The Information Content from Lending Relationships Across the Supply Chain

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Abstract

Using unique data on between-firm payments and bank to firm lending, we investigate whether bank relationships across firms connected through product market ties affect the provision of loans to these firms. We show that the loans provided by a bank to a firm increase when the bank also lends to one of the firm's trade partners (customers or suppliers). Negative information about the creditworthiness of a firm's trading partner is acknowledged by common lending banks, which reduce the loan amount, increases the cost, and reduces the duration of loans provided to the firm. These results suggest that lending to firms connected through the supply chain conveys valuable information to banks.

Keywords: bank relationship, cross-client lending, supply chain, network spillovers.

JEL Codes: G21, E50, E59, E24.

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1. Introduction

Business ties are an important driver of firms' financial performance. A bank may extract useful information about a borrowing firm by learning about the firm's customers and suppliers. Several recent studies investigate the interplay between a firm's business ties and the credit market. Valta (2012) and Campello and Gao (2017) study how competition in the product market affects firms' cost of debt and loan terms. Another stream of literature investigates how interfirm relationships affect business performance (Cohen and Frazzini, 2008; Cai and Szeidl, 2018) and the firm's capital structure (Banerjee et al., 2008). A recent strand of literature studies how shocks to a bank propagate through the supply chain and to the employees of the bank's borrowers (Huremovic et al. 2020; Cortes et al., 2020; Alfaro et al., 2021).

In this paper, we investigate how the relationships of a bank with a firm's customers and suppliers affect lending to the firm. To identify the firms' commercial counterparties (i.e., their customers and suppliers), we use a unique dataset that tracks money transfers and therefore maps the network of the real economy in Brazil, allowing us to identify each firm's customers and suppliers. We merge this dataset with credit bureau data that contain detailed loan-level information on bank-to-firm loans. Hence, our data allow us to use information on lending at the bank-firm level, while at the same time identifying bank lending to each firm's customers and suppliers in a novel way.

There is a growing literature on the interplay between bank lending and trade relationships in the real economy. Alfaro et al. (2021) and Huremovic et al. (2020) provide evidence on the real effects of credit supply shocks that originate in the financial sector and propagate through customers and suppliers. Giacomini et al. (2022) show that supplier-customer relationships are strengthened when both firms share a common lending bank and Hasan et al. (2020) show that same-bank relationship with the firm's main supplier is associated with better loan terms. Campello and Gao (2017) show that loan terms are associated with customer concentration and Rahaman et al. (2020) argue that supply chain power is relevant to bank financing. Giannetti et al. (2018) show that high-market-share lenders provide liquidity to customers and suppliers of distressed industries. However, little is known about the information content that banks acquire by engaging in multiple relationships with firms that are connected through the supply chain, and the effects of an unexpected (idiosyncratic) shock to a given firm in terms of the provision of loans to its commercial counterparties.

We start by documenting that bank relationships across the supply chain are relevant at both the extensive and intensive margins. A bank lends more to a firm if it also lends to the firm's customers and suppliers. Borrowers whose customers (suppliers) have any loans from a given bank receive an incremental 15.6% (14.9%) in loans from that same bank on average. At the intensive margin, doubling the size of the loan portfolio of the firm's customers (suppliers) with a bank translates into an additional 1.5% (1.3%) in the borrower's amount of loans from that bank.

Lending to a firm's customers and suppliers enhances a bank´s information set about the firm. This enhanced information may allow the bank to adjust the loan terms to a firm based on information coming from the firm's commercial counterparties. However, lending to multiple firms that are linked by commercial ties also increases the concentration risk of the bank's loan portfolio by means of cross-client contagion and increased cash flow risk (BIS, 1999). Because of business ties, idiosyncratic negative shocks to a borrower may propagate to its entire economic network. Hence, bank lending to multiple firms across the same supply chain increases the bank's exposure to such shocks (Hertzel et al., 2008; Giannetti et al., 2018; Kolay et al., 2016; Croci et al., 2021).

Accordingly, we follow our analysis by investigating how different banking relationships across the supply chain shape the provision of loans to a firm when different banks receive similar - but not identical - signs of credit deterioration. More specifically, we examine firms whose main commercial counterparty has a loan default[4] within the same lending bank. A loan default provides negative information about the defaulter itself (in this case, a main supplier or customer), which may propagate to the borrower, which is indeed what we find in our data.

The information that a firm has a loan in arrears is accessible to all the banks operating in the financial system through credit bureaus. However, we argue that a common lending bank is in a better position to make use of such information for several reasons. First, other (i.e., non-common) lenders are less

[4] For simplicity, we use the term "default" to describe a loan falling into arrears for 15 or more days.

likely to be aware the existence of the customer-supplier trade relationship than the lending bank. Second, even if other lenders are aware of the existence of the trade relationship, the information of a default by the borrower's main customer is less salient to a bank if it does not lend to the defaulting firm (Baros, 2022). Finally, other lenders may take longer to receive the information that the firm's main customer has defaulted, because the information that a borrower has a loan in arrears may take several weeks before being available to all the banks through the credit bureau. Therefore, we claim that the common lending bank that receives the negative information about a firm's main customer is able to adjust the lending terms on a timely and intensive manner.

To test our claim, we do a triple difference model, defining a firm-bank-quarter observation as "treated" if the firm's main customer has a loan falling into arrears. The third difference in our triple differences model compares lending to treated firms across different common lending banks. Specifically, we compare how the bank that received the default adjusts its lending terms to the treated firm in comparison to other common banks that did not receive a default.. We find that the bank that receives such negative information (i.e., a default) about the firm's main customer reacts by increasing interest rates by 8.4 percentage points and decreasing the duration of loans to the firm by 11.0%, when compared to other banks.

Our inferences are robust to bank-specific variations in loans granted over time and firm-specific variations in loan demand over time (including firm size and other observable changes in creditworthiness), as we use bank-time and firm-

time fixed effects in all our estimations. In other words, our estimates look at within-firm variation in bank lending, depending on the relationship of different banks with the firm's customers and suppliers while controlling for the heterogeneity in bank loan supply over time.

We add to the literature on relationship banking by looking at how banks produce information from lending to multiple borrowers that are connected through business ties. Most of the literature to date has looked at how the intensity and length of a bank-firm lending relationship affect loan terms and analyzed the role of competition and the tradeoffs of single versus multiple bank relationships (e.g., Petersen and Rajan, 1994; Berger and Udell, 1995; von Thadden, 1995; Boot and Thakor, 2002; Degryse and Van Cayseele, 2000; Elyasiani, 2004; Agarwal and Hauswald, 2010; Bolton et al., 2016; Beck et al., 2018, among others). Another stream of literature focuses on how bank relationships across different financial services (but with the same borrower) affect contracting terms (e.g., Puri, 1996, 1999; Drucker and Puri, 2005; Mester et al., 2007; Norden and Weber, 2010; Puri et al., 2017). A third stream looks at the role of bank relationships in facilitating firms' access to new product markets, such as exports (Bronzini and D'Ignazio, 2017).

We innovate by widening the notion of bank relationships from narrow bank-firm lending *per se* to a broader concept of lending across the supply chain, i.e., to a borrower's suppliers and customers. Our paper adds to Huremovic et al.'s (2020) findings in that they document how shocks to a bank spill over to the customers and suppliers of the bank's borrowing firms, whereas we document

how idiosyncratic shocks to a given firm affect the amount, price and maturity of loans to the firm's commercial counterparties. We also add to Hasan et al. (2020) by investigating how a firm's loan terms are affected by idiosyncratic shocks to its commercial counterparties.[5] More indirectly, our paper also relates to the literature that investigates the role of bank relationships for firms in financial distress (e.g., Dahiya et al., 2003) in that we study the effects of idiosyncratic negative information about a firm on the supply of loans to its commercial counterparties.

Our results are important to regulators, as they show that negative shocks to firms (even if idiosyncratic) may have detrimental effects on the loan portfolio of banks that go beyond loans to that specific borrower. Finally, these results also have implications for information sharing initiatives ("open banking"). They show that banks benefit from gathering private information not only about the borrowing firm itself (which could be shared through open banking initiatives) but also from information that cannot be shared via open banking (in our case, information about the creditworthiness of the firm's commercial counterparties), meaning that relationship lending is still valuable to banks, even with information sharing mechanisms in place.

[5] We use a less restrictive concept of relationship across the supply chain, as we use information on the firm's entire supply chain, *i.e.*, we look at the entire set of suppliers and customers, whereas Hasan et al.'s (2020) paper uses only the firm's main supplier. We also use the entire spectrum of bank loans (as opposed to only syndicated loans), which allows us to take care of omitted variable problems by saturating our regressions with bank-time and firm-time fixed effects. In this sense, our empirical approach is conceptually close to Khwaja et al. (2011), but it is different on two major features: first, our notion of network formation stems from business ties in the product market (customers and suppliers), not from common board participants.

The remainder of this paper is structured as follows. Section 2 presents our hypothesis development. Section 3 describes our data gathering setup and descriptive statistics. Section 4 provides the empirical identification strategy, and Section 5 concludes.

2. Hypotheses Development

Agency costs and information asymmetries may induce banks to ration credit (Stiglitz and Weiss, 1981). The unique characteristics of banks in monitoring debtors can induce market discipline (Diamond 1984, Holmstrom and Tirole 1997) and help reduce market frictions (Becket al., 2007). The relationship banking literature has shown that banks benefit from their information monopoly and can still provide funds to opaque and risky firms (Petersen and Rajan 1994, Freixas and Rochet 2008).

Our aim with this paper is to present a known – but previously undocumented – channel by which banks enhance their screening and monitoring processes. When a bank lends to a firm and, at the same time, to the firm's customers and suppliers, it learns from these cross-borrower relationships and improves the information set used for selecting applicants, pricing loans and monitoring portfolio risks. This is an analogous version to Petersen and Rajan's (1994) argument: while their work is underpinned by the relationship between the borrower and the bank over time, ours is based on a cross-sectional information set that stems from the borrower's business ties.

Our conjecture is that banks use this cross-client information to achieve a more comprehensive credit assessment of the borrower. Hence, our hypothesis is:

> **H1.** The amount of loans granted by a bank to a firm is positively related to the existence of a lending relationship between the bank and the firms' commercial counterparties.

By the same token, we argue that the information content of cross-client lending allows banks to re-estimate credit risks and to adjust the granted loan amount and lending terms of firms' commercial counterparties based on new information coming from these cross-client relationships. We expect that when a bank receives negative information about a firm's creditworthiness (such as a loan falling into arrears), it will respond by tightening the loan terms of other firms in the same supply chain. Therefore, our second hypothesis is:

> **H2.** The amount of loans granted by a bank to a firm is reduced when a loan of one of its important commercial counterparties falls into arrears in the same bank.

3. Data and Descriptive Statistics

To understand the implications of lending across the supply chain, we merge two unique datasets. The first dataset is built from the *Banco Central do Brasil* credit bureau (e.g., Bustos et al. 2020, Ponticelli and Alencar 2016, use the same dataset). The bureau data contain loan-level information for all borrowers whose credit exposure with a given bank is above 200 Brazilian reais (approximately 40

USD, as of September 2020) in any month. Our sample encompasses loans from commercial and multiple banks, following most of the literature. These types of intermediaries are responsible for approximately 80% of lending in the Brazilian banking system, as of September 2020. We exclude cooperative banks, development banks and nonbanking institutions because their credit granting processes are typically different from those of commercial banks.

We restrict our sample to firms with outstanding credit amounting to at least 1 million Brazilian reais (approximately 200 thousand US dollars) in the Brazilian banking system in any month between January 2017 and September 2020, including actual loans *and* any other type of contingent exposure (e.g., lines of credit).[6] The rationale for restricting our sample to firms with a certain level of credit taken from banks is that credit risk assessment for this group of (larger) firms is more subject to upstream and downstream network analysis by the lender, whereas the credit assessment process for smaller firms is retail-style, with own-firm idiosyncrasies playing a major role. The loans to the firms in our sample amount to BRL 1.13 trillion, or 67% of the overall loans provided by banks to nonfinancial firms in Brazil, as of September 2020. Based on this information, we build a quarterly measure of the loan outstanding amount at the

[6] We use a broader definition of outstanding credit, including lines of credit and other contingent exposures, to mitigate selection bias. Had we not considered these types of exposure, we might have excluded creditworthy firms that use little bank debt. The rationale for restricting credit bureau data do 2017Q1 to 2020Q3 is twofold: first, we only have money transfer data for 2018 (and we acknowledge the fact that these networks may change over time); second, in the last quarter of 2020, the Brazilian payment system introduced a new (low cost) money transfer tool (*Pix*).

bank-to-firm level for every firm in our sample in every quarter between 2017Q1 and 2020Q3.[7]

The second dataset also comes from the *Banco Central do Brasil* and contains information on interfirm payments. More specifically, it covers all money transfers between accounts in different banks ("TED", for its acronym in Portuguese [8]) and "*boletos*" (which are a form of payment bill that accompanies invoices), which run through the Brazilian Payments System (SPB, the acronym in Portuguese) in 2019. In contrast to credit bureau data, only recently have SPB data been used by scholars (Correia et al. 2020, Cortes and Van Doornik 2019) and by the Central Bank in contagion exercises (BCB 2015; 2020). Most customer-to-supplier payments in Brazil are made using either TEDs or *boletos*. This information allows us to identify the receiver and the payer, as well as the amount paid, for every single direct money transfer and *boleto*. Although we cannot identify other types of money transfers – particularly same-bank book transfers – we rely on SPB data to build the network of customers and suppliers in the real economy. [9]

[7] The first 4 quarters (i.e., 2017 data) of credit data is used only to acquire information on lagged independent variables, while data from 2018 onwards is used in the core of our analysis.

[8] TED (*Transferência Eletrônica Disponível*) is a form of interfirm money transfer between different banks that enables the transfer to be done within a 30-minute limit.

[9] Starting in 2016, the Central Bank of Brazil (BCB) does supervisory contagion routines on the credit portfolio of the Brazilian Financial System (BCB, 2015). In the beginning, this was done by analyzing only direct money transfers (IMF 2018). Since 2019, the BCB improved its measure by adding the "*boletos*" (payment bills). Accordingly, we use 2019 data to build our supplier-customer network.

Therefore, for each firm that makes or receives payments in our sample, it is possible to observe its full set of suppliers and customers, as well as the value of interfirm payments. In our dataset, there are 3.28 million unique firms that received payments and 3.48 million firms that made payments. These payments add up to BRL 3.96 trillion (money transfers) and BRL 3.46 trillion (*boletos*), which correspond to 54% and 48% of Brazil´s GDP, respectively, as of 2019. In our database, there are 9.5 million pairs of firms transferring money through "TEDs" and 23.2 million pairs using *boletos*. The mean (median) money transfer is BRL 417 thousand (BRL 39 thousand), while the mean (median) *boleto* is BRL 149 thousand (BRL 26 thousand).[10]

By merging these two datasets, we can build several measures of bank relationships within the supplier-customer network. For example, we can build bank-firm-quarter measures constituting the overall amount of loans provided by a bank to the suppliers and to the customers of a given firm in each period. Overall, our sample comprises a total of 136,777 firms, 131 banks and 3.57 million bank-firm-quarter observations of bank-to-firm loans.[11]

Table 1 shows the descriptive statistics for the main variables of the "raw" sample data. The variable in the first row of Table 1 is the outstanding loan amount at

[10] Brazil has approximately 20 million active firms, but only 2 million of them have any form of bank debt. The average exchange rate in 2019 was 3.95 BRL/USD.

[11] A firm is defined in our sample by its national 8-digit registry code ("CNPJ – Cadastro Nacional de Pessoa Jurídica"). Consistent with the previous literature using US data (Gatev and Strahan, 2006) and Brazilian data (e.g., Oliveira et al., 2015), we use information at the bank holding company-level (bank conglomerate code), to consider loan granting as a unique process within the conglomerate. The number of firms in the merged dataset is substantially smaller than in the payments data because of the exclusion of firms with less than BRL 1 million in outstanding credit in any quarter.

the bank-firm-quarter level (i.e., the loan amount provided by bank *b* to firm *i* in quarter *t*). Panel A shows that the median (average) borrower has an outstanding loan amount of BRL 0.24 million (BRL 3.03 million) from a given bank. We note that the outstanding loan amount is smaller than the threshold of 1 million BRL that we use to select our sample for approximately 78% of our observations. This occurs for three reasons. First, for a firm to be included in the sample, we require it to have reached the 1 million BRL threshold in *any* quarter during our sample period, which means that, in a given quarter, the firm may have a smaller amount of outstanding loans. Second, our inclusion criteria refer to the sum of loans with all banks being larger than 1 million BRL, whereas the measure reported in Table 1 is the outstanding loan amount with a single bank. Third, the BRL 1 million selection threshold used for sample selection takes loans, credit lines and other types of contingent credit exposure into consideration, whereas our measure of outstanding loans in Table 1 includes only *actual* loans taken by the firms.

The variables described in the second and third rows in Panel A of Table 1 are also at the bank-firm-quarter level and measure the outstanding loans of all suppliers and customers of a given firm at the bank in each quarter, respectively. Out of the 3.57 million firm-bank-quarter observations, 1.49 million (1.15 million) of them have *at least one* of the suppliers (customers) borrowing from the same bank in the same quarter.[12]

[12] This possibly occurs because many firms (i) do not transfer money at all; (ii) transfer money but their commercial counterparties do not have debt in their balance sheet; or alternatively (iii)

In the subsequent rows of Panel A of Table 1, we dissect the previous variable by discriminating the amount of loans outstanding for each of the five most relevant suppliers and customers of the firm. Comparing the loan amount at the same bank, the main suppliers, when tracked, are larger than the typical firm in our sample. While the loans outstanding for the median firm are BRL 0.24 million, the median Top1 Supplier (Top 1 Customer) has outstanding loans of BRL 2.80 million (BRL 2.72 million) with the same bank (fourth and ninth rows of Table 1, Panel A). This occurs because large firms are more likely to be the main supplier or main customers for a given firm than small firms are (we will return to this point later, in Section 3). As we move to the second through fifth most important suppliers and customers, their mean and median loan outstanding amounts with the same bank monotonically decrease, hence, suggesting that larger firms are more likely to be the main customers and suppliers for a firm in our sample.

On Panel B of Table 1, we show that, conditional on having at least one supplier that borrows from the same bank, the average number of suppliers with loans at the same bank is 12. The analogous value for customers is 15.

The data described in Panel C of Table 1 show that, irrespective of whether the supplier and customer have outstanding loans at the same bank as the firm, we can detect at least one supplier (customer) in 1.90 million (1.86 million) observations or just over half of our observations. We conjecture that this is primarily due to the lack of intrabank money transfer data in our setting (which

they only have debt in other banks; (iv) and, to a lesser extent, their suppliers or customers do not have outstanding loans that amount to BRL 1 million anytime during our sample period.

happens when a customer pays a supplier by transferring money between their respective accounts in the same bank, a piece of information that is not included in our data). Finally, for those firms whose main supplier was detected, the main supplier accounts for 25% of the firms' payments on average. Using the same analogy, the main customer of the average firm responds for 22% of the total payments received by the firm (conditional on having the main customer detected).

We also note that the ratio between money transfers and the portfolio of loans is sizeable. The money transfers made by the average firm are equivalent to 19% of the same-bank outstanding loan amount of its suppliers, whereas the transfers received by the average firm from its customers equal 22% of the same-bank outstanding loan amount of the firm's customers. While on average, suppliers received BRL 77.62 million in 2019, their customers had an average outstanding loan amount of BRL 415.26 million with the same bank. The average customer transfers BRL 108.43 million to firms that borrow an average of BRL 484.94 million.

To address the large number of missing observations, we create, for each firm-bank-quarter observation, a dummy variable, *Dummy(All Suppliers)*, that has a value of 1 whenever the web of suppliers is traceable *and* at least one of the firm's suppliers has outstanding loans with same bank, and is 0 otherwise. An analogous dummy variable is created for customers, *Dummy(All Customers)*. To mitigate the effect of outliers, we winsorize all continuous variables at the 1st and

99th percentiles. Using these procedures, Panels D, E, F and G of Table 1 describe the data that we use as input in our econometric models.

Table 1 - Descriptive Statistics

Panel A/B/C - Raw data

The descriptive statistics below show the figures of each variable "as is": missing observations are *not* assigned to zero values.

	Unit	Mean	p25	p50	p75	sd	Observations
Panel A: Loan amounts							
Borrower Loans	BRL Million	3.03	0.04	0.24	0.84	61.30	3,573,632
All Suppliers	BRL Million	415.26	4.35	41.00	286.71	1128.51	1,494,708
All Customers	BRL Million	484.94	1.51	19.71	176.54	1945.19	1,151,060
Top 1 Supplier	BRL Million	150.69	0.28	2.80	34.54	703.80	348,224
Top 2 Supplier	BRL Million	105.10	0.23	2.28	22.74	498.55	300,255
Top 3 Supplier	BRL Million	89.72	0.21	2.04	18.12	425.17	273,927
Top 4 Supplier	BRL Million	85.48	0.21	1.93	16.13	479.20	260,695
Top 5 Supplier	BRL Million	71.74	0.19	1.81	14.46	401.35	244,857
Top 1 Customer	BRL Million	197.93	0.23	2.72	29.58	1142.14	238,557
Top 2 Customer	BRL Million	136.47	0.20	2.14	21.63	872.17	234,861
Top 3 Customer	BRL Million	115.04	0.18	1.85	17.95	820.76	214,873
Top 4 Customer	BRL Million	103.98	0.18	1.79	15.60	793.81	197,698
Top 5 Customer	BRL Million	102.41	0.17	1.72	15.28	778.65	185,319
Panel B: Number of business relationships							
Number of Suppliers	Un.	12.13	2.00	5.00	12.00	25.10	1,494,708
Number of Customers	Un.	15.75	1.00	4.00	11.00	59.81	1,151,060
Panel C: Transaction amounts (transfers in 2019)							
Top 1 Supplier	BRL Million	19.36	0.30	0.98	3.95	628.56	1,899,010
Top 2 Supplier	BRL Million	5.82	0.15	0.45	1.60	65.20	1,868,398
Top 3 Supplier	BRL Million	3.83	0.10	0.30	1.05	46.03	1,839,273
Top 4 Supplier	BRL Million	2.83	0.08	0.23	0.80	25.30	1,808,698
Top 5 Supplier	BRL Million	2.36	0.07	0.19	0.65	22.86	1,777,468
Other Suppliers (ex Top1-Top5)	BRL Million	46.92	0.38	1.62	7.64	579.20	1,777,468
All Suppliers	BRL Million	77.62	1.19	4.23	16.43	1100.10	1,899,010
Top 1 Customer	BRL Million	23.62	0.41	1.43	5.44	785.76	1,863,049
Top 2 Customer	BRL Million	11.15	0.16	0.54	2.11	489.43	1,775,070
Top 3 Customer	BRL Million	8.51	0.10	0.34	1.31	448.90	1,681,258
Top 4 Customer	BRL Million	6.11	0.08	0.25	0.97	295.11	1,593,574
Top 5 Customer	BRL Million	4.02	0.07	0.21	0.80	136.10	1,515,283
Other Customers (ex Top1-Top5)	BRL Million	71.33	0.23	1.47	8.55	1684.56	1,515,283
All Customers	BRL Million	108.43	1.16	4.39	18.70	3461.33	1,863,049

Panel D/E/F/G - Winsorized and Missing value assigned to zero

The descriptive statistics below show the figures of each variable assigned zero values when missing, and after winsorization at 1%.

	Unit	Mean	p25	p50	p75	sd	Observations
Panel D: Loan amounts							
Borrower Loans	BRL Million	1.53	0.04	0.24	0.84	4.87	3,573,632
All Suppliers	BRL Million	160.93	0.00	0.00	19.27	585.66	3,573,632
All Customers	BRL Million	136.51	0.00	0.00	1.10	788.37	3,573,632
Top 1 Supplier	BRL Million	12.55	0.00	0.00	0.00	137.50	3,573,632
Top 2 Supplier	BRL Million	7.72	0.00	0.00	0.00	99.86	3,573,632
Top 3 Supplier	BRL Million	6.07	0.00	0.00	0.00	85.09	3,573,632
Top 4 Supplier	BRL Million	5.12	0.00	0.00	0.00	75.13	3,573,632
Top 5 Supplier	BRL Million	3.93	0.00	0.00	0.00	58.60	3,573,632
Top 1 Customer	BRL Million	9.73	0.00	0.00	0.00	157.16	3,573,632
Top 2 Customer	BRL Million	6.16	0.00	0.00	0.00	94.53	3,573,632
Top 3 Customer	BRL Million	4.36	0.00	0.00	0.00	70.27	3,573,632
Top 4 Customer	BRL Million	3.40	0.00	0.00	0.00	58.12	3,573,632
Top 5 Customer	BRL Million	3.08	0.00	0.00	0.00	55.04	3,573,632
Panel E: Number of business relationships							
Number of Suppliers	Un.	4.77	0.00	0.00	3.00	13.30	3,573,632
Number of Customers	Un.	4.32	0.00	0.00	1.00	17.98	3,573,632
Panel F: Transaction amounts (transfers in 2019)							
Main Bank - Borrower (dummy)	%	36.25	0.00	0.00	100.00	48.07	3,573,632
Main Bank - Top 1 Supplier (dummy)	%	2.95	0.00	0.00	0.00	16.93	3,573,632
Main Bank - Top 1 Customer (dummy)	%	1.96	0.00	0.00	0.00	13.85	3,573,632
Panel G: Loan Terms							
Duration	years	0.880	0.181	0.664	1.274	0.950	3,573,632
Interest Rate	% per year	54.24	12.42	19.21	35.84	91.61	2,963,219
Loans in arrears	% of portfolio	3.510	0	0	0	16.48	3,573,632

Notes: *Loan* is the outstanding loan portfolio of firm *i* at bank *b*; *All Suppliers* (*All Customers*) is the outstanding amount of loans of all the firm´s suppliers (customers) at the same bank; *Number of Suppliers* (*Customers*) is the number of suppliers (customers) of a given firm with loan amount > 0 at the same bank; *Top n Supplier* (*customer*) is the outstanding loan portfolio at the *n* largest connections of the firm, in which the ordering is measured using transaction values in 2019 (this supplier may or may not have bank loans); *Main Bank - Borrower* is a dummy variable equal to 1 for the bank with the largest loan amount granted to the firm in the previous 4 quarters; *Main Bank Top 1* is a dummy variable equal to 1 for the bank with largest loan exposure to the firm´s Top1 supplier or Top1 customer in the previous 4 quarters; *Duration* is the duration of the loan portfolio of firm *i* at bank *b* in quarter *t*; *Int. Rate (%)* is the value-weighted average interest rate for all fixed rate loans of firm *i* at bank *b* in quarter *t*; *Loans in arrears* is the ratio of loans in arrears for more than 14 days (%). Customer (supplier) is defined by any firm that pays (receives) to (from) the firm in 2019 through money transfer or *boleto*. Data are quarterly, from 2018-Q1 to 2020-Q3.

The statistics shown in Panels D and E of Table 1 are analogous to those in Panels A and B, respectively, but we assign zero to the firm-bank-quarter observations in which the firm's customers or suppliers do not have any loans

with the same bank. By construction, the average and median values reported are smaller than those of Panels A and B. Nevertheless, the average number of a firm's suppliers and customers borrowing from the same bank as the firm are respectively 4.77 and 4.32 on average.

Finally, we create, for each bank-firm-quarter observation, a dummy variable that receives a value of 1 if the bank is the main lender of the firm (i.e., the bank with the highest outstanding loan amount for that firm) in the last 4 quarters. The average value for this dummy variable is 0.36, meaning that each firm has on average $1/0.36 \approx 2.8$ lending banks in each 4-quarter period. We also create a dummy variable to indicate whether, for each observation, the main bank of the Top 1 supplier is the bank in that observation and another analogous dummy for the firm's Top 1 customer. Panel F in Table 1 shows that the main bank of the firm's Top 1 supplier (Top 1 customer) is the bank in that observation 2.95% (1.96%) of the time. The last two rows in Panel G of Table 1 present descriptive statistics of loan terms: the median borrower has a loan portfolio duration of 0.66 years (8 months) with its bank, pays a 19.21% interest rate (per year), and has 3.51% of loans in arrears.[13]

[13] Duration is a time-weighted average of outstanding loan amount per maturity, provided the granularity available in the credit bureau. For each outstanding loan we have the amount that is due within 1 to 14 days, 15-30 days, 31-60 days, 61-90 days, 91-180, 181-360, 1-2 years, 2-3 years, 3-4 years, 4-5 years, 5-15 years, >15 years to pay. Using the midpoint of those timespans as a proxy to the time to repay the loan (e.g., 45 days for the 31–60-day bracket), we then calculate an average time to receive the payment for that loan. We apply this procedure to both floating and fixed rate loans.

4. Identification Strategy and regression results

In this section, we layout our identification strategy and regression results in four subsections. The first outlines our assumptions and endogeneity concerns. In the second subsection, we provide stylized facts on the overlap between bank lending to firms and their commercial counterparties. Finally, in the third subsection, we provide causal evidence on how new information about the creditworthiness of the customers and suppliers of a firm affects its borrowing terms.

4.1. Lending Across the Supply Chain

To investigate if – and by how much – the loan amount granted to a firm is associated with the amount of loans provided to its suppliers or customers, we estimate the following models:

$$Loan_{i,b,t} = \beta_0 + \beta_1 * AllSuppliers_{i,b,t-4} + \delta_{i,t} + \mu_{b,t} + \varepsilon_{i,b,t} \quad (1)$$

$$Loan_{i,b,t} = \beta_0 + \beta_1 * AllCustomers_{i,b,t-4} + \delta_{i,t} + \mu_{b,t} + \varepsilon_{i,b,t} \quad (2)$$

where $Loan_{i,b,t}$ is the natural logarithm of the outstanding loan amount from bank b to firm i in quarter t; $AllSuppliers_{i,b,t-4}$ ($AllCustomers_{i,b,t-4}$) is a continuous variable equal to the natural logarithm of loans granted by bank b to all of firm i's suppliers (customers) a year before[14]. We saturate the model by including $Firm * Time$ ($\delta_{i,t}$) and $Bank * Time$ ($\mu_{b,t}$) fixed effects in all specifications.

[14] Because supplier loans could be zero, either because the supplier network could not be traced or because the suppliers do not share same bank affiliations as the borrower, we add 1 BRL to

Firm ∗ Time fixed effects enhance our identification strategy by controlling for all the borrowers´ unobserved time-variant characteristics. Most importantly, these fixed effects capture the firm's demand for loans in each quarter, as well as other features such as firm size and indebtedness (Khwaja & Mian, 2008). Furthermore, since our mapping of the firms' suppliers and customers is time-invariant (it is based on 2019 data, i.e., it is a static network), all the time-varying heterogeneities in terms of the suppliers' and customers' networks of firm *i* are already being controlled for. Because we use *firm * time* fixed effects, we restrict our sample to firms that have outstanding loans with at least two different banks in any given quarter. This procedure excludes 10.2% of the observations in the sample.

Bank ∗ Time fixed effects control for any bank-level shock that may affect a bank's lending activities intertemporally. This includes supply-side shocks, such as the opening and closing of branches, funding shocks, interest rate pass-through, and bank-wide credit policy shifts. In all our regressions, the standard errors are robust to heteroscedasticity and clustered at the bank level to account for the correlation of the error term within the observations of the same bank.

Given this multitude of fixed effects, our coefficients show the association between lending to the firm's customers (or suppliers) and to the firm itself, comparing the same firm in the same quarter across banks with different exposure to the firm's customers (or suppliers), after partialling out any firm and

the outstanding loan portfolio. This does not materially affect any of the inferences since loans, when existent, are normally much larger than 1 BRL (see Table 1).

bank time-variant shocks[15]. Hence, a positive β_1 implies that the amount of loans between bank b and the commercial counterparties of firm i is associated with larger credit granting from bank b to firm i.

4.2. Regression Results – Supply Chain Relationships

The output of specification 1 in Panel A of Table 2 provides the first suggestive evidence in favor of our hypothesis: the existence of 'same-bank' loans to *any* of a firm's customers is associated with a 15.60% increase in loans to the firm at the same bank on average. The results of Column 2 show that a 100% increase in the loan amount provided to a firm's customers translates to a 1.46% increase in the firm's loan amount.

The estimates reported in Column 3 of Table 2 show that increasing the number of customers that have outstanding loans with the same bank also corresponds to larger credit granting. This effect increases monotonically in the number of customers and may add up to +60.09% when the firm have more than 20 same-bank relationships to their customers.

In the next columns of Table 2 (Panel A) we replicate the same specification to other loans terms. At the extensive margin we find that customers sharing a common lending bank to their borrower do not translate into lower interest rates (column 4) or longer duration (column 7). Notwithstanding, in the intensive

[15] Due to the very large number of customers and banks (as well as their interactions terms with the time variable), we "lose" more than 800,000 degrees of freedom after the inclusion of $firm * time$ and $bank * time$ fixed effects. Although we understand that the inclusion of fixed effects is a necessary feature in our model, we have run a series of models without them (omitted here). The results do not change materially.

margin we show that the borrower pays lower rates or have longer duration portfolios by a common-bank lending (Columns 5 and 8). Regarding the number of customers with same-bank loans, we find that the aforementioned result is again found for interest rates (Column 6), but not for portfolio duration (Column 9).

Panel B of Table 2 reports the analogous results replacing customers with suppliers. The effect of sharing the same lending bank with *any* of the firm's suppliers is a 14.94% increase in loans to the firm, whereas doubling the amount of loans to the firm's customers results in a 1.35% increase in lending to the firm. The effect of the number of same-bank customers also increases monotonically (Column 3).

Regarding interest rates and customer same-bank lending, the only (statistically significant) outcome is that when many same-bank relationships exist (e.g. more than 20), the borrower may experience a lower 5.43% interest rate (Column 6, Table 2-B). Finally, loan duration does appear to be only marginally affected by same-bank supplier lending (Columns 7-9, Table 2-B).

Although the presence of bank and firm time-variant fixed effects alleviates identification concerns over supply-side and demand-side driven unobserved heterogeneities, a possible concern is that borrowers might be transferring resources (e.g., trade credit) to their customers and suppliers to prevent them from being credit constrained (Biais and Gollier 1997, Petersen and Rajan 1997). Table A.1 in the appendix reports separate regression estimations for each

quarter between 2018 and 2020 (i.e., cross-sectional regressions), and the results are qualitatively similar. Since our definition of the business relationships between firms relies on 2019 money transfer data, it is very unlikely that this mechanism brings any bias into *every* period of cross-sectional regressions. [16]

[16] Another valid concern is that borrowers who deal with suppliers who share banking affiliations are (nonlinearly) different from their counterparties. Moreover, the real mechanism behind borrower and supplier (or customer) loans portfolios relation could be blurred by disappearing firms, (e.g. due to the write-off of "falling angels" portfolios). To address these concerns, we filter our sample in the specifications reported in Table A.2 in the Appendix as follows: (i) for firms that have at least one customer or one supplier that have loans with the same bank (Columns 1 and 4); (ii) for borrowers that remain in the bank portfolio throughout the entire sample period (Columns 2 and 5) and (iii) for both previous filters simultaneously (Columns 3 and 6). Qualitatively, the results do not change.

Table 2 - Lending and Business Ties

Panel A - Customer and Borrower Lending

VARIABLES	(1) Ln (Loan)	(2) Ln (Loan)	(3) Ln (Loan)	(4) Int. Rate (%)	(5) Int. Rate (%)	(6) Int. Rate (%)	(7) Ln (duration)	(8) Ln (duration)	(9) Ln (duration)
Dummy (All Customers)	0.1560***			0.1796			0.0225		
	(0.0356)			(0.9866)			(0.0146)		
Ln (Loans to all customers)		0.0146***			-0.0997**			0.0018**	
		(0.0022)			(0.0450)			(0.0007)	
Dummy (firm has 1 to 5 same-bank customers)			0.1441***			0.4245			0.0229
			(0.0338)			(1.0063)			(0.0148)
Dummy (firm has 6 to 10 same-bank customers)			0.2999***			-3.3589***			0.0274
			(0.0489)			(0.6653)			(0.0204)
Dummy (firm has 11 to 15 same-bank customers)			0.4071***			-4.9254***			-0.0121
			(0.0727)			(1.1559)			(0.0311)
Dummy (firm has 16 to 20 same-bank customers)			0.4537***			-6.1434***			-0.0009
			(0.1083)			(1.5669)			(0.0349)
Dummy (firm has 21+ same-bank customers)			0.6009***			-9.2816***			0.0090
			(0.1286)			(2.7166)			(0.0474)
Constant	12.1619***	12.1335***	12.1242***	48.5150***	49.1122***	49.3028***	-0.8538***	-0.8563***	-0.8523***
	(0.0116)	(0.0119)	(0.0110)	(0.3224)	(0.2431)	(0.1995)	(0.0048)	(0.0040)	(0.0039)
Observations	2,468,711	2,468,711	2,468,711	1,999,445	1,999,445	1,999,445	2,468,711	2,468,711	2,468,711
R-squared	0.5093	0.5095	0.5097	0.4442	0.4442	0.4444	0.4667	0.4667	0.4667
Bank-Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Borrower-Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Clusters	115	115	115	99	99	99	115	115	115

Robust standard errors in parentheses (clustered at bank level)

*** p<0.01, ** p<0.05, * p<0.1

Table 2 - Lending and Business Ties (cont.)

Panel B - Supplier and Borrower Lending

VARIABLES	(1) Ln (Loan)	(2) Ln (Loan)	(3) Ln (Loan)	(4) Int. Rate (%)	(5) Int. Rate (%)	(6) Int. Rate (%)	(7) Ln (duration)	(8) Ln (duration)	(9) Ln (duration)
Dummy (All Suppliers)	0.1494***			0.7386			0.0367*		
	(0.0445)			(1.1909)			(0.0220)		
Ln (Loans to all Suppliers)		0.0135***			-0.0175			0.0013	
		(0.0029)			(0.0544)			(0.0014)	
Dummy (firm has 1 to 5 same-bank suppliers)			0.1421***			0.8269			0.0364*
			(0.0410)			(1.0881)			(0.0207)
Dummy (firm has 6 to 10 same-bank suppliers)			0.2749***			-1.5805			0.0144
			(0.0558)			(1.6081)			(0.0340)
Dummy (firm has 11 to 15 same-bank suppliers)			0.3470***			-4.0115***			0.0211
			(0.0444)			(1.0870)			(0.0385)
Dummy (firm has 16 to 20 same-bank suppliers)			0.4096***			-5.1451***			0.0172
			(0.0511)			(1.1501)			(0.0458)
Dummy (firm has 21+ same-bank suppliers)			0.4574***			-5.4314**			-0.0520
			(0.1117)			(2.2894)			(0.0594)
Constant	12.1509***	12.1156***	12.1089***	48.2654***	48.7004***	49.1370***	-0.8617***	-0.8559***	-0.8529***
	(0.0185)	(0.0207)	(0.0161)	(0.4973)	(0.3940)	(0.3189)	(0.0092)	(0.0103)	(0.0100)
Observations	2,468,711	2,468,711	2,468,711	1,999,445	1,999,445	1,999,445	2,468,711	2,468,711	2,468,711
R-squared	0.5093	0.5094	0.5096	0.4442	0.4442	0.4443	0.4667	0.4667	0.4667
Bank-Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Borrower-Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Clusters	115	115	115	99	99	99	115	115	115

Robust standard errors in parentheses (clustered at bank level)
*** p<0.01, ** p<0.05, * p<0.1

Notes: *Loan*, All Customers, All Suppliers and *Number of Customers* (*Suppliers*) are defined as in Table 1; *Dummy (All Suppliers)* and *Dummy (All Customers)* is a binary variable equal to one if any of the firm´s suppliers or customers, respectively, has an outstanding loan at the same bank; The dummies "*firm has N to M same-bank suppliers*" and "*firm has N to M same-bank customers*" receives 1 if the number of suppliers (or customers, respectively) that have outstanding loans with the same bank is between N and M, and 0 otherwise. All independent variables are measured with a one-year lag. We denote significance at 10%, 5%, and 1% with $*$, $**$, and $***$, respectively. Robust standard errors clustered at the bank level are reported in parentheses.

We then check whether the intensity (rather than the mere existence) of the relationship of a bank with a firm's customers (or suppliers) increases the amount of loans from that bank to the firm. The estimations in Table 3 show that a customer´s close relationship with its bank also plays an important role in cross-client bank lending. In Column 1, we create a dummy (*main bank(top1)*) that takes a value of 1 if bank *b* is the lender with the largest amount of loans to the top customer (or supplier, in the analogous regressions) of firm *i*. The results from Column 1, 3, and 5 of Panel A show that being the main bank of the firm's Top 1 customer is associated with an increase of 19.03% in loan amount, -1.81% interest rate and a 4.37% longer duration, respectively. In Panel B, Columns 1, 3 and 5, we re-do these same specifications for suppliers and find qualitatively similar results for loan amounts and interest rates rate.

Furthermore, to measure relationship intensity in a more granular manner, we replace the *main bank* dummies with another variable that is extensively used in the literature, the proportion of the firms' total borrowing from a given bank. In the estimations reported in Columns 2, 4 and 6 of Table 3, we replicate previous specifications using this independent variable. The results are qualitatively similar, albeit non statistically significant on customers pricing (Column 3, Panel A of Table 3).

To summarize, in this section we have exhibited some stylized facts relating loan terms and bank lending relationships along the supply chain. In the next section, we show our main model, which provides (causal) evidence that those relationships do matter for bank lending.

Table 3 - Main Bank Associations

Panel A - Most Relevant Customer (i.e. Top1 Customer)

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Ln (Loan)		Int. Rate (%)		Ln (duration)	
Main Bank of Top1 Customer	0.1903***		-1.8128***		0.0437***	
	(0.0278)		(0.5977)		(0.0093)	
Bank Share Top1 Customer		0.0021***		-0.0052		0.0005***
		(0.0004)		(0.0080)		(0.0002)
Constant	12.0136***	12.2093***	52.3826***	48.5830***	-0.8954***	-0.8473***
	(0.0005)	(0.0008)	(0.0119)	(0.0141)	(0.0002)	(0.0003)
Observations	3,211,146	2,468,711	2,594,186	1,999,445	3,211,146	2,468,711
R-squared	0.4789	0.5092	0.4309	0.4442	0.4636	0.4667
Bank-Time FE	YES	YES	YES	YES	YES	YES
Borrower-Time FE	YES	YES	YES	YES	YES	YES
Clusters	126	115	113	99	126	115

Robust standard errors in parentheses (clustered at bank level)
*** p<0.01, ** p<0.05, * p<0.1

Table 3 - Main Bank Associations (cont.)

Panel B - Most Relevant Supplier (i.e. Top1 Supplier)

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Ln (Loan)		Int. Rate (%)		Ln (duration)	
Main Bank of Top1 Supplier	0.1476***		-2.1999***		0.0141	
	(0.0317)		(0.5113)		(0.0090)	
Bank Share Top1 Supplier		0.0021***		-0.0382***		0.0002
		(0.0006)		(0.0143)		(0.0001)
Constant	12.0130***	12.2075***	52.4130***	48.6754***	-0.8950***	-0.8470***
	(0.0009)	(0.0014)	(0.0154)	(0.0380)	(0.0003)	(0.0004)
Observations	3,211,146	2,468,711	2,594,186	1,999,445	3,211,146	2,468,711
R-squared	0.4789	0.5092	0.4309	0.4443	0.4636	0.4667
Bank-Time FE	YES	YES	YES	YES	YES	YES
Borrower-Time FE	YES	YES	YES	YES	YES	YES
Clusters	126	115	113	99	126	115

Robust standard errors in parentheses (clustered at bank level)

*** p<0.01, ** p<0.05, * p<0.1

Notes: Loan is defined as in Table 1; *Main Bank of the Top1 Supplier* and *Main Bank of the Top1 Customer* are dummy variables equal to 1 for the bank with the largest 12 month loan exposure to the Top1 supplier and the Top1 customer, respectively; *Bank Share Top 1 Customer* and *Bank Share Top 1 Supplier* are the proportion of the firms' major customer and major supplier total borrowing from a given bank. All independent variables are measured with a one-year lag. We denote significance at 10%, 5%, and 1% with $*$, $**$, and $***$, respectively. Robust standard errors clustered at the bank level are reported in parentheses.

4.3. Do banks respond to negative surprises conveyed by loans to commercial counterparties?

The results shown in the previous sections suggest that lending to firms linked by business ties seems to provide information to banks about their borrowers. Therefore, according to our second hypothesis, we expect that when a negative credit event occurs to a connected firm, such as a loan falling into arrears, valuable information is conveyed to banks in their credit granting process, and the banks should respond by adjusting loan terms.

Before we enter into the model detail, it is worth depicting some possible banking relationships along the supply chain. First, there are banks that lend to borrowers but not to their Top 1 customer (we call this group 'G1"). Alternatively, there are 'common banks', which lend to borrowers and to top 1 customers that did not fall into arrears ("G2") or, otherwise, whose top 1 customer fell into arrears ("G3").[17]

Our initial model in this section is a comparison between banks that lend along the supply chain (i.e. G3 and G2), versus banks that do not (G1). In this model, we also differentiate between banks that receive the negative information directly (G3) and the ones that do not have any loan falling into arrears with the Top 1 customer (G2).

[17] Analogous figures do exist regarding Top 1 supplier banking relationships.

Our treatment variable (*Arrears*) is an indicator that assumes a value equal to 1 if firm *i*'s top customer (supplier) has any loan falling into arrears for 14 days or more with bank *b* in a given quarter (but did not in the previous four quarters) and zero otherwise. Because firm *i*'s top supplier did not have any loans in arrears with the same bank in the previous year, the information is a "negative surprise shock" to the bank about the creditworthiness of firm *i*'s top supplier.

Since our treatment events are staggered over time, we adopt the stacked approach (for example, as in Gormley and Matsa, 2011), i.e., we pool the data across quarters (cohorts) *c* to estimate the average treatment effect. This econometric approach alleviates concerns over firms that might be treated after the shock, i.e. a bad control (Callaway and Sant'Anna, 2018; Chaisemartin and D'Haultfœuille, 2020).

Our 'triple diff' model captures the different treatment effect between borrowers whose main customer or borrower fall into arrears (1st difference), before and after they fall into arrears (2nd difference), comparing common banks in which they effectively entered into arrears versus all other common banks (3rd difference). We leverage on a recent strand of econometric literature on diff-in-diff models (see, for instance, Baker et al 2022), adding a further third difference into those models. We use six quarters of data around each cohort *c*.

$$LoanTerms_{i,b,t,c} = \omega_0 + \omega_1 CommonBank_{i,b,c} + \omega_2 CommonBank_{i,b,c} * Arrears_{i,b,c} + \omega_3 CommonBank_{i,b,c} * Post_{t,c} + \omega_4 CommonBank_{i,b,c} * Post_{t,c} * Arrears_{i,b,c} + \delta_{i,t,c} + \mu_{b,t,c} + \varepsilon_{i,b,t,c} \quad (3)$$

$Post_{t,c}$ is a dummy that takes a value equal to 1 in the three quarters that follow cohort (quarter) c and 0 in the three quarters preceding it.[18]

We use four different measures for the dependent variable, $LoanTerms_{i,b,t,c}$: i) the loan amount outstanding of firm i with bank b in quarter t for cohort c; ii) the average interest rate charged by bank b for firm i in quarter t for cohort c; iii) the average duration of the loans provided by bank b to firm i in quarter t for cohort c; iv) the percentage of the borrower´s loan that are in arrears for more than 14 days.

Our main coefficient of interest is ω_4, which shows, for a given borrower that has loans with at least two banks, how its loan terms with bank A change when bank A receives a negative surprise from its lending relationship with the firm`s top customer (or supplier), in comparison to bank B, which does not receive such negative information. To rule out possible concerns of a major customer (supplier) being economically insignificant to the borrower, we only label as treated borrowers whose top 1 customer (supplier) receives (pays) more than 25% of all money transfer from (to) the borrower.

*Bank * time * cohort* fixed effects are denoted by $\mu_{b,t,c}$ and account for supply-side shocks at different banks in each quarter by cohort. Our regressions also include *firm * time * cohort* fixed effects to account for each firm`s demand for loans and any change in its creditworthiness that can be inferred by all its lending banks.

[18] We exclude 'control firms' whose main supplier or customer fall into arrears in the "post shock" period (i.e. a bad control); and 'treated firms' that fell into arrears before the shock (i.e. they will be treated firms, but on prior cohorts).

Since our network of suppliers is static (i.e., time invariant), we also have an embedded fixed effect on "*top supplier* $*$ *time*" in the specification of Equation (3). This econometric feature of our model controls for supplier and customer time-variant heterogeneities (e.g., an overall deterioration of the creditworthiness of the commercial counterparty that could be observed by all the banks that lend to firm *i*). Therefore, the only variation that is left in this setup is the bank-firm-customer relationship.

The results reported in Columns 1 to 4 of Table 4 show that lending terms are more favorable to borrowers whenever they share a common bank to their supply chain partner: lending size is 35.98% (33.44%) larger for banks that also lend to customers (suppliers); interest rates are 5.36% (6.56%) smaller; duration is 11.69% (11.88%) bigger (Panel A and B, respectively).[19]

Notwithstanding, after one of the customers enter into arrears, borrowers in a common bank relationship experience a diminish in lending size (-3.34%), lower interest rate (-0.86%), lower duration (-4.96%) and more loans in arrears (+0.19%) (Table 4-A, Columns 1-4), with similar effects when it is the supplier that enters into arrears (Table 4-B, Columns 1-4). The columns 5-8 from Panels A and B at Table 4 also shows that firms which remain borrowing from the same (common) bank are able to smooth out the negative shock, increasing in lending size (column 5), with mixed results on pricing (column 6), duration (column 7) and loans in arrears (column 8).

[19] These effects are analogous to the ones that we have shown in Section 4.2., i.e. common bank lenders supply loans at more favorable terms.

Next, we focus on our main coefficient of interest, which is the triple difference (ω_4). For a given borrower with multiple common lending bank, we track what are the loan terms between banks that experience a top 1 customer falling into arrears versus others, before and after the fall. Table 4 (Panel A) shows that when a Top 1 customer in a common bank relationship falls into arrears interest rates rise by 4.67% or 5.86% (Columns 2 or 6, respectively), with a minor reduction in duration for the firms that remain in sample through the entire cohort (-5.68%, Column 7, Table 4-A).

Irrespectively if the shocks are stemming from customers or suppliers that fall into arrears, Table 4 also shows evidence that borrowers strategically choose to fall into arrears in the banks that that are (also) experiencing loans falling into arrears by Top 1 Customer or Supplier (column 4 or 8, panel A and B).

As we have shown in the descriptive statistics (see Section 3), in our sample it is seldom to find borrowers and major customer or suppliers that share a common lending bank. Still, we hypothesize that common lenders which experience a *direct* shock on the borrower´s major customer or supplier falling into arrears, , receive a more timely and accurate information. Therefore, we go one step further and build a model only on a common bank relationship sample. We compare banks that lend at the same time to borrowers and to their business ties and did not experience a negative shock (i.e. our control group, or G2) and borrowers whose Top 1 Customer (or Supplier) fell into arrears (our treatment group, or G3).

Table 5 (Panel B) shows that within a given borrower whose top 1 customer fell into arrears in one common bank but not on others, 'treated' borrowers face higher interest rates (+8.44%), lower duration (-11.02%) and a higher share of loans falling into arrears (+1.25%), either at the raw sample (columns 1-4) or at borrower whose major business ties remain through the entire cohort (i.e. six quarters, columns 5-8).

Interestingly, Panel B at Table 5 shows that the aforementioned effect on pricing (column 2 and 6) and duration (columns 3 and 7) do not stand out when it is the top 1 supplier, not the top 1 customer, that falls into arrears.

The evidence above shows that banks acknowledge the fact that customers and suppliers that endure harsh times may passthrough part of the risk along the supply chain, affecting borrower´s creditworthiness. That is why banks react: when it is the customer that fall into arrears, banks 'price in' the new information set, increasing interest rates and lowering duration to the borrower. Alternatively, when it is the supplier that fall into arrears, borrower' loan terms are not significantly altered.

Table 4 - DiDiD: Top1 Customer (or Top 1 Supplier) falling into arrears

Panel A - Top 1 Customer fall into arrears

VARIABLES	(1) Ln(loan)	(2) Int. rate (%)	(3) Ln(duration)	(4) Loan in arrears	(5) Ln(loan)	(6) Int. rate (%)	(7) Ln(duration)	(8) Loan in arrears
Common bank	0.3598***	-5.3581***	0.1169***	-0.0019	0.0909***	-0.3872	-0.0180	0.0013
	(0.0319)	(1.2068)	(0.0188)	(0.0020)	(0.0217)	(0.6955)	(0.0132)	(0.0014)
Common Bank * Top 1 customer in arrears	-0.1163*	-1.8488	0.0583	-0.0024	0.0179	-2.1756	0.0824*	-0.0006
	(0.0692)	(2.0342)	(0.0560)	(0.0029)	(0.0562)	(2.1044)	(0.0420)	(0.0012)
Common bank * Post	-0.0334*	-0.8696***	-0.0496***	0.0019***	0.0219*	0.1489	0.0153*	0.0003
	(0.0178)	(0.2521)	(0.0132)	(0.0006)	(0.0114)	(0.3241)	(0.0082)	(0.0006)
Common bank * Top 1 customer in arrears * Post	0.0710	4.6740*	-0.0388	0.0055	0.0016	5.8693**	-0.0568*	0.0050*
	(0.0503)	(2.6791)	(0.0503)	(0.0036)	(0.0388)	(2.5293)	(0.0335)	(0.0027)
Constant	11.9923***	53.8716***	-0.9246***	0.0309***	12.4425***	46.4170***	-0.6600***	0.0206***
	(0.0015)	(0.0539)	(0.0008)	(0.0001)	(0.0013)	(0.0382)	(0.0007)	(0.0001)
Observations	14,184,261	11,506,283	14,184,261	14,184,261	9,591,796	7,802,337	9,591,796	9,591,796
R2	0.4871	0.4368	0.4633	0.5498	0.5572	0.4604	0.4913	0.5455
Bank x Quarter x Cohort FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm x Quarter x Cohort FE	YES	YES	YES	YES	YES	YES	YES	YES
Borrower survived in cohort (6 quarters)	NO	NO	NO	NO	YES	YES	YES	YES
Clusters	126	113	126	126	113	97	113	113

Table 4 - DiDiD: Top1 Customer (or Top 1 Supplier) falling into arrears (cont.)

Panel B - Top 1 Supplier fall into arrears

VARIABLES	(1) Ln(loan)	(2) Int. rate (%)	(3) Ln(duration)	(4) Loan in arrears	(5) Ln(loan)	(6) Int. rate (%)	(7) Ln(duration)	(8) Loan in arrears
Common bank	0.3344***	-6.5560***	0.1188***	-0.0009	0.0795***	-1.6188	-0.0037	0.0011
	(0.0445)	(1.5455)	(0.0223)	(0.0022)	(0.0298)	(1.1194)	(0.0110)	(0.0012)
Common Bank * Top 1 supplier in arrears	-0.1568***	2.1116	-0.0429	-0.0028	-0.1306**	1.1200	-0.0508*	-0.0016
	(0.0406)	(1.6001)	(0.0262)	(0.0024)	(0.0524)	(2.5162)	(0.0295)	(0.0013)
Common bank * Post	-0.0217	-1.4496***	-0.0641***	0.0024***	0.0309***	-0.6845**	-0.0101	0.0020**
	(0.0169)	(0.4264)	(0.0116)	(0.0007)	(0.0084)	(0.3207)	(0.0089)	(0.0008)
Common bank * Top 1 supplier in arrears * Post	0.0307	-0.6194	0.0063	0.0078***	-0.0130	-0.4532	0.0102	0.0070**
	(0.0313)	(2.0620)	(0.0253)	(0.0026)	(0.0287)	(1.7984)	(0.0265)	(0.0028)
Constant	11.9916***	53.9556***	-0.9225***	0.0309***	12.4403***	46.5230***	-0.6590***	0.0205***
	(0.0029)	(0.1128)	(0.0012)	(0.0001)	(0.0023)	(0.0820)	(0.0009)	(0.0001)
Observations	14,012,071	11,351,148	14,012,071	14,012,071	9,506,145	7,725,170	9,506,145	9,506,145
R2	0.4892	0.4384	0.4643	0.5502	0.5582	0.4612	0.4917	0.5454
Bank x Quarter x Cohort FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm x Quarter x Cohort FE	YES	YES	YES	YES	YES	YES	YES	YES
Borrower survived in cohort (6 quarters)	NO	NO	NO	NO	YES	YES	YES	YES
Clusters	126	113	126	126	113	97	113	113

Notes: *Loan* is defined as in Table 1; *Int. Rate (%)* is the value-weighted average interest rate for all fixed rate loans of firm *i* at bank *b* in quarter *t*; *Ln (duration)* is the natural logarithm of the duration of the loan portfolio of firm *i* at bank *b* in quarter *t; Loans in arrears* is the ratio of firm loans in arrears for 14 days or more; *Common Bank* is dummy equal to 1 if the firm and its Top 1 Customer (or Supplier) have loan in the same bank; *Top 1 Customer (Supplier) in arrears* is an indicator that assumes value of 1 if firm i's major customer (or supplier) has any loan falling into arrears for 14 days or more with the bank in a given cohort, and zero otherwise; *Post* is a dummy that takes a value equal to 1 in the three quarters that follow cohort (quarter) c and 0 in the three quarters preceding it. We denote significance at 10%, 5%, and 1% with $*$, $**$, and $***$, respectively. *Post* is a dummy that assumes 1 in the four quarters that follow cohort c and 0 in the four quarters preceding it. Robust standard errors clustered at the bank level are reported in parentheses.

Table 5 - DiDiD: Top1 Customer (or Top 1 Supplier) falling into arrears in a common bank to the borrower (only common bank sample)

Panel A - Top 1 Customer fall into arrears

VARIABLES	(1) Ln(loan)	(2) Int. rate (%)	(3) Ln(duration)	(4) Loan in arrears	(5) Ln(loan)	(6) Int. rate (%)	(7) Ln(duration)	(8) Loan in arrears
Top 1 Cust. arrears in common bank	0.1222**	-7.3463**	0.1195***	-0.0027	0.2389***	-4.8558*	0.0937***	-0.0002
	(0.0458)	(3.1702)	(0.0306)	(0.0017)	(0.0693)	(2.7186)	(0.0318)	(0.0022)
Top 1 Cust. arrears in common bank * Post	-0.0427	8.4426***	-0.1102***	0.0125***	-0.0072	8.7846***	-0.0631**	0.0104***
	(0.0360)	(1.9810)	(0.0389)	(0.0037)	(0.0549)	(2.1335)	(0.0279)	(0.0038)
Constant	12.8298***	46.2369***	-0.8245***	0.0116***	13.0842***	41.4538***	-0.7065***	0.0087***
	(0.0006)	(0.0400)	(0.0003)	(0.0000)	(0.0008)	(0.0310)	(0.0005)	(0.0000)
Observations	408,147	327,508	408,147	408,147	268,958	216,600	268,958	268,958
R2	0.6232	0.5200	0.5661	0.5888	0.6536	0.5270	0.5887	0.5867
Bank x Quarter x Cohort FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm x Quarter x Cohort FE	YES	YES	YES	YES	YES	YES	YES	YES
Top 1 Customer survived in cohort (6 quarters)	NO	NO	NO	NO	YES	YES	YES	YES
Clusters	56	53	56	56	43	38	43	43

Table 5 - DiDiD: Top1 Customer (or Top 1 Supplier) falling into arrears (only common bank sample) (cont.)

Panel B - Top 1 Supplier fall into arrears

VARIABLES	(1) Ln(loan)	(2) Int. rate (%)	(3) Ln(duration)	(4) Loan in arrears	(5) Ln(loan)	(6) Int. rate (%)	(7) Ln(duration)	(8) Loan in arrears
Top 1 Supplier arrears in common bank	-0.0706	1.7481	-0.0228	-0.0031	-0.1382***	0.6993	-0.0541	0.0011
	(0.0524)	(2.5577)	(0.0259)	(0.0024)	(0.0387)	(4.1524)	(0.0373)	(0.0022)
Top 1 Supplier arrears in common bank * Post	-0.0012	-1.7406	-0.0161	0.0105**	0.0044	-1.0982	-0.0075	0.0083
	(0.0246)	(3.3384)	(0.0276)	(0.0043)	(0.0259)	(4.5402)	(0.0376)	(0.0063)
Constant	12.6947***	47.1914***	-0.8084***	0.0138***	12.9407***	42.9464***	-0.6758***	0.0099***
	(0.0007)	(0.0312)	(0.0002)	(0.0000)	(0.0005)	(0.0383)	(0.0004)	(0.0000)
Observations	587,582	482,715	587,582	587,582	380,764	313,097	380,764	380,764
R2	0.6162	0.5135	0.5554	0.6156	0.6548	0.5197	0.5694	0.6100
Bank x Quarter x Cohort FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm x Quarter x Cohort FE	YES	YES	YES	YES	YES	YES	YES	YES
Top 1 Supplier survived in cohort (6 quarters)	NO	NO	NO	NO	YES	YES	YES	YES
Clusters	52	49	52	52	43	43	43	43

Notes: *Loan* is defined as in Table 1; *Int. Rate (%)* is the value-weighted average interest rate for all fixed rate loans of firm *i* at bank *b* in quarter *t*; *Ln (duration)* is the natural logarithm of the duration of the loan portfolio of firm *i* at bank *b* in quarter *t; Loans in arrears* is the ratio of firm loans in arrears for 14 days or more; *Top 1 Customer (Supplier) in arrears* is an indicator that assumes value of 1 if firm i's major customer (or supplier) has any loan falling into arrears for 14 days or more with the bank in a given cohort, and zero otherwise; *Post* is a dummy that takes a value equal to 1 in the three quarters that follow cohort (quarter) c and 0 in the three quarters preceding it. We denote significance at 10%, 5%, and 1% with $*$, $**$, and $***$, respectively. *Post* is a dummy that assumes 1 in the four quarters that follow cohort c and 0 in the four quarters preceding it. Robust standard errors clustered at the bank level are reported in parentheses.

5. Conclusion

This paper shows that bank lending across the supply chain conveys information to banks that lend to medium and large firms in Brazil. We document that borrowers benefit from a larger access to loans when their customers and suppliers share the same lending bank.

Nevertheless, we also show that banks react to negative information about the firm's commercial counterparties creditworthiness by tightening the firm's loan terms. This passthrough is more straightforward when the shock takes place at major customer, not a major supplier. These effects strongly suggest that banks re-estimate the risk of firms by incorporating valuable information that they obtain from lending along the supply chain. Indeed, by lending to the firm's business ties banks may anticipate a future contagion, which we also verify in our data.

The avenues for future research are promising. It would be interesting to understand the firm-level implications of our results in terms of incentives for firms in choosing their lending banks. First, firms may induce their business partners to migrate toward the same financial institution to obtain further access to loans; second, they could *ex ante* choose a bank that already has relationships with their business ties to obtain more favorable access to financing; third, they could strategically coordinate which bank to default.

Another possible research stream would be to examine the bank-level incentives of this feature. The overlap of network loan exposures and loss-given default

minimization may induce banks to forbear existing loans (Mourad et al. 2020; Bonfim et al., 2021) or postpone judicial recovery processes when they foresee negative network externalities. Finally, one could study, for instance, other types of cross-client exposures that stem not only from loans but also from other types of contingent exposures such as lines of credit and OTC derivatives.

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APPENDIX

Table A.1 - Cross-section regressions

Panel A - Customer and Borrower Lending

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
VARIABLES	Ln (Loan)	Ln (Loan)	Ln (Loan)	Ln (Loan)	Ln (Loan)	Ln (Loan)	Ln (Loan)	Ln (Loan)	Ln (Loan)	Ln (Loan)	Ln (Loan)
Ln (All Customers)	0.0130***	0.0118***	0.0139***	0.0149***	0.0139***	0.0158***	0.0154***	0.0149***	0.0156***	0.0158***	0.0154***
	(0.0024)	(0.0025)	(0.0024)	(0.0026)	(0.0028)	(0.0022)	(0.0023)	(0.0026)	(0.0021)	(0.0021)	(0.0024)
Constant	12.1433***	12.1605***	12.1649***	12.1744***	12.1748***	12.0725***	12.0909***	12.1400***	12.1379***	12.0458***	12.1660***
	(0.0123)	(0.0131)	(0.0125)	(0.0136)	(0.0152)	(0.0119)	(0.0125)	(0.0145)	(0.0120)	(0.0119)	(0.0140)
Observations	228,754	224,266	221,171	221,955	220,926	224,572	223,990	224,090	223,456	227,464	228,067
R-squared	0.5253	0.5248	0.5259	0.5275	0.5264	0.5035	0.5019	0.4990	0.5039	0.4924	0.4932
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Borrower FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Period	Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20
Clusters	103	106	104	106	104	104	104	103	102	104	103

Robust standard errors in parentheses (clustered at bank level)
*** p<0.01, ** p<0.05, * p<0.1

Panel B - Supplier and Borrower Lending

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
VARIABLES	Ln (Loan)	Ln (Loan)	Ln (Loan)	Ln (Loan)	Ln (Loan)	Ln (Loan)	Ln (Loan)	Ln (Loan)	Ln (Loan)	Ln (Loan)	Ln (Loan)
Ln (All Suppliers)	0.0129***	0.0135***	0.0138***	0.0124***	0.0144***	0.0139***	0.0148***	0.0133***	0.0141***	0.0131***	0.0124***
	(0.0030)	(0.0032)	(0.0031)	(0.0031)	(0.0033)	(0.0033)	(0.0029)	(0.0034)	(0.0029)	(0.0030)	(0.0027)
Constant	12.1226***	12.1286***	12.1421***	12.1667***	12.1472***	12.0579***	12.0672***	12.1251***	12.1202***	12.0362***	12.1597***
	(0.0203)	(0.0217)	(0.0212)	(0.0215)	(0.0234)	(0.0241)	(0.0211)	(0.0251)	(0.0216)	(0.0229)	(0.0208)
Observations	228,754	224,266	221,171	221,955	220,926	224,572	223,990	224,090	223,456	227,464	228,067
R-squared	0.5253	0.5249	0.5259	0.5274	0.5264	0.5034	0.5019	0.4989	0.5038	0.4923	0.4931
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Borrower FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Period	Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20
Clusters	103	106	104	106	104	104	104	103	102	104	103

Table A.1 - Cross-section regressions (cont.)

Panel C - Customer and Borrower Lending

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
VARIABLES	Int. Rate (%)	Int. Rate (%)	Int. Rate (%)	Int. Rate (%)	Int. Rate (%)	Int. Rate (%)	Int. Rate (%)	Int. Rate (%)	Int. Rate (%)	Int. Rate (%)	Int. Rate (%)
Ln (All Customers)	-0.1120**	-0.1403***	-0.1184**	-0.0677	-0.0416	-0.1707**	-0.0918*	-0.1321*	-0.1069	-0.0652	-0.0521
	(0.0482)	(0.0517)	(0.0472)	(0.0492)	(0.0575)	(0.0723)	(0.0472)	(0.0746)	(0.0960)	(0.0708)	(0.0773)
Constant	48.9659***	48.1865***	48.8073***	50.6885***	52.8501***	55.8874***	51.3613***	49.3128***	50.2730***	43.5077***	40.1252***
	(0.2416)	(0.2623)	(0.2436)	(0.2613)	(0.3062)	(0.3913)	(0.2591)	(0.4187)	(0.5408)	(0.4024)	(0.4418)
Observations	189,431	184,262	180,248	182,114	180,903	183,671	181,797	179,575	179,679	179,232	178,533
R-squared	0.4424	0.4421	0.4389	0.4567	0.4622	0.4546	0.4400	0.4383	0.4394	0.4220	0.4216
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Borrower FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Period	5	6	7	8	9	10	11	12	13	14	15
Clusters	84	86	88	91	90	89	91	87	87	88	89

Robust standard errors in parentheses (clustered at bank level)
*** p<0.01, ** p<0.05, * p<0.1

Panel D - Supplier and Borrower Lending

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
VARIABLES	Int. Rate (%)	Int. Rate (%)	Int. Rate (%)	Int. Rate (%)	Int. Rate (%)	Int. Rate (%)	Int. Rate (%)	Int. Rate (%)	Int. Rate (%)	Int. Rate (%)	Int. Rate (%)
Ln (All Suppliers)	-0.0740	-0.0464	0.0649	0.0272	-0.0931	-0.0356	-0.0304	0.0665	0.0155	-0.0271	-0.0524
	(0.0723)	(0.0701)	(0.0478)	(0.0604)	(0.0855)	(0.0835)	(0.0550)	(0.0768)	(0.0796)	(0.0955)	(0.0602)
Constant	48.9006***	47.7913***	47.7492***	50.1360***	53.2926***	55.2221***	51.0821***	48.0724***	49.5534***	43.3448***	40.2305***
	(0.4856)	(0.4785)	(0.3294)	(0.4280)	(0.6096)	(0.6059)	(0.4066)	(0.5758)	(0.6034)	(0.7303)	(0.4634)
Observations	189,431	184,262	180,248	182,114	180,903	183,671	181,797	179,575	179,679	179,232	178,533
R-squared	0.4424	0.4421	0.4389	0.4567	0.4622	0.4546	0.4400	0.4383	0.4394	0.4220	0.4216
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Borrower FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Period	5	6	7	8	9	10	11	12	13	14	15
Clusters	84	86	88	91	90	89	91	87	87	88	89

Table A.1 - Cross-section regressions (cont.)

Panel E - Customer and Borrower Lending

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
VARIABLES	Ln (duration)	Ln (duration)	Ln (duration)	Ln (duration)	Ln (duration)	Ln (duration)	Ln (duration)	Ln (duration)	Ln (duration)	Ln (duration)	Ln (duration)
Ln (All Customers)	0.0007	0.0000	0.0002	0.0021**	0.0026***	0.0020**	0.0021**	0.0019*	0.0020	0.0032***	0.0028**
	(0.0009)	(0.0009)	(0.0009)	(0.0008)	(0.0010)	(0.0010)	(0.0008)	(0.0011)	(0.0013)	(0.0012)	(0.0012)
Constant	-0.8838***	-0.8571***	-0.8660***	-0.8799***	-0.9110***	-0.9262***	-0.9041***	-0.8800***	-0.8919***	-0.7815***	-0.6430***
	(0.0047)	(0.0049)	(0.0047)	(0.0044)	(0.0051)	(0.0053)	(0.0046)	(0.0061)	(0.0073)	(0.0066)	(0.0069)
Observations	228,754	224,266	221,171	221,955	220,926	224,572	223,990	224,090	223,456	227,464	228,067
R-squared	0.4544	0.4512	0.4510	0.4660	0.4665	0.4684	0.4688	0.4750	0.4753	0.4714	0.4707
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Borrower FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Period	5	6	7	8	9	10	11	12	13	14	15
Clusters	103	106	104	106	104	104	104	103	102	104	103

Robust standard errors in parentheses (clustered at bank level)
*** p<0.01, ** p<0.05, * p<0.1

Panel F - Supplier and Borrower Lending

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
VARIABLES	Ln (duration)	Ln (duration)	Ln (duration)	Ln (duration)	Ln (duration)	Ln (duration)	Ln (duration)	Ln (duration)	Ln (duration)	Ln (duration)	Ln (duration)
Ln (All Suppliers)	-0.0002	0.0007	-0.0004	0.0004	0.0014	0.0017	0.0013	0.0008	0.0029	0.0027*	0.0027*
	(0.0012)	(0.0018)	(0.0016)	(0.0015)	(0.0019)	(0.0018)	(0.0015)	(0.0018)	(0.0018)	(0.0016)	(0.0015)
Constant	-0.8794***	-0.8618***	-0.8621***	-0.8716***	-0.9069***	-0.9280***	-0.9020***	-0.8754***	-0.9023***	-0.7835***	-0.6478***
	(0.0079)	(0.0122)	(0.0109)	(0.0109)	(0.0132)	(0.0132)	(0.0110)	(0.0134)	(0.0138)	(0.0121)	(0.0114)
Observations	228,754	224,266	221,171	221,955	220,926	224,572	223,990	224,090	223,456	227,464	228,067
R-squared	0.4544	0.4512	0.4510	0.4660	0.4665	0.4684	0.4688	0.4750	0.4754	0.4714	0.4707
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Borrower FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Period	5	6	7	8	9	10	11	12	13	14	15
Clusters	103	106	104	106	104	104	104	103	102	104	103

Notes: *Loan* and *All Suppliers* (*All Customers*) are defined as in Table 1. All independent variables are measured with a one-year lag. We denote significance at 10%, 5%, and 1% with $*$, $**$, and $***$, respectively. Robust standard errors clustered at the bank level are reported in parentheses.

Table A.2 - Robustness: firms that remain in bank portfolio and firm non-zero network exposure

Panel A - Loan volumes

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES			Ln (Loan)			
Model Type	AllCustomer >0	Remain in bank portfolio	AllCustomer >0 & Remain in bank portfolio	AllSupplier >0	Remain in bank portfolio	AllSupplier >0 & Remain in bank portfolio
Ln (All Customers)	0.0247***	0.0145***	0.0240***			
	(0.0052)	(0.0022)	(0.0053)			
Ln (All Suppliers)				0.0228***	0.0138***	0.0239***
				(0.0064)	(0.0029)	(0.0066)
Constant	12.2400***	12.1593***	12.2799***	12.0767***	12.1388***	12.0856***
	(0.0842)	(0.0123)	(0.0873)	(0.1098)	(0.0210)	(0.1139)
Observations	752,536	2,309,184	713,922	976,371	2,309,184	920,779
R-squared	0.5288	0.5067	0.5270	0.5256	0.5067	0.5235
Bank-Time FE	YES	YES	YES	YES	YES	YES
Borrower-Time FE	YES	YES	YES	YES	YES	YES
Clusters	94	113	93	95	113	95

Robust standard errors in parentheses (clustered at bank level)
*** p<0.01, ** p<0.05, * p<0.1

Panel B - Interest Rates

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES			Int. Rates (%)			
Model Type	AllCustomer >0	Remain in bank portfolio	AllCustomer >0 & Remain in bank portfolio	AllSupplier >0	Remain in bank portfolio	AllSupplier >0 & Remain in bank portfolio
Ln (All Customers)	-0.1970***	-0.0804*	-0.1464**			
	(0.0694)	(0.0433)	(0.0668)			
Ln (All Suppliers)				-0.0242	-0.0069	-0.0452
				(0.0703)	(0.0556)	(0.0697)
Constant	50.2798***	48.1511***	48.8008***	48.1455***	47.7621***	47.8886***
	(1.1306)	(0.2365)	(1.0935)	(1.2075)	(0.4045)	(1.2004)
Observations	605,143	1,878,499	575,025	792,598	1,878,499	748,903
R-squared	0.4542	0.4390	0.4495	0.4522	0.4389	0.4478
Bank-Time FE	YES	YES	YES	YES	YES	YES
Borrower-Time FE	YES	YES	YES	YES	YES	YES
Clusters	78	99	78	80	99	79

Robust standard errors in parentheses (clustered at bank level)
*** p<0.01, ** p<0.05, * p<0.1

Table A.2 - Robustness: firms that survived and firm non-zero network exposure (cont.)

Panel C - Duration

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Ln (duration)					
Model Type	AllCustomer >0	Remain in bank portfolio	AllCustomer >0 & Remain in bank portfolio	AllSupplier >0	Remain in bank portfolio	AllSupplier >0 & Remain in bank portfolio
Ln (All Customers)	0.0035**	0.0020**	0.0031*			
	(0.0016)	(0.0008)	(0.0017)			
Ln (All Suppliers)				0.0006	0.0018	0.0009
				(0.0015)	(0.0013)	(0.0016)
Constant	-0.9246***	-0.8201***	-0.9033***	-0.8689***	-0.8221***	-0.8586***
	(0.0263)	(0.0044)	(0.0272)	(0.0255)	(0.0096)	(0.0272)
Observations	752,536	2,309,184	713,922	976,371	2,309,184	920,779
R-squared	0.4822	0.4550	0.4744	0.4922	0.4550	0.4841
Bank-Time FE	YES	YES	YES	YES	YES	YES
Borrower-Time FE	YES	YES	YES	YES	YES	YES
Clusters	94	113	93	95	113	95

Robust standard errors in parentheses (clustered at bank level)
*** p<0.01, ** p<0.05, * p<0.1

Notes: Columns (1) and (4) are the baseline model, restricted to only firms with a nonzero loan portfolio at the same bank; Columns (2) and (5) are the baseline model with firms only appearing in all quarters of the sample; Columns (3) and (6) use the intersection of the two previous conditions. Variables are defined as in Table 1. All independent variables are measured with a one-year lag. We denote significance at 10%, 5%, and 1% with $*$, $**$, and $***$, respectively. Robust standard errors clustered at the bank level are reported in parentheses.

Table A.3 - Descriptive Statistics for Relationship Lending

Panel A - Raw data

The descriptive statistics below show the figures of each variable "as is": missing observations are *not* assigned to zero values.

	Unit	Mean	p25	p50	p75	sd	Observations
Borrower							
Bank Share of the Borrower	%	36.51	5.11	23.41	64.04	35.46	3,547,979
Top 1 Customer							
Bank Share of Top 1 Customer	%	28.65	2.78	16.13	43.86	31.70	238,626
Bank Share of the Borrower * Top 1 Customer	% * %	1170.68	15.43	247.13	1310.25	2046.93	236,866
Top 1 Supplier							
Bank Share of Top 1 Supplier	%	28.98	2.24	15.77	47.21	32.20	348,312
Bank Share of the Borrower * Top 1 Supplier	% * %	1201.11	12.10	226.92	1363.48	2095.79	345,380

Panel B - Missing value assigned to zero

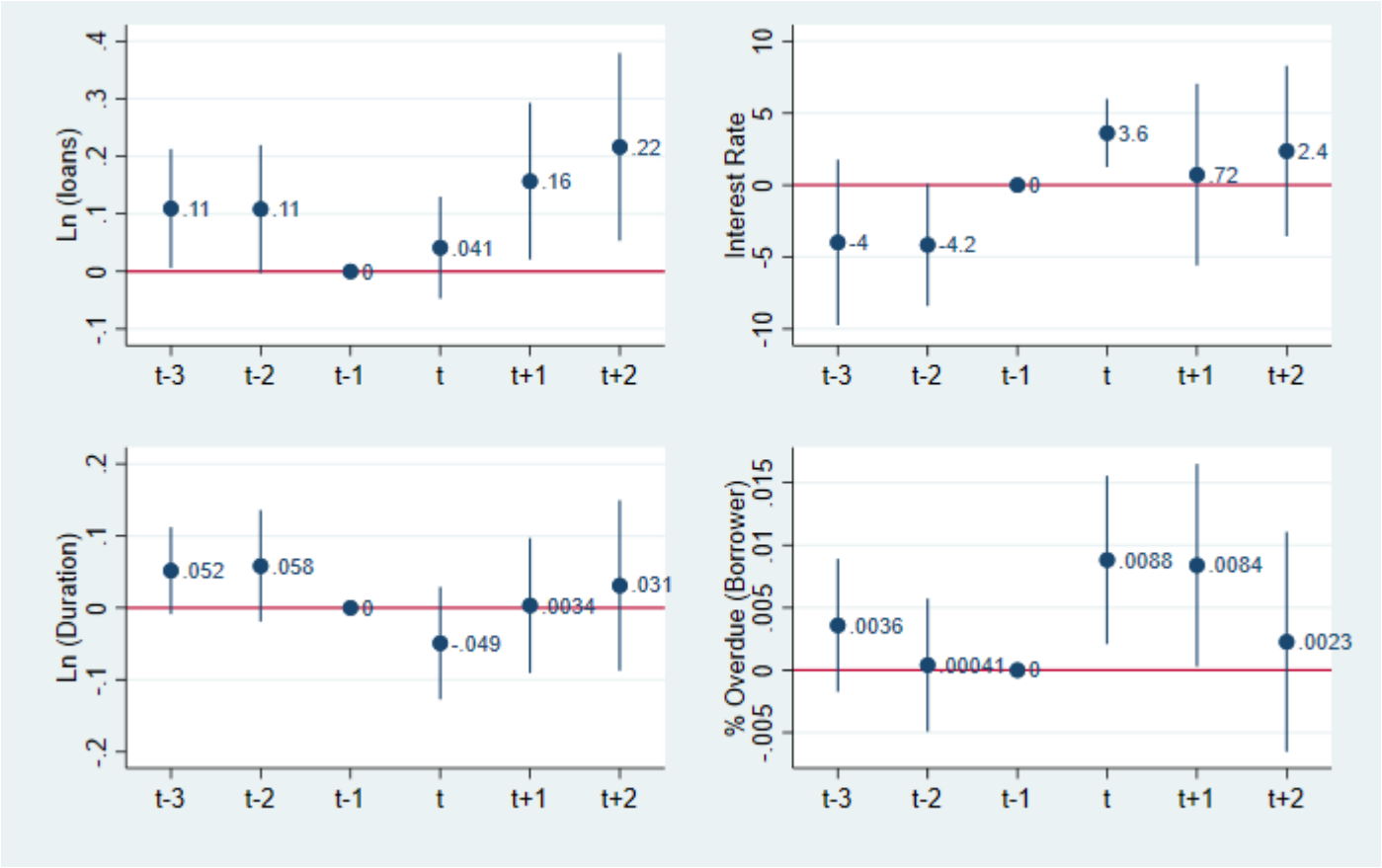
The descriptive statistics below show the figures of each variable assigned zero values when missing.

	Unit	Mean	p25	p50	p75	sd	Observations
Borrower							
Bank Share of the Borrower	%	36.51	5.11	23.41	64.04	35.46	3,547,979
Top 1 Customer							
Bank Share of Top 1 Customer	%	1.91	0.00	0.00	0.00	10.87	3,574,987
Bank Share of the Borrower * Top 1 Customer	% * %	78.16	0.00	0.00	0.00	604.24	3,547,979
Top 1 Supplier							
Bank Share of Top 1 Supplier	%	2.82	0.00	0.00	0.00	13.22	3,574,987
Bank Share of the Borrower * Top 1 Supplier	% * %	116.92	0.00	0.00	0.00	744.54	3,547,979

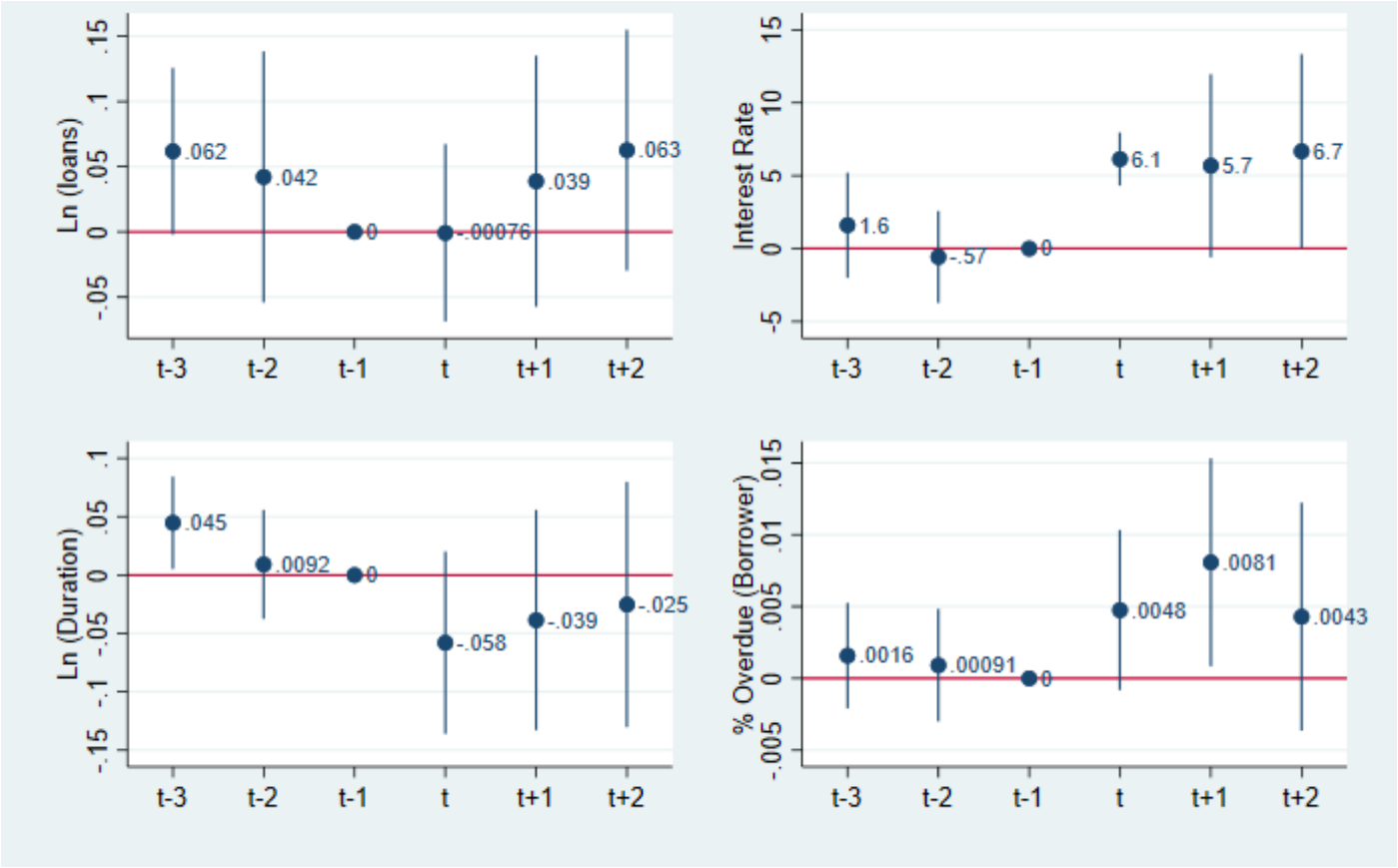
Notes: *Bank Share of the Borrower* and *Bank Share of the Top 1 Supplier* (*Top 1 Customer*) are defined as in Table 3.

Figure 1 (supplementary to Table 4) – DiDiD: Top1 Customer (or Top 1 Supplier) falling into arrears

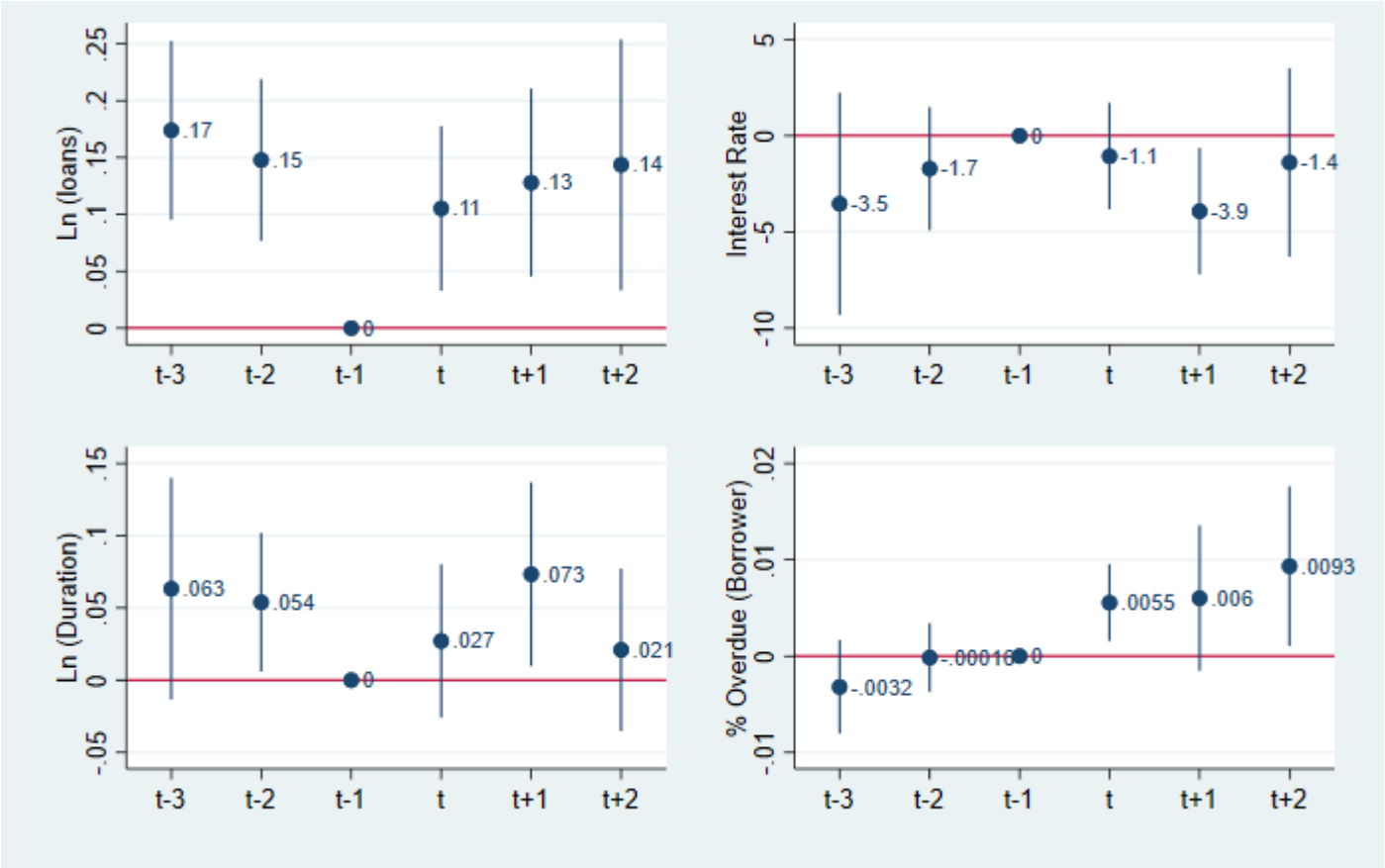
Panel A – Top 1 Customer fall into arrears



Panel B – Top 1 Customer fall into arrears (only borrowers that remain through entire cohort)



Panel C – Top 1 Supplier fall into arrears



Panel D – Top 1 Supplier fall into arrears (only borrowers that remain through entire cohort)

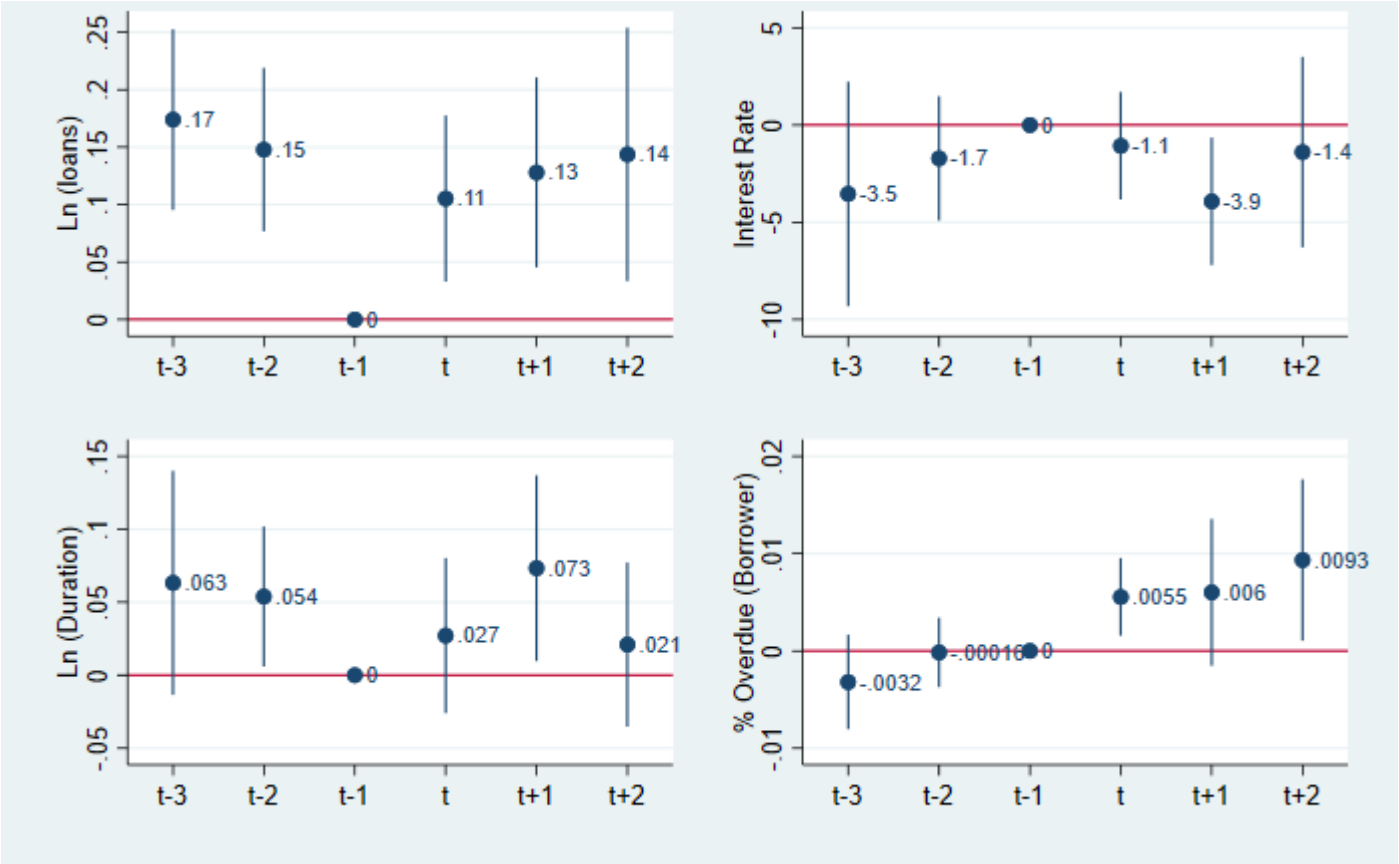
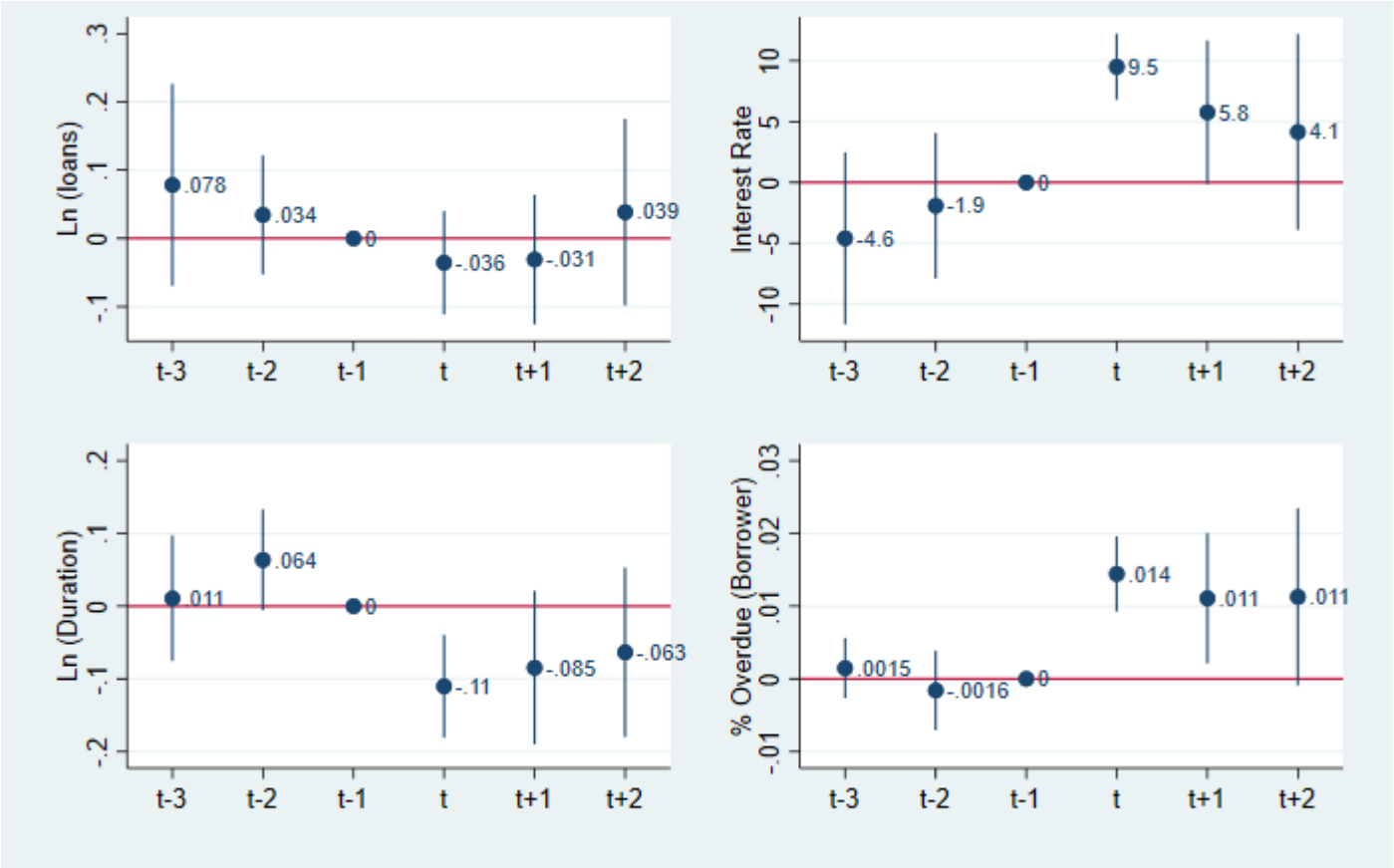
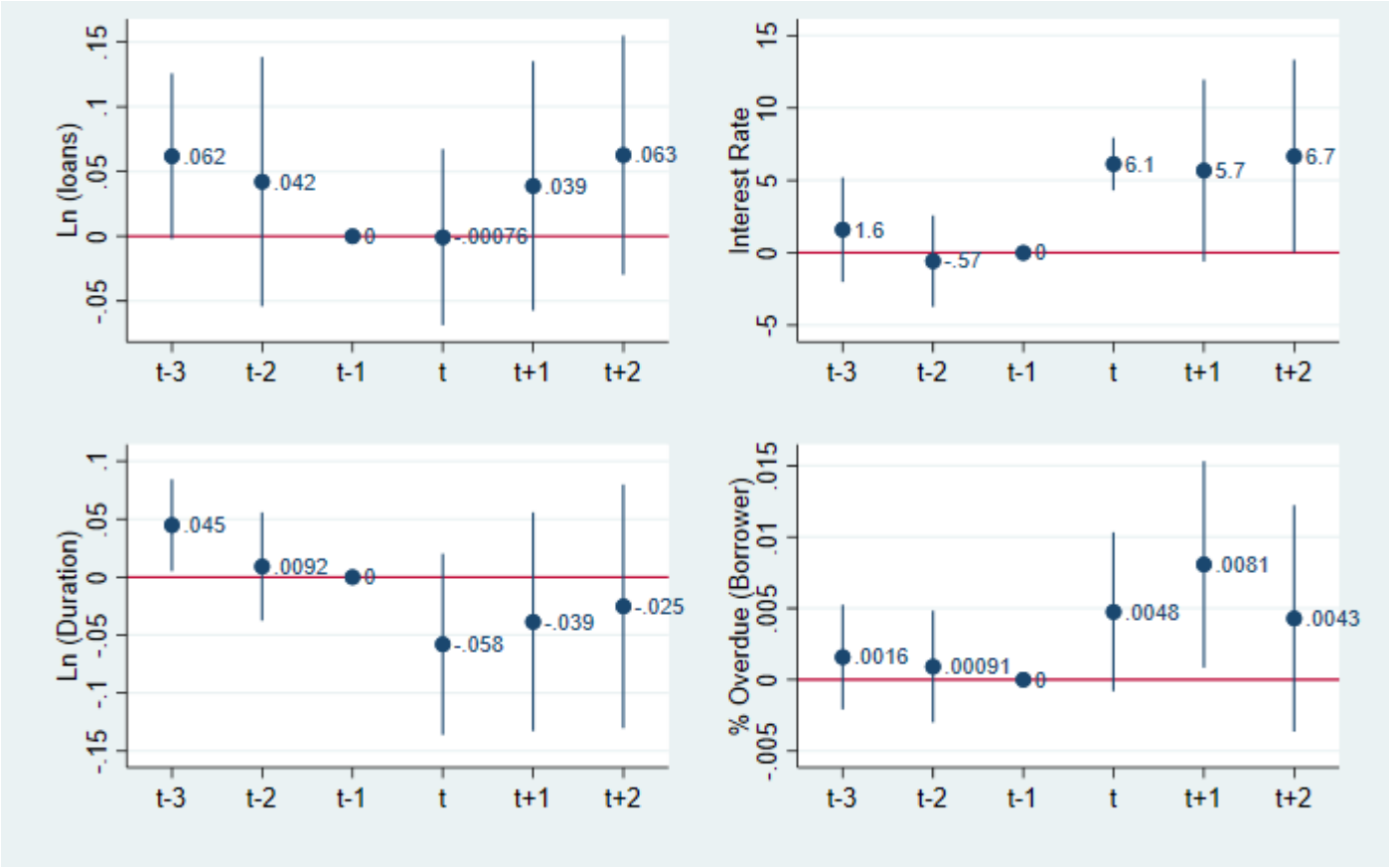


Figure 2 (supplementary to Table 5) - DiDiD: Top1 Customer (or Top 1 Supplier) falling into arrears in a common bank to the borrower (only common bank sample)

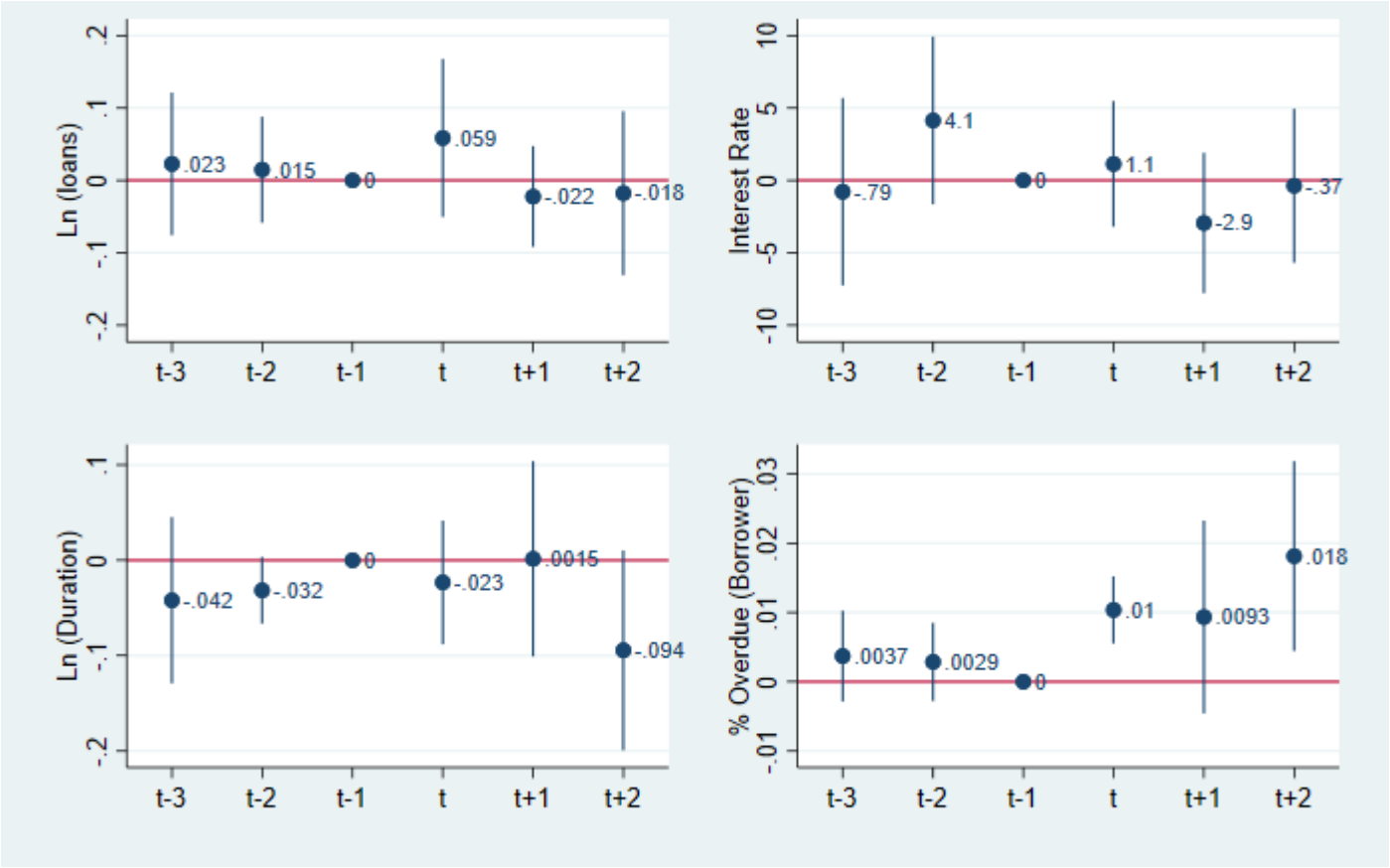
Panel A – Top 1 Customer fall into arrears



Panel B – Top 1 Customer fall into arrears (Top 1 Customer remains in sample through entire cohort)



Panel C – Top 1 Supplier fall into arrears



Panel D – Top 1 Supplier fall into arrears (Top 1 Supplier remains in sample through entire cohort)