.0304
			(0.0177)			(0.0643)
Firm-Time FE	Y	Y	Y	Y	Y	Y
Bank-Time FE	Y	Y	Y	Y	Y	Y
Bank-Firm FE	Y	Y	Y	Y	Y	Y
N	13,397	13,397	13,397	13,397	13,397	13,397

Table A9: Aggregate analysis on the firm-year level: Extensive margin

The table shows extensive margin results that are aggregated on the firm-year level. The outcome variable is a dummy that equals one if firm *i* has any new credit in year *t*. The bank competition measure, *Comp - All branches*, is applying an exponential weight of the distance in kilometers between branch *b* in year $t-1$ and all competitor branches. The decay parameter depends on the firm location: for rural locations, the parameter is -0.03 while for urban locations it is -1.27. The competition measures are also calculated separately for all branches by relational, denoted by *Comp - Branches by relational lenders*, and arm's length lenders, *Comp - Branches by arm's length lenders*. For the aggregation on the firm-year level, we use the maximum competition measure across all branches serving firm *i* in year $t-1$. The standard errors in parentheses are clustered at the firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Firm location:	Rural	Rural	Rural	Urban	Urban	Urban
Comp - All branches	0.0081***			0.0091*		
	(0.0025)			(0.0050)		
Comp - Branches by relational lender		0.0284***			0.0249***	
		(0.0072)			(0.0090)	
Comp - Branches by arm's length lender			0.0101***			0.0029
			(0.0037)			(0.0044)
Firm FE	Y	Y	Y	Y	Y	Y
City-Time FE	Y	Y	Y	Y	Y	Y
N	105,437	105,437	105,437	123,127	123,127	123,127

Table A10: Aggregate analysis on the firm-year level: Loan performance

The table shows loan performance results that are aggregated on the firm-year level. The outcome variable, *Default*, is a dummy that equals one if a firm was overdue for more than 90 days to any of its loan in year t. The bank competition measure, *Comp - All branches*, is applying an exponential weight of the distance in kilometers between branch b in year $t-1$ and all competitor branches. The decay parameter depends on the firm location: for rural locations, the parameter is -0.03 while for urban locations it is -1.27. The competition measures are also calculated separately for all branches by relational, denoted by *Comp - Branches by relational lenders*, and arm's length lenders, *Comp - Branches by arm's length lenders*. For the aggregation on the firm-year level, we use the maximum competition measure across all branches serving firm i in year $t-1$. The standard errors in parentheses are clustered at the firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Firm location:	Rural	Rural	Rural	Urban	Urban	Urban
Comp - All branches	0.0350**			0.0140		
	(0.0141)			(0.0107)		
Comp - Branches by relational lender		-0.0075			0.0427*	
		(0.0098)			(0.0236)	
Comp - Branches by arm's length lender			0.0153*			0.0056
			(0.0090)			(0.0106)
Firm FE	Y	Y	Y	Y	Y	Y
City-Time FE	Y	Y	Y	Y	Y	Y
N	5,758	5,758	5,758	6,609	6,609	6,609