Spillovers in Local Banking Markets*

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Abstract

How and why do liquidity events influence the local business landscape? We analyze exchange-rate-induced movements of Peruvian firms across a threshold that governs their regulatory treatment by banks. Firms that quasi-randomly cross the threshold supply more information to their banks and experience a substantial increase in financing. We find positive spillover effects: the neighbors of the above-threshold firms also experience increased financing. These spillovers are confined to neighbors sharing a bank, and the performance of new loans to these neighbors improves, suggesting that the bank has become better informed about other local firms.

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Liquidity events have been viewed as potentially transformative factors in the evolution of local business geographies (Chevalier (1995), Stuart and Sorenson (2003)). The basic insight that the newly obtained liquidity helps unlock the potential of a firm, but also affects its business environment through organizational and competitive mechanisms has led to a vast and important stream of research in strategy (e.g., Klepper and Sleeper (2005), Klepper (2007), Wu (2012)). Yet two outstanding issues hinder progress in this literature, one statistical and one economic. First, geography-specific liquidity events are typically not random, so it is relatively hard to draw valid inference about the main impact of a liquidity event because of the typical endogeneity problems of omitted variable bias and reverse causality. Second, inquiries into the economic mechanisms linking liquidity events and local outcomes have been mostly focused on the firms and individuals receiving the liquidity, but not on the financial institutions behind the liquidity event, which are natural candidates to connect different firms through informational mechanisms (e.g., Asker and Ljungvist (2010), Hegde and Tumlinson (2014)). This paper seeks to bridge these gaps by exploiting firm-specific regulatory shocks in a regression discontinuity design and by employing microgeographic data on all firm-bank relationships in Peru. The results show causal evidence that liquidity events —in the form of new bank financing to a focal firm— "spill over" to benefit the funding of very close neighboring firms. Moreover, the results indicate that these spillovers happen through a bank-specific channel, thus advancing the informational role of connectors in shaping the business landscape of a local geography.

Our empirical approach makes use of Peruvian banking regulations that apply a set of different rules to loans to firms with total debt that exceeds a certain threshold. Firms above this threshold (set at \$20,000 up to 2003 and \$30,000 thereafter) are designated as "Commercial" (COM) and those below it are referred to as "Micro-enterprises" (MES). A crucial distinction between firms in the two categories is that banks lending to COM firms, unlike those lending to MES firms, are required to collect quantitative information about them in the form of financial statements. A shift in status for a firm from MES to COM status thus results in a move to significantly more intense information collection, and a different regulatory regime, for its bank.

The decision to grant a firm COM status should be generally seen as negotiated by the firm and its

bank, a result of an endogenous bargaining process. It is the case, however, that some exogenous factors influence this negotiation. In particular, most Peruvian firms borrow in the local currency (the Nuevo Sol, called Sol hereafter), while, for historical reasons, the thresholds were defined in U.S. dollars during the sample period. As a result, among the class of MES firms with Sol loan balances that are below but close to the threshold, there is a group that may be pushed above the threshold by Sol-U.S. dollar exchange rate movements in the subsequent months. These exchange rate movements cause some firms to be forced across the threshold and into COM status while other, very similar, firms fall just short of the threshold and remain MES. We make use of this regulatory threshold and currency movements that are clearly exogenous from the perspective of any firm to implement a regression discontinuity design contrasting future outcomes for firms that end up just above and just below the threshold.

We first show that firms with exchange-rate-adjusted balances above the threshold are indeed more likely to be assigned COM status. The relationship is subject to some noise (due, for example, to shifts in the loan balance over the course of the month), but we find a large discontinuous jump in the probability of COM status for firms with exchange-rate-adjusted balances just above this threshold, which allows us to implement a "fuzzy" regression discontinuity design. We also provide evidence in support of the argument that the assignment to COM status is quasi-random.

We label the firms close to the threshold "focal firms". We show that focal firms with exchange-rate-adjusted balances just above the threshold subsequently receive significantly more new financing from their banks in the subsequent twelve months. We thus view exchange-rate-generated transitions of firms to COM status as a regulatory shock that leads them to both supply more information to their banks and to receive more financing (Stiglitz and Weiss (1981)).

To uncover the effect of focal firms' shocks on nearby businesses, we turn our attention towards their "financial neighbors," which we define to be all businesses within 500 meters of a focal firm that share a bank with the focal firm. What impact would we expect on the financing of these neighbors? Two arguments suggest that financial neighbor firms should enjoy more financing after a focal firm's transition to COM. First, the focal firm should be expected to grow more quickly now, which may generate economic benefits for its financial neighbors, leading them to borrow more. Second, a focal

firm's shift to COM status leads its bank to be provided with far more detailed financial information about the focal firm and its neighborhood. From an information perspective, we may expect this reduction in asymmetric information to lead to more lending to financial neighbor firms (Stiglitz and Weiss (1981)). An effect of this type, illustrating the diffusion of information across firm boundaries within a banking network, would add a new dimension to our understanding of how liquidity events shape a local business landscape.

Conversely, however, there are two reasons to expect the financial neighbors of focal firms that transition to COM to borrow less. First, it may be that local bank managers have loan allocations that are relatively fixed (Zhang (1997)). This may be due to diversification considerations or to agency problems within large banks that can result in local investment allocations that depend mainly on bank-wide performance and that do not fully reflect local opportunities (Scharfstein and Stein (2002) and Ozbas and Scharfstein (2010)). Second, the increased flow of funding to the focal firm may lead its financial neighbors to scale back on investment and financing for competitive reasons.

We estimate the impact of the shock by comparing outcomes for financial neighbors of focal firms just above and just below the threshold. These neighbor firms should be quite alike, aside from the fact that some experience an increase in information supplied to and financing provided by their bank to the local focal firm and others do not. We find that the financial neighbors of focal firms just above the cutoff subsequently receive approximately 1.3% more new financing in the subsequent twelve months. In other words, financial neighbor firms receive more financing when focal firms provide financial statements to their lenders and get more loans. This result is consistent with either the broader economic benefits of a loan to a focal firm or with improved bank information after the focal firm's transition to COM.

To help disentangle these two mechanisms, we also consider the impact of a focal firm's transition on the financing of its geographic neighbors, which we define to be those firms within 500 meters of the focal firm, irrespective of whether they share a bank. If lending to the focal firm generates pure economic spillovers (e.g., by promoting local economic growth), these should affect all nearby firms, irrespective of whether they share a lender. We show that geographic neighbors do not experience an increase in new financing after the focal firm becomes COM; only those neighbors that share a bank

with the focal firm receive more new loans. This finding suggests that the financial spillovers have an informational basis. Under the information hypothesis, banks unaffiliated with the focal firm would not receive any additional information after its transition, so the lending of these banks should not be affected, which is what we show.

To provide more direct evidence on the information effects, we consider whether the performance of new loans to financial neighbors improves after the focal firm crosses the COM threshold. Specifically, we analyze the probability that a financial neighbor firm receiving a new loan will subsequently cease business operations. If banks are better informed after a focal firm transition, then we would expect to see them making fewer loans to firms that later fail. This is, indeed, what we find: the correlation between making a new loan and subsequent firm failure is more negative for financial neighbors of focal firms that traverse the COM eligibility border. Banks are apparently better able to distinguish between the high- and low-quality neighbors of focal firms pushed across the COM boundary by exchange rate movements.

Our findings complement prior work focusing on the informational role of banks in connection to firms (e.g., Petersen and Rajan (2002), Dass and Massa (2011)). Prior studies of information flows have mostly stayed within the boundaries of the firm-bank relationship. Our results go one step further to suggest that in the course of learning about one company, banks can also acquire knowledge about their neighboring firms. In other words, we provide evidence that a bank's information acquisition process can cross firm boundaries and generate deeper insights into hard to observe neighborhood characteristics (Kurlat and Stroebel (2014)). Our results highlight the role of information flows that may be fundamental to generate the connection between the liquidity events benefitting one firm and the broader outlook of its local business landscape.

Our results also expand recent work on the microgeographic relationships of business organizations, both within and across firm boundaries (Ren et al. (2011), Natividad (2014)). In the case of liquidity events, broadening the analysis beyond production to consider also information and financing may prove useful. Our nuanced characterization thus sheds new light on business relationships in the context of task systems (Baldwin (2008)).

1 Data

We analyze monthly business bank loan data from Peru over the period 2001-2010. The Peruvian economy is dependent on millions of small firms (de Soto (2002)) and in Peru, as in developed economies, banks play a key role in financing growth. The data are supplied by the Peruvian banking regulator, *Superintendencia de Banca, Seguros, y AFPs* (SBS) and are labeled the RCD (*Reporte Crediticio de Deudores*) database.[1] The data describe for each Peruvian financial institution the monthly loan balances of every business borrower. We draw from two data sets. Firms are assigned to a category, and an associated data set, based on the amount of their borrowing. The first is the Micro-enterprise (MES) data set that is designed to report loan balances for all firms with a total borrowing across the entire financial system of less than $20,000 (changed to $30,000 in 2003). We describe this cutoff as the COM threshold. The second is the COM data set for firms with a total loan balance above the MES threshold. In Section 1.1 below, we discuss in some detail the rules for assigning firms to either category, and the implications of this assignment for firms and banks. We are primarily interested in firms in the MES data set, with a particular focus on those that transition to COM status. There are 18 million firm-bank-month observations in this joint MES and COM database.

In addition to supplying loan balances, the data specify the currency in which each loan is denominated (either Peruvian Soles, denoted by S/., or U.S. dollars). Over the term of the sample period, 77% of the loan balances of MES firms are in Soles, with this fraction increasing over time. By 2010, 90% of the loan balances of MES firms are in Soles. Much of our analysis will consider the amount of new financing received by a firm. The RCD database provides information on loan balances, and does not identify new loans. We therefore adopt the classification rule that any exchange-rate-adjusted increase in the loan balance of more than 5% is treated as a new loan. For a firm that receives a new loan, we view the entire new balance as a new loan. Our results are robust to using cutoffs other than 5%.

We also have geocoded location information for firms in 120 out of 195 provinces in Peru, including all major cities. Locations are provided in the form of eight digit longitudes and latitudes, and are precise

[1] Berger, Frame and Ioannidou (2011) make use of a similar registry in Bolivia.

to an accuracy of +/- 7.5 meters. This precision enables us to undertake a microgeographical analysis of the effects of a firm's financing on the funding of its neighbors.

1.1 MES versus COM

The central distinction between the banking regulations applicable to MES and COM firms is that once firms enter the COM category, their lenders are required to collect formal financial statements from them.[2] That is, the transition to COM results in the provision of quantitative information to lenders. Why don't banks require financial statements from MES borrowers as well? Generating these documents is costly for small borrowers, and collecting and evaluating them is costly for banks.

It is also the case that along with the formal requirement for the provision of financial statements, banks will often send representatives to meet with firms that transition to COM. These representatives are typically assigned responsibility for specific geographic areas. In some cases, these bank representatives will also canvass neighboring firms for their views of the company. In general, a shift to COM status leads to significantly more information gathering by the bank, a process that includes an intensified consideration of the firm's local market conditions.

COM and MES firms also differ in certain other aspects of their regulatory regimes. Most importantly, delinquency is assessed differently for COM and MES firms, and banks are required to make different loss provisions for delinquent COM and MES firms. Our analysis will also consider the possible impact of these regulatory differences.

2 Empirical Specification

We are interested in the effect of an exogenous information and financing shock on the provision of loans to a firm and to its neighbor firms. Following the formal rules of the Peruvian banking regulation, firms with a total loan balance above the threshold should be subject to COM regulations. Banks and firms likely agree to the COM transition for unobserved reasons, so a regression of financing characteristics

[2]Source: SBS Resolution 808-2003, among others.

on an indicator for COM status would likely be subject to endogeneity concerns. The formal eligibility threshold can, however, be used in a regression discontinuity design to measure the causal impact of a transition to COM status. Banks are required to assign firms with total balances above the threshold to COM. The threshold level in Soles will not be known until the end of the period, at which point the official exchange rate is announced. The firm's end of month balance in Soles may also not be known, particularly if the firm has U.S. dollar debt. This suggests that there may be some noise in the assignment of firms to COM status. Nonetheless, a bank may observe a firm's previous period balance and the current Sol per Dollar exchange rate R_t to assess whether the firm is likely to exceed the eligibility threshold. Consider the set of firms with MES status in period $t-1$. A firm i in month t with an exchange-rate-adjusted month $t-1$ balance that exceeds the month t exchange-rate-adjusted cutoff should be likely to be assigned to COM:

$$Commercial\ Status_{i,t} = \alpha + \beta(Exchange\ rate\ adjusted\ Balance_{i,t} > Cutoff_t) + \epsilon_{i,t} \tag{1}$$

$$= \alpha + \beta(USD\ balance_{i,t-1} * R_t + Soles\ balance_{i,t-1} > (DollarCutoff_t)R_t) + \epsilon_{i,t}$$

where $Commercial\,Status_{i,t}$ is an indicator variable for whether firm i is assigned to the COM database for the first time, $Cutoff_t$ is the month t Commercial cutoff measured in Soles and $\epsilon_{i,t}$ is an error term. Equation (1) can be estimated via local linear regression (Hahn, Todd and Van der Klaauw, 2001).

The bank may also use other unobserved variables to assign a firm to COM status, but we will not exploit this potentially endogenous information in our design. The bank may also have information about within-month balances that we cannot exploit given our end-of-month database. In this sense, equation (1) describes a "fuzzy" regression discontinuity design, in which we are testing for a discontinuous jump in the probability of COM status assignment, but this jump need not be equal to one. In essence, we are testing if firms that are pushed across the eligibility threshold by exchange

rate movements are substantially more likely to be given COM status.

We first consider whether a focal firm's entry into COM has an impact on its financing. This suggests the following specification:

$$Financing\,outcome_{i,t+12} = \gamma + \delta(Exchange\,rate\,adjusted\,Balance_{i,t} > Cutoff_t) + \nu_{i,t}, \qquad (2)$$

where $\nu_{i,t}$ is an error term. We estimate equation (2) using local linear regression techniques.

As described in Section 1.1, focal firms that enter COM status receive both an information and a regulatory shock that should lead to more financing. What effect does this have on neighbor firms? To measure the impact of this shock, we match each focal firm that may potentially be subject to a transition to the set of neighbor firms within 500 meters of its location that share a bank with the focal firm. The focal firm is designated the "local focal firm" for each of its neighbors. We consider a focal firm to be potentially subject to a transition if its exchange-rate-adjusted balance is within some window of the cutoff in period t. We then contrast financing outcomes T months in the future for neighbors of focal firms that cross the threshold with the corresponding outcomes for neighbors of focal firms that do not cross the threshold. Specifically, we estimate:

$$Neighbor\,Firm\,Financing\,Outcome_{i,t+T} \qquad (3)$$

$$= \zeta + \lambda(Local\,Focal\,Firm\,Exchange\,rate\,adjusted\,Balance_{i,t} > Cutoff_t) + controls_{i,t} + u_{i,t},$$

where $controls_{i,t}$ is a set of neighbor firm controls include location, time and industry fixed effects and $u_{i,t}$ is an error term. The smallest administrative subdivision of Peru is a district, of which there are 1,834. Given Peru's population of 29.4 million, this gives an average size of just over 16,000 people

per district, or roughly twice the population of a typical U.S. ZIP code. We include fixed effects at the district-year-month interaction level to control for a rich set of time and location unobservables. We estimate equation (3) using ordinary least squares (OLS), analyzing the differences between the neighbors of focal firms that are on opposing sides of the threshold, for samples in which the focal firms are all within tight windows of the cutoff.

In our main specification, we consider focal firms with exchange-rate-adjusted balances within 2,500 Soles of the threshold (during our sample period the Sol traded at an average of 3.3 per US dollar). Sample statistics are given in Table 1 for the set of 8,806 firm-month observations that fall within this window.

3 Results

3.1 Transition to Commercial Status

As described in Section 1.1.1 above, Peruvian firms are assigned to either MES or COM status, and this categorization is formally governed by the total outstanding loan balance, expressed in dollars, held by the firm in the financial system. We begin by analyzing the relationship between loan balances and COM/MES status. Does the loan balance threshold determine the firm classification in practice?

We adopt the approach described in Section 2 and analyze the effect on a firm's COM status of exchange rate shocks to both the threshold and the firm's balance in the previous month. This approach does not make use of within-month balance changes (which we do not observe) or other endogenous variables that may govern the bank's decision to grant a firm COM designation, so we do not expect to perfectly predict this outcome. By exploiting the impact of currency shifts, however, we can contrast firms that fall on either side of the threshold for exogenous reasons.

3.1.1 Sample selection

For firms to be included in our sample they must meet two criteria. First, we only consider MES firms. Transitions over the COM threshold will have no impact on firms that are already classified as COM. Transition to COM is unidirectional; once a firm has become COM, it remains COM and its movements through the COM threshold have no effect on its status. Second, we only include MES firms with a $t-1$ balance that is below the threshold. That is, we exclude MES firms that are already above the threshold but that have not been classified as COM, for whatever reason. We exclude these MES firms because it is possible that they have not been classified as COM due to some unobserved characteristic and this may lead to endogenous selection. By excluding this second group of firms, we are able to focus on MES firms that transition over the threshold *only* due to exchange-rate movements and for no other reason.

The distribution of prior month $(t-1)$ loan balances for firms in the sample is depicted in Figure 1. The figure illustrates two features of the data. First, as described, all the firms in the sample have prior-month loan balances below the COM threshold. Second, there is a clear peak in the data just below the threshold, and there is a significant mass of firms that is quite close to the threshold. These may be firms for which the costs and benefits of crossing the threshold are relatively similar, either for the firms themselves or for their banks. While these firms may be somewhat distinctive in this regard, the key point of our empirical approach is to always make comparisons across firms that are all within this general grouping; we compare firms close to the threshold that are pushed over the threshold by the exchange rate with other firms that are close to the threshold but for which exchange rate movements leave them just short of the threshold. That is, we exploit quasi-random variation within the general group of firms with balances close the threshold.

3.1.2 Are differences between above- and below-threshold firms quasi-random?

We exploit the exchange rate variation which pushes some of the firms above the threshold and leaves others below it. The first question is whether differences between above- and below-threshold firms

are indeed quasi-random. While this cannot be proven incontrovertibly, there are three arguments that suggest it is likely to be the case. The first is that exchange rate changes are hard to forecast and exogenous from the perspective of any given firm, so it seems quite likely that this introduces an element of random noise into the exchange-rate-adjusted loan balance (Lee (2008)). The second point is to consider the distribution of exchange-rate-adjusted loan balances. A significant discontinuity in this distribution at the threshold showing, for example, substantially more firms below the threshold than above, might indicate that the exchange-rated-adjusted loan balances are being manipulated. Figure 2 shows the exchange-rate-adjusted loan balance (with the threshold normalized to zero) for loans within 2,500 Soles of the boundary. As the figure makes clear, there is no significant discontinuity at zero. A formal McCrary test comparing the relative log heights of the estimated probability densities at zero yields a coefficient of -0.024 and a t-statistic of -0.35. There is no evidence of a jump in the frequency of firms with exchange-rate-adjusted balances just above or below the cutoffs. While banks and firms may purposely choose initial loan balances above or below the threshold (as suggested by Figure 1), Figure 2 demonstrates that exchange rate movements generate enough local noise to ensure that exchange-rate-adjusted balances are quasi-randomly distributed around the cutoff. It is for this reason that our analysis focuses on exchange-rate-adjusted balances rather than the balances themselves.

As a third test, we analyze the distribution of observable firm characteristics around the threshold. We present results for three variables. The first is the worst classification of any loan held by the firm; Peruvian banking regulations mandate that all financial institutions report on the delinquency status of each loan, on a five-point scale from normal (a score of 0) to loss (a score of 4). The second characteristic is the share of troubled debt, defined to be any debt with a classification of below normal, over total debt. The third is the ratio of all new financing received by the firm between month $t-11$ and month t, divided by total debt as of month $t-12$. As shown in Figure 3, none of these variables exhibits a discontinuity at the cutoff. That is, above- and below-threshold firms have quite similar loan classifications, fractions of troubled loans and ratios of new financing.

3.1.3 Does transition across the COM threshold lead to COM classification?

Next we consider whether exchange rate shocks that push MES firms with Sol loans across the COM eligibility threshold actually cause these firms to be given COM status. We address this issue by estimating equation (1) regressing COM status on the exchange-rate-adjusted balance. The results from this regression are shown in the first column of Table 2. The local linear estimator shows that there is a discrete jump of 11.7 percentage points (t-statistic=18.4) in the probability of COM status precisely at the formal eligibility threshold. This result demonstrates that even when a firm is pushed across the threshold by an exogenous exchange rate shock, the formal cutoffs continue to have a substantial effect on classification. This is a fuzzy regression discontinuity design in which we do not observe all the information the banks uses to classify firms. Nonetheless, it is clear that exchange rate driven shocks have a strong impact in pushing some firms across the threshold and leading them to enter COM status while other, very similar, firms remain below the threshold and maintain their MES classification.

Columns 2-4 of Table 2 display results from estimating equation (1) in which we use OLS to regress COM status on an indicator for an above-threshold exchange-rate-adjusted balance in varying narrow windows around zero. The results are shown for windows of +/-2,500, 2,000 and 1,500 Soles, in columns 2-4 respectively. To give a sense of magnitudes, the mean of the above-threshold indicator during the sample period was 0.04 for the whole database; in the narrow window of 2,500 Soles, the mean of the above-threshold indicator was 0.38. These results only make use of firms very close to the threshold to estimate the discontinuity. The results are somewhat smaller than for the local linear estimator, with coefficients ranging from 8.3 to 10.2 percentage points, and the estimated coefficients are significant (the t-statistics range from 9.84 to 16.02). Column 5 of Table 2 shows the similar result from an OLS polynomial specification, with the polynomial of order seven. This result is depicted graphically in Figure 4

3.2 Focal Firm Financing

The analysis in Table 2 establishes that firms that are pushed across the COM threshold by exchange rate movements are indeed significantly more likely to be granted COM status. We now consider the impact of COM status on the amount of financing received by a firm. Specifically, we estimate equation (2) and regress the log of the new financing received by the firm in the next year on an indicator for whether a firm has an exchange-rate-adjusted balance above the classification threshold. The local linear estimator using the optimal bandwidth of Imbens and Kalyanaraman (2012) yields a coefficient of 0.57 (t-statistic=4.83) on the above threshold indicator, as displayed in the first row of the first column Table 3. This indicates that firms that achieve COM status due to exchange rate movements receive significantly more new financing in the following year than otherwise very similar firms whose exchange-rate-adjusted balances fall just below the COM threshold. The results displayed in the second and third columns show that this positive effect is robust to the choice of other bandwidths. In other words, COM status appears to have a large causal effect on subsequent financing.

Why do focal firms that transition to COM status receive more financing? One argument is that firms that are exogenously pushed by exchange-rate movements across the threshold into COM status receive an information shock as their banks shift to the intensive information gathering processes required for COM firms. As a result information asymmetries are reduced, and more financing is supplied. It is the case, however, that a shift to COM status results in more than a pure information shock. There are presumably significant costs to a bank in establishing COM review procedures, which is why banks are much more likely to shift small firms to COM status only when required to do so by SBS regulations.

Suppose, for example, that COM status did not result in any additional information for the bank, but simply led to greater compliance costs. Even if this were true, we still might expect COM firms to receive greater future financing because they have already crossed the regulatory threshold, so the compliance costs have already been paid. For MES firms, an increase in future financing may be unattractive to the bank because it may lead to a costly transition and increase in compliance costs. For COM firms, these costs are already sunk. In other words, MES firms may face a bank that is reluctant

to extend them credit that leads to their breaching the COM threshold. This may place a ceiling on future lending to MES firms that is not present for COM firms.[3]

It is thus possible that any observed differences in future financing between focal firms that cross the cutoff for exchange rate reasons and those that do not may be driven by regulatory or informational considerations, or combination of both. The evidence is clear, however, that exchange-rate-driven transitions to COM generate a financial shock resulting in more lending to focal firms.

3.3 Financial Neighbor Firm Financing

What should we expect to be the impact of a focal firm's targeted regulatory information and financing shock on other local firms? There are two arguments that suggest that the focal firm's shock will lead to more lending to its neighbors. First, due to the provision of financing the focal firm may experience greater growth, which can generate positive economic spillovers for neighbors who may respond to these opportunities by borrowing more. Second, neighbors who borrow from the same bank may also benefit as the bank learns more about the focal firm and its local area- this improved information for the bank may lead to greater lending to all local firms (Stiglitz and Weiss)1981=). Conversely, there are two mechanisms that may lead to less borrowing by neighbor firms. First, if a bank imposes local capital budgeting limits (Zhang (1997)), perhaps for diversification reasons or due to agency considerations (Scharfstein and Stein (2002) and Ozbas and Scharfstein (2010)), then its increased lending to the focal firm may siphon away financing from neighbors. Second, if the focal firm competes with some neighbors, this may also lead them to receive less financing as the focal firm is strengthened by its financing shock. Understanding the local impact of this shock is thus clearly a question for empirical analysis.

To examine the impact of the shock on neighboring firms, we identify for each focal firm all the MES firms sharing the same bank within 500 meters of its location. We label these firms as the financial neighbors of the focal firm. We then contrast the outcomes for financial neighbors of focal firms whose exchange-rate-adjusted balances fall just above and just below the COM cutoff. Neighbors of above

[3]In support of this argument we find, in an unreported descriptive regression, that even when including fixed effects for current loan balance, firms that currently have COM status are dramatically more likely than MES firms to have a loan balance exceeding the cutoff next month.

threshold focal firms are significantly more likely to be subject to a local financial shock, as above threshold focal firms are more likely to achieve COM status.

To assess the impact of the financial shock on the neighboring firms we estimate equation (3), using a window of $[-2,500\ S/., +2,500\ S/.]$. For each financial neighbor firm we regress the log of new financing in the subsequent twelve months on an indicator for whether its associated focal firm has an exchange-rate-adjusted balance above the cutoff, age fixed effects, industry fixed effects, bank fixed effects, a control for the number of local neighbor firms and district-year-month interaction fixed effects. We report robust standard errors clustered by province to allow for local correlations. The result, detailed in the first column of Table 4, is that the neighbors of above threshold firms receive 1.3% more financing (t-statistic=3.76). A local information and financial shock due to the transition of a focal firm to COM status results in more financing for its financial neighbor firms.

The results are not dependent on the specific window used with respect to the threshold. As shown in the second and third columns of Table 4, the finding that a shock for the focal firm leads to more financing for its neighbors is robust across a number of specifications. Given this general robustness, much of our subsequent analysis will focus on the neighbors of focal firms with exchange-rate-adjusted balances in the window of $[-2,500\ S/., +2,500\ S/.]$

The findings in Table 4 are consistent with both the argument that financing generates broad economic spillovers and with the claim that increased information about one firm in a local area leads to more information about its neighbors. In our subsequent analysis we provide further evidence on these two possible mechanisms.

3.3.1 Financing Shocks and Geographic Distance: Very close vs. Farther Locations

The magnitude and significance of spillovers may vary depending on the geographic distance between the focal firm and its financial neighbors. So far the analysis has been conducted employing data on all financial neighbors within 500 meters of the focal firm. While this boundary appears natural in our empirical context (e.g., in the case of Lima, it amounts to about four blocks), using other geographic

distances may help illustrate the informational nature of the financing shock.

The first column of Table 5 reduces the boundary for distance in 90% to focus only on financial neighbors within 50 meters of the focal firm. The coefficient on the above threshold indicator is 0.061 (t-statistic=3.78), consistent with an economically and statistically large effect of the shock on close financial neighbors. Moreover, the second column of Table 5 further cuts this short distance in 80% to keep in the sample only those financial neighbors within 10 meters of the focal firm and finds again a positive and significant coefficient of 0.057 (t-statistic=3.30) for very close neighbors. The shock therefore appears to be stronger at closer locations, consistent with a story in which information diffuses more strongly and rapidly within short distances.

By contrast, the third column of Table 5 reports a regression that goes beyond the 500-meter mark to focus exclusively on those financial neighbors that are relatively far from the focal firm. Specifically, only financial neighbors located between 500 meters and 1,000 meters away from the focal firm are considered for the test. The coefficient of interest is -0.013 and is not statistically significant. This suggests that the nature of the shocks we are analyzing is very local, as the shocks lose power when considered at longer geographic distances.

3.3.2 Financing Shocks, Financial Neighbors' and Geographic Neighbors' New Financing

The analysis in Table 4 focuses on the impact of a focal firm's exchange-rate-induced transition to COM on the financing of neighbor firms located within 500 meters who share a bank with the focal firm. If the additional financing received by a transitioning focal firm leads to more financing for its neighbors because of general economic spillovers, then we should expect to see all local firms benefitting from these spillovers, not just those that share a bank. In this section we consider whether the spillovers documented in Table 4 are confined solely to neighboring firms with whom it shares a bank (financial neighbors) or whether all local firms within 500 meters (geographic neighbors) benefit.

For each geographic neighbor firm, we regress the log of the new financing received by the neighbor in the next twelve months on an indicator for whether the associated focal firm was pushed across the

COM boundary, an indicator for whether the neighbor and focal firm share a bank, the interaction between these two variables and the standard controls. The result, shown in the first column of Table 6, is that the coefficient on the interaction is 0.023 (t-statistic=4.83). This shows that financial neighbors who share a bank receive more financing. The coefficient on the above threshold indicator alone is -0.009 (t-statistic=-1.87) which indicates that geographic neighbors of transitioning focal firms do not receive any additional financing. This conclusion is consistent across other narrow windows of exchange-rate-adjusted balances: there is no evidence that geographic neighbors receive more new loans. This suggests that a pure financial shock to a focal firm does not generate a broad economic spillover benefit for all local firms. The findings in Tables 4 and 6 show that only local firms that share a bank with the focal firm are affected by the spillover.

Overall, these findings are consistent with the hypothesis that after a firm becomes COM, its bank receives more information about both the firm and the local area and is therefore able to expand its financing to neighboring companies. The evidence presented to this point, however, has mainly served to weigh against alterative mechanisms. In the next section we consider a more direct test of the information hypothesis.

3.3.3 Financing Shocks, Financial Neighbors' New Loans and Removal from Tax System

One way to assess whether banks are more informed about the neighbors of firms who experience an exchange-rate-generated transition to COM is to evaluate the success of their lending to these neighbors. Specifically, we consider whether banks are more or less likely to make loans to neighbors who subsequently experience business failure. Presumably, more informed banks should be less likely to make such loans. For this analysis, we are only interested in loans to financial neighbors, other firms in the local area who share a bank with the focal firm. Other banks unrelated to the focal firm are unlikely to become more informed by its transition to COM.

Our measure for failure is whether the neighbor firm was removed from the database of the Peruvian tax authority SUNAT. Firms removed from the tax system are presumed to be no longer actively engaged in any business activity (e.g., they are not issuing receipts). Are the neighbors of

above-threshold focal firms who receive new loans less likely to go out of business? To evaluate this question, we regress an indicator for whether a financial neighbor firm is removed from the tax system over the next twelve months on an indicator for an above-threshold associated focal firm, an indicator for whether the neighbor received a new loan, the interaction between these variables and the usual controls. The coefficient of interest is the one on the interaction term. It describes whether the new loans made to the neighbors of above-threshold focal firms are more or less likely to subsequently exit the tax system.

As shown in the first column of Table 7, we estimate this coefficient to be -0.008 (t-statistic=-6.03). This indicates that financial neighbors of above-threshold firms who receive new loans are subsequently significantly less likely to end operations. This is evidence in favor of the argument that banks have more information about these neighbors and are able to identify better prospects for financing.

This regression is not meant to be interpreted in a causal manner. Indeed, we are making use of the fact that granting a new loan is an endogenous decision by the bank. We are interested in whether the bank exhibits an enhanced ability to selectively make loans to better financial neighbor firms after the transition of the focal firm to COM status. The negative coefficient we estimate on the interaction shows that the correlation between making a new loan to a neighbor and its firm performance is indeed tighter (more negative) after an associated focal firm becomes COM. A similar pattern can be observed in the second and third columns of Table 7, which consider exit within longer horizons of 24 months and 36 months. The results are consistent with the argument that the bank knows more about financial neighbor firms after the focal firm is pushed across the COM threshold by exchange rate movements. Banks can better distinguish between the high- and low-quality neighbors of above-threshold focal firms, indicating that the bank does indeed have more information about these neighbors. The evidence in Tables 4, 6 and 7 is thus broadly supportive of the claim that the local spillovers leading to more financing for neighbors are driven by information considerations.

4 Conclusion

We study the impact of information and financing shocks to firms on the supply of bank loans to their neighbor companies in a sample of Peruvian businesses in the period 2001-2010. Banks of firms with total loan balances above a certain U.S. dollar threshold were required by banking regulation to collect formal financial statements from their clients; these firms were designated to have a Commercial status and were governed by different regulations. Exploiting currency movements and implementing a regression discontinuity analysis, we contrast outcomes for firms with exchange-rate-adjusted balances just above and below the threshold. We label the companies close to the threshold as focal firms, and we find that focal firms pushed into Commercial status by exchange rate movements subsequently receive substantially more financing.

We further find that the very close financial neighbors that share a bank with focal firms that transition receive significantly more financing. Geographic neighbors in the same local area who do not share a bank are unaffected. New loans made to the financial neighbors exhibit improved performance. This evidence generally supports the argument that the increased information flow to the bank lending to the focal firm is what enables it to lend more and with greater success to other local clients. Economic spillovers arising purely from the provision of a loan to the focal firm do not appear to have much effect on neighboring firms. Our results therefore suggest that in this large sample of small firms in an emerging market, improved information about a specific company has a clear positive spillover effect on the funding of its neighbors. A better understanding of the complex financial interrelationships between neighboring firms is likely to have substantial welfare implications.

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Table 1: Summary Statistics

Summary statistics are based on 8,806 firm-month observations on focal firms, defined as firms with a monthly foreign exchange adjusted existing debt of $t-1$ within 2,500 soles of the threshold of month t. The foreign exchange adjustment is: USD (US dollar) balance$_{t-1}$ * (exchange rate in Soles/USD)$_t$ + Soles balance$_{t-1}$. Existing debt is in soles and for month t. New financing, also expressed in Soles, sums over all new loans between months $t+1$ and $t+12$ for the focal firm. Firm classification is as the worst classification of a loan received by the firm in the financial system by any bank in that month. Share of troubled debt over total debt is a ratio, where troubled debt is all past due, refinanced, restructured, and in judicial collection. Fraction of new financing prior 12 months is the ratio of all new financing received by the firm between month $t-11$ and month t, divided by total debt as of month $t-12$.

Variable	Mean	Median	Std.Dev.	1^{st} pctile.	99^{th} pctile.
Existing debt	81665	83529.28	11483	31769	98006
New financing	122258	91826	129801	0	540469
Firm classification	0.181	0	0.671	0	4
Share of troubled debt	0.030	0	0.158	0	1
Fraction of new financing prior 12 months	223	3	19169	0	37

Table 2: Exchange-rate-adjusted Distance to Threshold and Transitioning to Commercial Status

This table reports the discontinuous impact of total exchange-rate-adjusted debt on whether a firm receives its first commercial loan in month t using different estimation techniques and different samples. The baseline sample is all MES firms that have no commercial loans in month $t-1$ and whose total debt balance is below the COM threshold in month $t-1$. The assignment variable for all models is defined using the following foreign exchange adjustment: USD (US dollar) balance$_{t-1}$ * (exchange rate in Soles/USD)$_t$ + Soles balance$_{t-1}$. This assignment variable and the threshold are scaled by 100,000 (i.e., 0.025 units = 2,500 soles). The threshold is for month t and expressed in soles. The second, third, and fourth models are estimated using a narrow window of the assignment variable. Above threshold is a dummy for when the assignment variable is greater than or equal to the threshold.

	Dependent Variable: Transitioned to Commercial Status (1/0)				
Estimation:	RD	OLS			
Focal window:		[-0.025,0.025]	[-0.02,0.02]	[-0.015,0.015]	
	(2.1)	(2.2)	(2.3)	(2.4)	(2.5)
Above threshold	0.117***	0.102***	0.098***	0.083***	0.111***
	(18.43)	(16.02)	(13.58)	(9.84)	(11.21)
Polynomials	No	No	No	No	7
R^2		0.03	0.03	0.02	0.01
Sample size	23M	8806	7138	5344	23M
Number of clusters (firms)					775105

***, **,* significant at the 1%, 5% and 10% level. Standard errors are heteroskedasticity-robust and clustered when indicated.

Table 3: Financing Shocks and Focal Firm Financing in Local Regression Models

Each entry is from a different model analyzing the impact of above threshold loan amounts on focal firm financing. Observations for each regression are at the firm-month level for all firm-month combinations that have no history of commercial loans up to month $t-1$ and whose total debt balance does not cross the MES threshold in month t. Debt amounts are in logs of soles. All logs are of one plus the variable of interest. Twelve-month values include all months between +1 and +12, respectively. These local regression models fit non-parametric local linear regressions using the optimal bandwidth of Imbens and Kalyanaraman (2012) with the rectangular kernel, calculating the model at different multiples (i.e., 100%, 50%, 200%) of this optimal bandwidth.

	Dependent Variable:		
	Log of 12-month new financing		
	(3.1)	(3.2)	(3.3)
Above threshold	0.572^{***}	0.323^{**}	0.902^{***}
	(4.83)	(2.06)	(9.59)
Multiple of optimal bandwidth	100%	50%	200%

***, **,* significant at the 1%, 5% and 10% level. t-statistics shown in parentheses.

Table 4: Financing Shocks and Financial Neighbor Firms' Financing

Observations are at the focal firm / neighbor firm / bank / month level for all financial neighbors of all focal firms that are within 0.5 kilometers of the focal firm and share a bank with the focal firm. Above threshold is defined for focal firms, as in Table 2, and its value is imputed to neighboring firms to explain these neighboring firms' financing in the 12 months following the month when the focal firm's exchange-rate adjusted balance is within 2,500 soles (or 2,000 soles or 1,500 soles) of the MES threshold. t-statistics are shown, based on robust standard errors clustered by province.

	Dependent Variable:		
	Log of 12-month new financing		
Focal window:	[-0.025,0.025]	[-0.02,0.02]	[-0.015,0.015]
	(4.1)	(4.2)	(4.3)
Above threshold	0.013***	0.019**	0.022***
	(3.76)	(2.43)	(3.57)
Controlling for existing debt	Yes	Yes	Yes
Age fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes
Border firms quartile fixed effects	Yes	Yes	Yes
District × Year-month fixed effects	Yes	Yes	Yes
R^2	0.05	0.05	0.05
Sample size	2.6M	2.1M	1.6M
Number of clusters (provinces)	120	116	113

***, **,* significant at the 1%, 5% and 10% level.

Standard errors are heteroskedasticity-robust and clustered by province.

Table 5: Financing of Neighbors at Very Close vs. Farther Geographic Locations

Observations are at the focal firm / neighbor firm / bank / month level for all financial neighbors of the focal firm that share a bank with the focal firm and that are located within specified distances with respect to the focal firm: within 50 meters, within 10 meters, or between 500 and 1,000 meters. Above threshold is defined for focal firms, as in Table 2, and its value is imputed to neighboring firms to explain these neighboring firms' financing in the 12 months following the month when the focal firm's exchange-rate adjusted balance is within 2,500 soles of the MES threshold. t-statistics are shown, based on robust standard errors clustered by province.

	Dependent Variable:		
	Log of 12-month new financing		
Neighbor location:	$\leq$ 50 meters	$\leq$ 10 meters	$500m < x \leq 1000m$
	(5.1)	(5.2)	(5.3)
Above threshold	0.061^{***}	0.057^{***}	-0.013
	(3.78)	(3.30)	(-1.66)
Controlling for existing debt	Yes	Yes	Yes
Age fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes
Border firms quartile fixed effects	Yes	Yes	Yes
District $\times$ Year-month fixed effects	Yes	Yes	Yes
R^2	0.07	0.08	0.05
Sample size	190241	146439	2.3M
Number of clusters (provinces)	120	115	64

***, **,* significant at the 1%, 5% and 10% level.

Standard errors are heteroskedasticity-robust and clustered by province.

Table 6: Financing Shocks, Financial Neighbors' and Geographic Neighbors' Financing

Observations are at the focal firm / neighbor firm / bank / month level for all neighbors of all focal firms that are within 0.5 kilometers of the focal firm, regardless of whether they share a bank or not with the focal firm. Above threshold is defined for focal firms, as in Table 2, and its value is imputed to neighboring firms to explain these neighboring firms' financing in the 12 months following the month when the focal firm's exchange-rate adjusted balance is within 2,500 soles (or 2,000 soles or 1,500 soles) of the MES threshold. Shares a bank is a dummy equal to one when the neighbor shares a bank with the focal firm. Above threshold × Shares a bank is an interaction of these variables. t-statistics are shown, based on robust standard errors clustered by province.

	Dependent Variable:		
	Log of 12-month new financing		
Focal window:	[-0.025,0.025]	[-0.02,0.02]	[-0.015,0.015]
	(4.1)	(4.2)	(4.3)
Above threshold × Shares a bank	0.023^{***}	0.016^{***}	0.013
	(4.83)	(2.71)	(1.65)
Above threshold	-0.009^{*}	-0.002	0.004
	(-1.87)	(-0.50)	(0.70)
Shares a bank	0.032^{*}	0.032^{**}	0.023
	(1.83)	(2.10)	(1.52)
Controlling for existing debt	Yes	Yes	Yes
Age fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes
Border firms quartile fixed effects	Yes	Yes	Yes
District × Year-month fixed effects	Yes	Yes	Yes
R^2	0.08	0.08	0.08
Sample size	6.1M	5M	3.8M
Number of clusters (provinces)	120	117	114

***, **,* significant at the 1%, 5% and 10% level.

Standard errors are heteroskedasticity-robust and clustered by province.

Table 7: Financing Shocks, Financial Neighbors' New Loans and Removal from Tax System

Observations are at the focal firm / neighbor firm / month level for all financial neighbors of all focal firms that are within 0.5 kilometers of the focal firm and share a bank with the focal firm. The dependent variable is a dummy for whether the neighbor firm was removed from Peru's tax system within the next 12 months, 24 months, or 36 months. Above threshold is defined for focal firms, as in Table 2, and its value is imputed to neighboring firms to explain these neighboring firms' reception of a new loan in the 12 months following the month when the focal firm's exchange-rate adjusted balance is within 2,500 soles of the MES threshold. This new loan reception dummy is introduced both in levels and as an interaction with the above threshold variable. t-statistics are shown, based on robust standard errors clustered by province.

	Dependent Variable:		
	Firm is removed from the tax system (1/0) over the next...		
	12 months	24 months	36 months
	(7.1)	(7.2)	(7.3)
Above threshold × Received new loan	-0.008^{***}	-0.015^{***}	-0.011^{***}
	(-6.03)	(-7.07)	(-4.55)
Above threshold	0.006^{***}	0.012^{***}	0.011^{***}
	(3.72)	(5.82)	(5.26)
Received new loan	-0.030^{***}	-0.044^{***}	-0.044^{***}
	(-6.24)	(-5.74)	(-6.09)
Controlling for existing debt	Yes	Yes	Yes
Age fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Border firms quartile fixed effects	Yes	Yes	Yes
District × Year-month fixed effects	Yes	Yes	Yes
R^2	0.02	0.03	0.04
Sample size	1M	1M	1M
Number of clusters (provinces)	120	120	120

***, **,* significant at the 1%, 5% and 10% level. Standard errors are heteroskedasticity-robust and clustered by province.

Figure 1: Density of Prior-Month Loan Balance Distance to Threshold

This figure shows the density of the prior-month loan balances close to the COM threshold, which is denoted by zero.

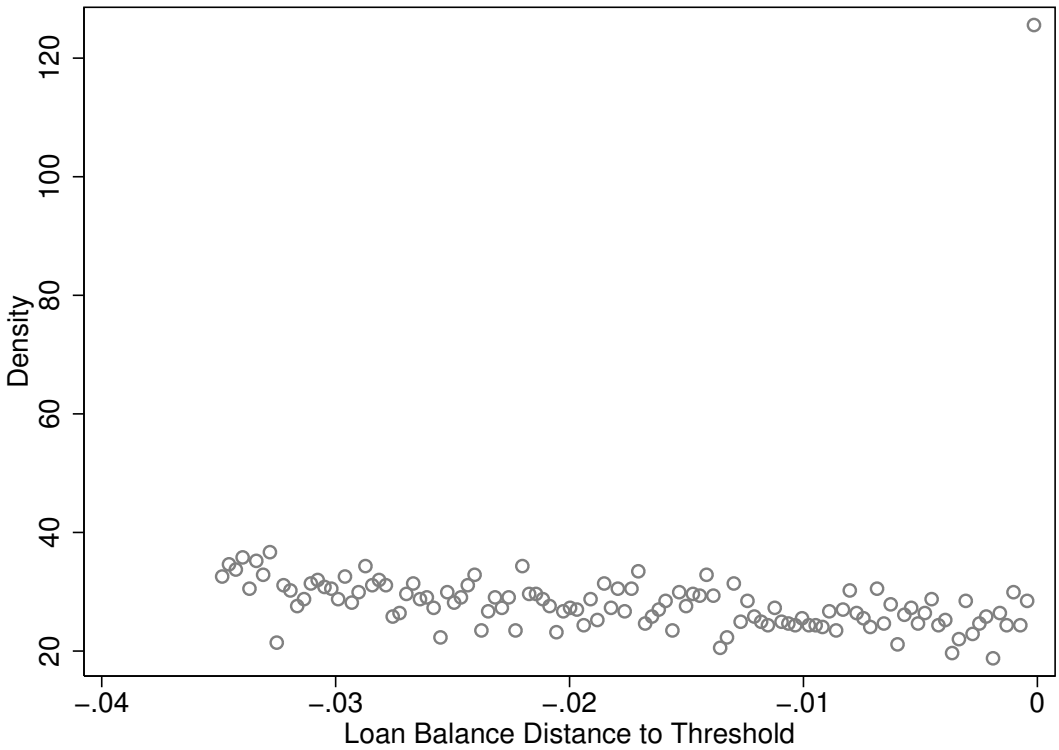

Figure 2: Density of Exchange-rate-adjusted Loan Balance Distance to Threshold

This figure shows the McCrary test for the exchange-rate-adjusted loan balances, where zero denotes the COM threshold.

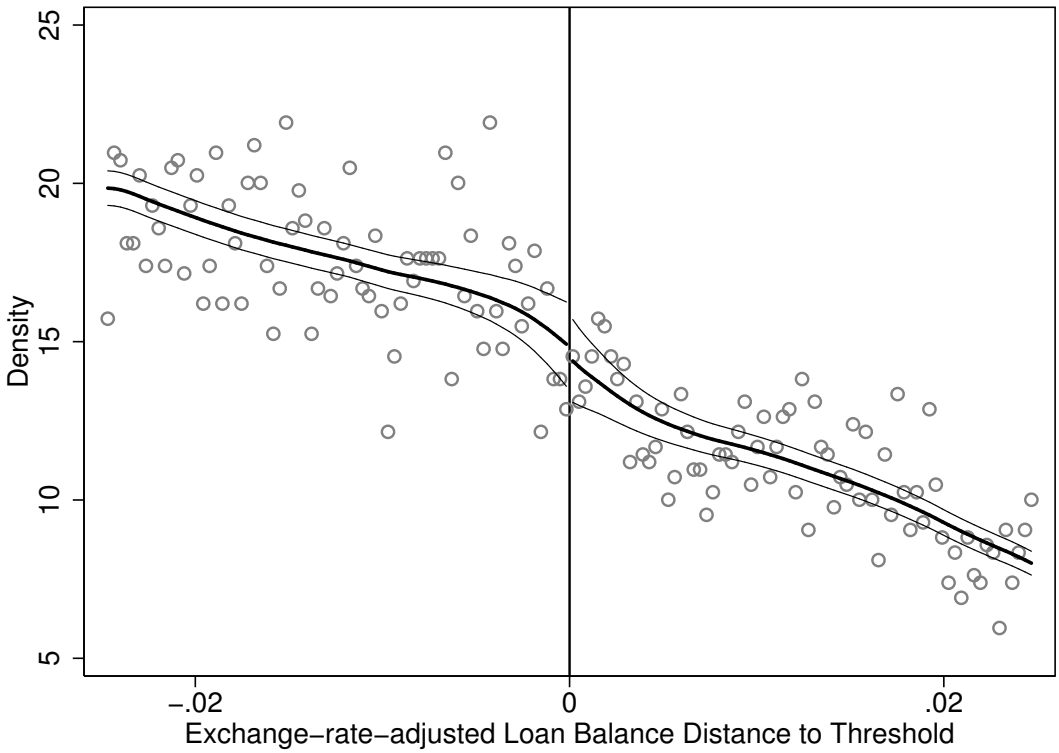

Figure 3: Comparing Observable Characteristics around the Threshold

Each panel displays the kernel densities of below-threshold firms (solid gray line) and above-threshold firms (dashed red line) for a given observable characteristic contemporaneous or prior to the month when these focal firms enter the range within 1,500 soles of the MES threshold. Only observations within the narrow window of 1,500 soles around the MES threshold are used for the comparison. The observable characteristics are the firm's loan classification, defined as the worst classification in the financial system by any bank in that month (Panel I), the share of troubled debt over total debt, where troubled debt is all past due, refinanced, restructured, and in judicial collection (Panel II), and the ratio of all new financing received by the firm between month $t-11$ and month t, divided by total debt as of month $t-12$ (Panel III). The p-values of Kolmogorov-Smirnov tests of equality of densities is reported at the bottom of each graph.

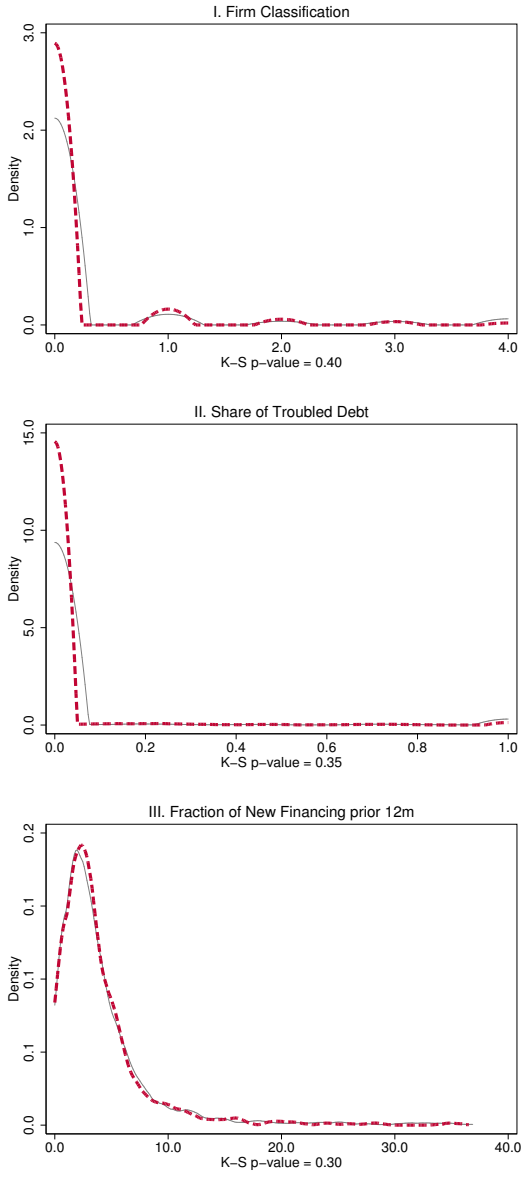

Figure 4: Exchange-rate-adjusted Loan Balance Distance to Threshold and Probability of Transition to Commercial Status

Each scattered dot represents a bin of the distance to debt threshold variable. The dashed lines represent 95% confidence intervals of 7th-degree polynomial fits of whether the firm received a commercial loan on the exchange-rate-adjusted distance to debt threshold values, as in the fifth model of Table 2.