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Banking on Deposit Relationships: Implications for Hold-Up Problems in the Loan Market

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Abstract

Theory suggests that by lending to a firm, inside banks gain an informational advantage over non-lender outside banks. This informational gap hinders borrowers from switching lenders due to a winner's curse faced by competing outside banks, leading to hold-up problems. In this paper, we show that firms can reduce this informational gap by forming deposit relationships with outside banks, thereby attenuating hold-up. Using unique data on the deposit and lending relationships of all firm-bank pairs in Norway, we find that having a deposit relationship with non-lender outside banks significantly increases a firm's likelihood of switching lenders. Furthermore, firms that have a prior deposit relationship with new lenders obtain significantly better loan conditions upon switching. In line with informational hold-up theory, these effects are driven by reduced information asymmetries, not cross-selling. Our findings have important implications for open banking and hold-up problems in the loan market.

JEL Classification: G21, D82, L11, L13,
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1. Introduction

Theoretical papers have highlighted that by lending to a firm, incumbent banks gain an informational advantage over outside banks (Rajan, 1992; Sharpe, 1990; von Thadden, 2004). This informational advantage hinders borrowers from switching to new lenders, as outside banks face a winner's curse, enabling incumbent banks to extract informational rents. Several empirical studies corroborate that switching lenders allows firms to borrow at a lower loan rate, indicating that they were being held up by their inside banks (e.g., Hale and Santos, 2009; Ioannidou and Ongena, 2010; Schenone, 2010). In this paper, we use unique data on the deposit and lending relationships of all firm-bank pairs in Norway to show that firms can mitigate outside banks' informational disadvantage by establishing deposit relationships with those banks, thereby attenuating hold-up problems in the loan market.

Our study consists of two parts. In the first part, we provide two new insights into the structure of firm-bank relationships. First, a large share of firms has more deposit than lending relationships. This can be the case, for example, if a firm obtains credit and has a deposit relationship with one bank, and a deposit relationship but no loans with another bank. Second, firms switching to a new lender often have a prior deposit relationship with this outside bank. That is, a large share of firms has a deposit relationship with outside banks at least one year prior to switching to those banks to obtain credit. These new findings suggest that deposit relationships play an important role when switching lenders.

In the second part of our study, we empirically examine the role of deposit relationships in lender switching. We start by analyzing whether having a deposit relationship with outside banks affects the probability that firms switch lenders, as this directly relates to bank competition. In general, theory predicts that if deposit relationships reduce outside banks' informational disadvantage, firms that have a deposit relationship with outside banks should have a higher probability of switching (Rajan, 1992; von Thadden, 2004). Building on the empirical framework of Bird et al. (2019), we find that firms that have a deposit relationship with outside banks are around 6 percentage points more likely to switch lenders in the following year, relative to firms without such a relationship. This result aligns with the theoretical prediction and is economically significant, corresponding to about 35% of the unconditional likelihood of switching lenders.

We then investigate whether having a pre-existing deposit relationship with outside banks affects the loan conditions that firms receive upon switching, as this directly relates to informational hold-up and switching costs. Theoretically, if deposit relationships reduce outside banks' informational disadvantage,

then firms with such relationships should receive better loan conditions when switching (Sharpe, 1990; von Thadden, 2004). To examine this, we follow the empirical framework of Ioannidou and Ongena (2010) to identify switching firms, and extend it to compare the loan terms obtained by similar firms with and without pre-existing deposit relationships. Our preferred matching model accounts for differences across lenders, borrowers, loan contract characteristics, relationship characteristics, and macroeconomic conditions, therefore reducing concerns that our results are due to differences between firms that switch to an outside lender and those that do not. To further ensure that our results are not driven by unobserved heterogeneity driving the decision to switch to a new lender, we compare the loan conditions offered by outside banks to similar *switching* firms with and without a pre-existing deposit relationship.[1]

Our findings are threefold. First, interest rates on new loans granted by an outside bank to a switching firm are, on average, 99 basis points (bps) lower than rates on similar loans granted by the outside bank to its existing borrowers. This result is economically relevant, as it compares to an average loan rate of around 520 bps. The result aligns quantitatively to the 89 bps discount estimated by Ioannidou and Ongena (2010), and is consistent with the existence of hold-up problems in the loan market (also see Bonfim et al., 2021; Liaudinskas, 2023).

Second and more importantly, the loan rate discount offered to switching firms largely depends on the existence of a prior deposit relationship with the outside bank. On average, the discount offered to a switching firm with a prior deposit relationship is 165 bps, while it is only 47 bps for switching firms without a prior deposit relationship. Thus, consistent with theoretical predictions, our results show that having a prior deposit relationship with outside banks allows firms to borrow at a lower loan rate when they switch lenders. This result holds when we compare the loan conditions obtained by switchers with and without a prior deposit relationship, with the same estimated credit risks by the outside bank.[2] Furthermore, we show that having a *prior* deposit relationship with the outside bank matters, as our results also hold when comparing switchers with a prior deposit relationship to switchers that establish a deposit relationship with the outside bank at the time of the switch.

Third, we show that having a prior deposit relationship also leads to better non-price lending conditions for switching firms. Specifically, we find that switchers with a prior deposit relationship obtain larger loan amounts, and are offered credit lines with higher probability. We do not find that

[1] Our results are also robust to a within-firm estimation approach that compares the loan terms obtained by the *same* firm when switching to outside banks with and without a prior deposit relationship.

[2] We match, among others, on the credit rating assigned by banks to firms. Thus, our results are not due to differences in credit risk between switching firms with and without a prior deposit relationship.

switchers with a prior deposit relationship are subject to different collateral requirements. Taken together, our results show that outside banks offer significantly better loan conditions to switchers with a prior deposit relationship.

We conjecture that the results may be attributed to deposit relationships reducing information asymmetries between firms and outside banks. This conjecture is based on two insights. First, theoretical studies on informational hold-up have highlighted that outside banks have an informational disadvantage vis-à-vis inside banks, which hinders firms' ability to switch (Rajan, 1992; Sharpe, 1990; von Thadden, 2004). Second, empirical studies have shown that banks can obtain private information from firms' deposit account activities, resulting in improved screening and monitoring capabilities (Black, 1975; Fama, 1985; Mester et al., 2007; Norden and Weber, 2010). Hence, information obtained from firms' deposit account activity could reduce outside banks' information gap, thereby attenuating hold-up problems in the loan market.

We provide several pieces of evidence that support this conjecture. First, we find that our results show an increase in the length and depth of the deposit relationship.[3] As the bank relationship literature argues that the information flow between borrowers and lenders increases in the length and the depth of the relationships (Bharath et al., 2007; Berger and Udell, 1995; Hibbeln et al., 2020; Petersen and Rajan, 1994; Norden and Weber, 2010), this finding is consistent with the idea that deposit relationships reduce information asymmetries between firms and outside banks.

Second, theory posits that outside banks would be less willing to bid on loans to borrowers with greater information asymmetries or higher adverse selection (Rajan, 1992). Hence, we would expect that deposit relationships are more relevant in cases where information asymmetries or adverse selection are more pronounced. Consistent with this, we find that the impact of deposit relationships is larger for younger firms, firms with less pledgeable assets, and firm operating in areas with higher bank competition.

Third, in the spirit of Weitzner and Howes (2021), we show that the initial credit rating assigned by an outside bank to a switching firm predicts future loan performance better for switching firms with a prior deposit relationship, compared to those without a prior deposit relationship. This suggests that deposit relationships improve outside banks' screening capability (Jaffee and Russell, 1976).

Our results are robust to several additional tests. First, our results are robust to different matching

[3]We measure the length as the number of years during which the switching firms and outside banks maintained a deposit relationship, and the depth as the number of deposit products underlying the deposit relationship or the share of deposits that switching firms held at the outside banks compared to the firms' total deposits.

approaches (including coarsened exact matching and propensity score matching), and to matching on several other characteristics (including deposit characteristics). In particular, our results remain quantitatively similar if we add the deposit amount and deposit rate of the switchers at the new banks to our set of matching variables. This result indicates that switchers with a prior deposit relationship do not get better loan conditions due to the role of deposits as a source of bank funding (Berlin and Mester, 1999; Kashyap et al., 2002), a form of collateral (Hellweg, 1961; Uchida, 2003), or a means of cross-selling (Basten and Juelsrud, 2023; Qi, 2023).

Second, a potential concern could be that the more favorable loan conditions obtained by switchers with a prior deposit relationship are offset by worse loan conditions over the course of the new lending relationship, for instance because switchers with a prior deposit relationship may be more likely to be subject to hold-up problems at the new bank (Sharpe, 1990). We find that this is not the case. In fact, new loans granted by the outside bank to switchers with and without a prior deposit relationship have a similar loan rate cycle.

Third, if having a deposit relationship with outside banks increases firms' outside options and lender competition, we would expect inside banks to improve borrowers' loan conditions after establishing a deposit relationship with outside banks (Sharpe, 1990; von Thadden, 2004). In line with this conjecture, we find that inside banks reduce borrowers' loan rates by around 30 bps after the borrowers establish a deposit relationship with outside banks. This reduction in loan rates is smaller than the loan rate discount that firms could obtain from switching to outside banks, but provides further evidence that having a deposit relationship with outside banks is in fact beneficial to borrowers as it mitigates hold-up problems (Bird et al., 2019; Schenone, 2010).

Fourth, our results hold using a within-firm matching strategy that is based on comparing the loan conditions on switching and non-switching loans given to the same firm at the same time, which mitigates potential concerns related to unobserved firm-specific heterogeneity at the time of the switch. Finally, we show that our results are robust to using a more restrictive definition of bank switching than the original definition proposed by Ioannidou and Ongena (2010). Taken together, we find robust evidence that having a prior deposit relationship with outside banks facilitates lender switching and attenuates hold-up problems in the loan market.

Overall, our study provides several new insights into the role of firm-bank deposit relationships in the loan market. We uncover that having a deposit relationship with non-lender outside banks facilitates lender switching. Moreover, we find that having a prior deposit relationship with outside

banks improves firms' loan conditions upon switching. In line with informational hold-up theory, we find that these results are driven by the fact that deposit relationships mitigate outside banks' informational disadvantage. Below, we discuss the implications of these results for our understanding of hold-up problems in the loan market and the potential role of open banking initiatives in increasing the competitiveness of the banking sector.

Related Literature Our paper contributes to several strands of research. First, we contribute to the literature on bank relationships (for an overview, see Boot, 2000; Degryse et al., 2015; Kysucky and Norden, 2016). This literature has almost exclusively focused on lending relationships and, more particularly, how lending relationships affect the price and availability of bank credit (Beck et al., 2018; Berger et al., 2021, 2022; Bharath et al., 2007, 2011; Boot and Thakor, 2000; Bolton et al., 2016; Dahiya et al., 2003; Degryse and Van Cayseele, 2000; Degryse and Ongena, 2005; Petersen and Rajan, 1994; Sette and Gobbi, 2015). There are few papers that study deposit relationships, and these papers primarily focus on the role of deposit relationships in bank monitoring (Agarwal et al., 2018; Hibbeln et al., 2020; Mester et al., 2007; Norden and Weber, 2010; Puri et al., 2017).[4] In line with the arguments made by Black (1975) and Fama (1985), these studies generally show that banks can use the information obtained from deposit accounts to monitor *existing* borrowers' creditworthiness and thereby improve loan outcomes.[5] Our contribution to this literature is to show that deposit relationships can be used to mitigate informational hold-up by incumbent banks, and to study their role in the formation of new lending relationships with outside banks.

Second, our paper contributes to the literature on bank switching and hold-up problems in the loan market (Hale and Santos, 2009; Ioannidou and Ongena, 2010; Rajan, 1992; Santos and Winton, 2008; Schenone, 2010; Sharpe, 1990; von Thadden, 1995, 2004). In the theoretical model of Sharpe (1990), information acquired by an incumbent (inside) bank as part of its lending relationship with a borrower can create an "informational monopoly" in that it is costly for the borrower to switch to another lender, which allows the inside bank to hold up borrowers for higher interest rates. In their seminal paper,

[4]There is also a small literature that studies the role of deposit relationships in bank runs (e.g., Chernykh and Mityakov, 2022; Iyer and Puri, 2012; Iyer et al., 2016, 2019) and cross-selling (e.g., Basten and Juelsrud, 2023; Qi, 2023).

[5]The idea that borrowers' checking accounts contain useful information about borrowers' financial health has been referred to as the "checking account hypothesis" (Nakamura, 1992). While it is not the focus of their paper, Norden and Weber (2010) provide some evidence on the link between deposit relationships and bank lending, albeit in the context of bank lending to existing borrowers. More precisely, they show that borrowers with a deposit relationship pay higher loan rates on loan renewals if the bank has recently obtained negative signals from the borrower's deposit account activity, suggesting that banks use information from deposit relationships to manage lending relationships with existing borrowers. However, unlike our study, Norden and Weber (2010) have data from only one bank, meaning that they cannot trace deposit and lending relationships across bank and firms over time to investigate the role of deposit relationships in lender switching and the potential mechanisms underlying this effects.

Ioannidou and Ongena (2010) use loan-level data from Bolivia to test this conjecture by analyzing the loan conditions before and after a firm switches to a new (outside) bank. They show that switching to an outside bank leads to a 89 bps drop in borrowers' loan rate, which indicates that the borrowers were being held up by inside banks (consistent with the conjecture from Sharpe, 1990). They also show that—although the outside bank initially decreases the loan rate—it sharply increases the loan rate over the duration of the bank relationship, which further corroborates the existence of hold-up problems in bank relationships. Other papers have estimated similar loan rate cycles using data from different countries (e.g., Bonfim et al., 2021; Liaudinskas, 2023).[6]

Our contribution to this literature is twofold. Firstly, we contribute to studies on bank switching by showing that the loan rate discount estimated by Ioannidou and Ongena (2010) and others largely depends on whether the switching firm had a prior deposit relationship with the outside bank. In particular, we show that switchers that have a prior deposit relationship with the outside bank receive a loan rate discount that is several times larger than switchers that do not have a prior deposit relationship with the outside bank. This implies that, if we assume that the loan rate discount obtained by switchers with a prior deposit relationship is closest to the potential loan rate discount obtained in a frictionless market with perfect information, hold-up problems may be larger than previously thought (or, stated differently, switching may be more difficult than previously thought). Secondly, our findings contribute to previous papers that study how to mitigate hold-up problems in the loan market. Rajan (1992) and Diamond (1991) for instance state that firms' option to issue public debt limits banks' monopoly power. Schenone (2010) argues that borrowing from multiple banks at the same time can reduce the information monopoly from any one bank, and other studies have emphasized the importance of public information sharing to mitigate hold-up (Hauswald and Marquez, 2006; Padilla and Pagano, 1997), for instance through voluntary disclosure of key financial information (Bird et al., 2019) or public credit ratings (Cahn et al., 2023). Our paper adds to these studies by showing that firms can mitigate outside banks' informational disadvantage through the formation of deposit relationships, thereby facilitating bank switching. An important policy implication that follows from this is that facilitating deposit switching could reduce hold-up problems.[7]

[6] More broadly, several studies have provided empirical evidence in line with informational hold-up in bank relationships (e.g., Berger and Udell, 1995; Degryse and Van Cayseele, 2000; Gopalan et al., 2011; Hale and Santos, 2009; Santos and Winton, 2008; Schenone, 2010; Saunders and Steffen, 2011)

[7] A recent example is the implementation of the Payment Services Directive (PSD2) in Belgium in 2018, which facilitates deposit switching for consumer and firms by placing the administrative burden related to deposit switching on the banking sector (National Bank of Belgium, 2018). Particularly, if a firm decides to transfer its deposit accounts from one bank to another, the new bank is responsible for arranging the transfer of the firms' payment orders and settlement from the firms' former current account with the former bank.

Finally, our paper also relates to the relevance of information sharing between financial intermediaries (Bird et al., 2019; Pagano and Jappelli, 1993) and, more particularly, the debate on open banking (Babina et al., 2022; Ghosh et al., 2022; He et al., 2023; Parlour et al., 2022). In general, a common way to overcome information asymmetries in the loan market is private information sharing between banks, for instance through a credit register, which banks can use to learn about potential borrowers (Pagano and Jappelli, 1993). While private information on firms' deposit account activities (including payment data) is generally not shared through credit registers, our results indicate that such information could play an important role in mitigating information asymmetries. Hence, in line with the premise of open banking, our results suggest that the sharing of borrowers' payment data could improve banks' screening capability and thereby alleviate hold-up problems in the loan market (He et al., 2023; Marquez, 2002).

2. Firm-bank relationships: New insights

We start our analysis by providing novel insights into the structure of firm-bank relationships. To do so, we use unique data on all deposit and loan accounts for the universe of Norwegian firms, administered by the Norwegian Tax Administration (*Skatteetaten*). These data are collected and maintained by the tax authority as a basis for corporate taxation, meaning that these data are essentially measurement error-free. For every firm-bank pair, the data record the end-of-year outstanding loan (deposit) amount and interest paid (received) on the account during the year.[8] We aggregate this firm-bank-account level data to the firm-bank level in order to track all bank-firm lending and deposit relationships at a yearly frequency for the period 2000-2019. We define a firm and a bank to be in a lending (deposit) relationship in a given year if the outstanding loan (deposit) amount or the interest paid (received) is larger than zero (as in Basten and Juelsrud, 2023). In doing so, we also account for bank mergers and acquisitions that took place during our sample period.[9] The final dataset comprises 180 banks and 241,466 firms for a total of 511,879 unique bank-firm relationships over the period 2000-2019.

Using these data, we start by analyzing the cross-section of firm-bank relationships over our sample period. Figure 1 shows the proportion of firm-bank relationships that contain (1) both a deposit and a lending relationships, (2) only a lending relationship, or (3) only a deposit relationship. We

[8]We do not have information on the type of account (i.e., we cannot observe whether a deposit account is a checking or a savings account, for instance). What we can observe is the number of different accounts underlying the deposit relationship, which allows us to measure the depth of the deposit relationship. We return to this point in Section 4.2.1.

[9]Particularly, if bank A absorbs bank B, bank A typically takes over the information that bank B collected on its clients in the years before the merger. Moreover, the clients of bank B who decide to stay with bank A after the merger do not incur switching costs. Therefore, the clients of bank B who stay with bank A after the merge are treated as continuing bank relationships.

observe that the majority of firm-bank relationships consist of both a deposit and a lending relationship. Nevertheless, approximately 5% of firm-bank relationships consist exclusively of a lending relationship and approximately 40-50% of firm-bank relationships consist exclusively of a deposit relationship. The latter pattern could be partly explained by a large fraction of firms (40%) that do not use bank credit in a given year (either due to no credit demand or to financial constraints). In Figure 2, we omit these firms and focus on firms that, in a given year, borrow from at least one bank. The figure shows that, even among firms with at least one lending relationship, 15-20% of firm-bank relationships only involve a deposit relationship. This evidence indicates that some firms maintain deposit relationships with banks from which they do not borrow.

We observe a similar pattern when we analyze the data at the firm level instead of the firm-bank level. In Figure 3, we compare firms' total number of deposit relationships to firms' total number of lending relationships (for the sample of firms with at least one lending relationship). Two points are worth highlighting. First, most firms have only one lending relationship. As previous papers find that banks' capability to capture borrowers increases when borrowing firms have fewer bank relationships (Farinha and Santos, 2002; Degryse and Ongena, 2008), this is an indication of hold-up in the Norwegian loan market. Second, in line with Figure 2, a non-negligible share of firms has more deposit than lending relationships.[10] This can be the case, for instance, if a firm has a deposit relationship with two different banks, and a lending relationship with only one of those two banks.

In Figure 4, we track firm-bank relationships over time for firms that switch to an outside bank. We find that it is common for firms that switch lenders to have a deposit relationship with their new outside bank prior to switching. Specifically, for firms that switch lenders, as many as 40% of firms had a deposit relationship with the outside banks at least one year before switching. Focusing on the firms that already had a prior deposit relationship with the outside banks prior to switching, Figures A1 to A3 in Appendix show the distribution of the length and the depth of the prior deposit relationships. In Figure A1, the length of firms' prior deposit relationship is measured as the number of years during which the switching firm and outside bank maintained a deposit relationship. The depth of firms' prior deposit relationship is measured as the number of deposit products underlying the deposit relationship in Figure A2, and as the share of deposits that the switching firm held at the outside bank compared to the firms' total deposits in Figure A3. Figures A1 and A2 show, respectively, that about 50% of

[10]This pattern is also reflected in Figure A4, which shows the distribution of the total number of bank lending and deposit relationships of firms with at least one lending relationship. We can observe that less than 20% of firms have more than one lending relationship while more than 30% of firms have more than one deposit relationship.

switching firms had a prior deposit relationship of at least seven years, or with at least three underlying deposit accounts. This suggests that many firms do not simply "walk over" to new outside banks but, instead, build deposit relationships with new outside banks prior to obtaining credit from those banks. Clearly, this relates to our first observation as the firms having deposit relationships with banks from which they do not borrow may in fact be firms that have deposit relationships with banks from which they do not borrow *yet*.

Our paper is the first to document these patterns for the corporate loan market.[11] In general, these patterns indicate that deposit relationships play an important role in bank switching.[12] In the next sections, we formally test this by examining whether having a prior deposit relationship affects the probability that firms switch lenders, the loan conditions that switching firms obtain when they switch lenders, and the potential mechanism underlying these effects.

3. Methodology

3.1. Definitions

In our analysis, we study the role of deposit relationships in lender switching. To define switches, we follow Ioannidou and Ongena (2010) and impose two conditions for a new loan to be classified as a switching loan. First, the new loan should be obtained from a bank with which the firm did not have a lending relationship during the previous twelve months. Second, the firm must have had at least one lending relationship in the previous twelve months with at least one other bank. This condition is based on the assumption that key inside information becomes inadequate within one year; however, our results are robust to assuming different time horizons for key inside information to become stale. New loans that do not satisfy these two conditions are non-switching loans. We refer to the bank from which the firm obtains the new loan as the outside bank, and to the bank from which the firm borrowed before switching as the inside bank.[13]

[11] Although our data only cover firm-bank relationships in Norway, evidence from previous papers suggests that this pattern is not limited to Norway. For instance, using survey data covering 20 countries, Ongena and Smith (2000) document that approximately 10% of firms in their data sample have a bank relationship that only involves non-lending related activities.

[12] This view is consistent with anecdotal evidence from Puri et al. (2017). Based on conversations with loan officers from a private bank, Puri et al. (2017) report that the bank induces potential borrowers to open a deposit account before loan negotiations, because the bank can use the deposit account activities to collect valuable information on the potential borrowers.

[13] Following Ioannidou and Ongena (2010), our definition of switching does not differentiate between firms that "move" between banks and firms that "add" a lending relationship. A first reason is that we focus on the potential heterogeneity in the conditions under which a firm obtains a loan from another bank (and not from an existing lender). A second reason is that differentiating between "movers" and "adders" based on whether they have or do not have other outstanding loans at the time of the switch does not necessarily provide a meaningful distinction. For instance, "adders" could be

3.2. Methodology

3.2.1. Deposit relationships and the probability of switching lenders

Results in Section 2 show that it is common for firms to have a deposit relationship with outside banks at least one year before they switch lenders and obtain credit from those banks. In the first part of our analysis, we formally test this by examining whether having a prior deposit relationship with outside banks affects the probability that firms switch lenders. In general, theory predicts that if deposit relationships reduce outside banks' informational disadvantage, firms that have a deposit relationship with outside banks should have a higher probability of receiving outside bids and hence switching (Rajan, 1992; von Thadden, 2004). Building on the empirical framework of Bird et al. (2019), we test this prediction using the following regression model:

$$Switch_{f,t} = \alpha + \beta Outside\ deposit\ relationship_{f,t-1} + \delta C_{f,t} + \lambda_f + \lambda_{b,t} + \epsilon_{f,t} \quad (1)$$

where $Switch_{f,t}$ is a dummy variable equal to one if a firm f switches to a new outside bank in year t, and $Outside\ deposit\ relationship_{f,t-1}$ is a dummy variable equal to one if the firm had a deposit relationship with at least one (non-lender) outside bank in the year $t-1$. $C_{f,t}$ is a vector of control variables, which includes both firm and loan variables. Firm controls include firms' size, leverage ratio, EBIT to total assets, fixed assets to total assets, and organizational form (i.e., a dummy equal to one for publicly listed firms). Loan controls include the loan interest, loan amount, proportion of loan collateralized, the probability of loan default, and a dummy variable equal to one for credit lines, and essentially capture banks' private information about the borrower. Hence, controlling for loan terms mitigates concerns that our results are biased by confounding factors that are observable to the bank but unobservable to the econometrician. In the most saturated regression models, we include firm and bank×time fixed effects which are represented by λ_f and $\lambda_{b,t}$, respectively. The former control for firm-specific time-invariant unobserved heterogeneity, while the latter control for bank-specific time-varying unobserved heterogeneity. $\epsilon_{f,t}$ is the error term which is clustered at the firm level. The coefficient of interest is β, which captures the effect of having a deposit relationship with outside banks on a firm's probability of switching lenders the next year.

classified as "movers" if, at the time of the switch, their inside loans expired and were not renewed until after they got a loan from an outside bank. Likewise, "movers" could be classified as "adders" if their inside loans happened to expire a few months after the switch.

3.2.2. Deposit relationships and the effects of switching lenders

We also study whether having a prior deposit relationship with outside banks affects the loan conditions that switching firms obtain when they switch lenders. If deposit relationships reduce outside banks' informational disadvantage, then switching firms with a prior deposit relationship should receive better loan conditions than switching firms without such a relationship (von Thadden, 2004). To study this, in an ideal setting, we would have information on the loan terms offered to a firm for a non-switching loan. Unfortunately, we do not have data on (unsuccessful) loan applications, which is why we follow the prior literature and use strict matching models to derive the loan terms offered to the firm for a non-switching loan (Ioannidou and Ongena, 2010). One matching model approximates the inside bank's (unsuccessful) offer using similar loans that the inside bank granted in the same year to other observably similar firms. Figure 5 provides a visual representation of this matching strategy. In an alternative but similar matching strategy, we take into account the possible impact of bank characteristics on the inside and outside offers by comparing the loan terms on switching loans to the loan terms of similar loans that the switcher's outside bank granted in the same year to other observably similar existing borrowers. This matching strategy is depicted in Figure 6. In our main analysis, we focus on the loan rate of the switching loans (Sharpe, 1990), but we also analyze other loan terms (such as loan amounts).

Table A1 in the Appendix provides an overview of the list of variables that are used to establish the matching model. Following Bonfim et al. (2021), we employ coarsened exact matching. This matching model requires fewer assumptions and possesses more attractive statistical properties than other matching models, such as propensity score matching (Iacus et al., 2012). Categorical covariates are matched exactly, and continuous covariates are coarsened using Surges' formula.[14] In matching the switching and non-switching loans, we allow for replacement (i.e., we retain any matched pair that satisfies the matching criteria, meaning that one non-switching loan can be matched with multiple switching loans, or that one switching loan can be matched with multiple non-switching loans). Replacement allows for better matches and less bias, although it comes at the expense of precision. In Section 4.3, we provide robustness tests on, among others, our matching model and the matching variables.

We match loans on the year of origination, firm characteristics (region, industry, legal structure,

[14] In the Appendix, we provide balance diagnostics supporting the validity of this approach. Figure A5 in the Appendix depicts the standardized mean differences of the continuous variables used in the five matching strategies applied in Table 4. This figure shows that the standardized mean differences of the different variables are between -0.20 and 0.20, which indicates that the variables are well-balanced.

size, and credit rating), and loan characteristics (loan amount, type, and collateralization). Matching on the year in which the loan is granted ensures that loans are granted under similar macroeconomic conditions; matching on region, industry, legal structure, size, and credit rating ensures that firms are comparable in terms of fundamental firm-specific dimensions; and matching on loan amount, type, and collateralization ensures that loans are comparable in terms of key loan terms. We match switching loans either with other non-switching loans from the firm's inside banks or with other non-switching loans from the firm's outside bank.

Our empirical strategy proceeds in three steps. First, we match each switching loan with all similar non-switching loans granted to other comparable firms by the switcher's inside or outside banks at the time of the switch. Second, we calculate the spreads between the rates on the switching loans and each matched loan. Third, we regress these spreads on a constant and a dummy variable equal to one if the switcher and the outside bank have a prior deposit relationship. The corresponding regression model is:

$$R_{switch} - R_{non-switch} = \alpha + \beta Prior\ deposit\ relationship + \epsilon \tag{2}$$

where R_{switch} and $R_{non-switch}$ represent the loan rates on the switching loans and matched loans, respectively. In this regression model, we adjust the point estimates by weighting each switching loan observation by one over the total number of comparable non-switching loans in order to account for the multiplicity of switching loans. The constant represented by α captures the average difference in loan rates obtained by switchers compared to non-switchers, and β captures the effect of having a prior deposit relationship on the loan rate obtained by switchers. A significantly negative coefficient estimate for α would suggest that the rates on switching loans are on average lower than the rates on comparable non-switching loans (indicating that switchers receive a loan rate discount). A significantly negative coefficient estimate for β would suggest that switchers with a prior deposit relationship receive a larger loan rate discount than switchers without such relationship.[15]

A potential concern with the empirical strategy explained above is that we match switchers with non-switchers, and then exploit heterogeneity in the loan conditions obtained by switchers with and without a prior deposit relationship. This could lead to biased results in case switchers with and without a prior deposit relationship differ along certain dimensions (for instance, if banks assess switchers with a

[15]An alternative method is to split the matched sample into two sub-samples: one sample of switching loans of switchers with a prior deposit relationship and the matched non-switching loans, and another sample of switching loans of switchers without a prior deposit relationship and the matched non-switching loans. Then, we could regress the spreads on a constant for the two sub-samples, in order to derive the average loan rate discount for the two types of switchers. The results of this alternative method, which are reported in Table A5 in the Appendix, are quantitatively similar.

prior deposit relationship to be less risky on average than switchers without a prior deposit relationship). To address this concern, we apply an alternative empirical strategy based on directly matching switchers with and without a prior deposit relationship. First, we match each switching loan granted by the outside banks to switchers with a prior deposit relationship with all similar switching loans granted by the outside banks to other comparable switchers without a prior deposit relationship. Second, we calculate the spreads between the rates on the switching loans granted to switchers with a prior deposit relationship and each matched loan granted to switchers without a prior deposit relationship. Third, we regress the spreads on a constant. The corresponding regression model is:

$$R_{switch}^{with\ prior\ deposit\ relationship} - R_{switch}^{without\ prior\ deposit\ relationship} = \alpha + \epsilon \tag{3}$$

where the loan rates on the switching loans granted to switchers with and without a prior deposit relationship are represented by $R_{switch}^{with\ prior\ deposit\ relationship}$ and $R_{switch}^{without\ prior\ deposit\ relationship}$, respectively. A significantly negative coefficient estimate for α would suggest that the rates on switching loans granted to switchers with a prior deposit relationship are on average lower than the rates on comparable switching loans granted to switchers without a prior deposit relationship.

3.3. Data and Summary Statistics

For our empirical analysis, we need detailed data on firm-bank relationships and loan contracts. We obtain the former from the Norwegian Tax Administration, which tracks the deposit and lending relationships of all firm-bank pairs in Norway, as explained in Section 2. The latter are retrieved from the credit register administered by the Financial Supervisory Authority of Norway (*Finanstilsynet*). These data allow us to retrieve loan exposures for every firm–bank pair, including detailed information on the loan contract (contractual loan amount, interest rate, proportion of the loan that is collateralized, loan type — i.e., whether the loan is a credit line or not — and status, i.e. the proportion of the loan that is written off). In addition, these data contain a firm-bank-specific credit rating which varies between zero and one, with values closer to one indicating a higher credit risk. Finanstilsynet data are available at a yearly frequency for the period 2014-2019.

We also obtain firm-specific information from the Norwegian Register of Business Enterprises, Brønnøysund Register Centre (*Brønnøysundregistrene*). Firms operating in Norway are required to register their balance sheets and financial statements at the Centre at the end of each year. We use

these data to obtain information about general firm characteristics (such as industry and location) and firms' income statement and balance sheet items (such as total assets, leverage, and profitability). We exclude firms from the financial and insurance sector, the public administration sector, the education sector, and activities of extra-territorial entities. We also restrict our sample to (private and public) limited liability companies, which account for approximately 90% of private sector employment in Norway.

Our final dataset comprises 115 banks and 74,295 firms for a total of 101,365 unique bank-firm relationships over the period 2014-2019. Given our definition of switching, the dataset yields 23,001 switching loans granted to 19,381 firms. This implies that approximately 7% of the loan originations are switching loans, and that 26% of the 74,295 firms in our sample switch banks at some point during our sample period. The percentage of switching loans is relatively constant over time and comparable to the percentage found in previous papers. For instance, Ioannidou and Ongena (2010) find that 4.5% of loan originations are switching loans using Bolivian data and Degryse et al. (2016) find that 5.5% of loan originations are switching loans using Swedish data.

Table 1 provides descriptive statistics for firms with and without an outside deposit relationship, and Table 2 provides descriptive statistics for switching and non-switching firms. The tables also indicate whether the differences in mean, median, and standard deviation between the two types of firms are statistically significant. Table 1 shows that the likelihood of lender switching is larger for firms with outside deposit relationship (29%) compared to firms without outside deposit relationship (16%). Firms that have outside deposit relationships tend to be larger, less leveraged, and more profitable. Turning to Table 2, we observe that the average interest rate for switching loans with a prior deposit relationship is 3.8%, or 134 bps lower than for non-switching loans and 138 bps lower than for switchers without a prior deposit relationship. Further, the loan amount as well as the loan collateralization of switching loans with a prior deposit relationship are larger than the loan amount of non-switching loans and switching loans without a prior deposit relationship. Switchers with and without prior deposit relationship are relatively similar in terms of size and credit rating. In addition, Table A3 in the Appendix show that the distribution of switchers with and without prior deposit relationship across industries is similar. An important difference between switchers with and without prior deposit relationship is, obviously, the fact that the former group had a deposit relationship with the outside banks before obtaining a loan from those banks, and Table 2 shows that the average length of the former group's prior deposit relationships equals about eight years.

4. Results

The results section is structured as follows. First, we examine whether having deposit relationships with outside banks increases firms' probability of switching lenders. Second, we examine whether having a prior deposit relationship with outside banks influences the loan conditions that outside banks offer to firms that switch lenders. Third, we explore the mechanism underlying these effects. Finally, we present a number of extensions and robustness tests.

4.1. Main results

We first assess whether having a deposit relationship with outside banks influences firms' propensity to switch lenders using the fixed effects regression model outlined in Equation (1). Results are presented in Table 3. Across the different columns, we find that having a deposit relationship with outside banks increases firms' probability of switching lenders the next year. Column I for instance indicates that, if a firm has a deposit relationship with an outside bank, it is around 1.6 percentage points more likely to switch lenders the next year. This effect is economically significant as the unconditional probability of switching in our data sample is 16%. The magnitude of the effect even increases to around 6 percentage points in Columns II to V when we saturate our model with firm and bank×time fixed effects. This change in magnitude suggests that firm and lender characteristics are associated with both the likelihood of having outside deposit relationships and the incidence of lender switching.[16] Overall, the results in Table 3 are consistent with the idea that having deposit relationships with outside banks increases firms' outside options and hence firms' probability of switching lenders.

We next examine whether having a pre-existing deposit relationship with outside banks affects the loan conditions that firms receive upon switching. To do so, we use the matching model outlined in Equation (2). The results are presented in Table 4, which depicts the list of matching variables that are used to compare the loan rate, the number of switching and non-switching loans, the total number of observations used in each regression model, and the coefficient estimates of α and β. Standard errors are reported in parentheses and are clustered at the firm level.

We apply five matching strategies. In Column I, we compare the loan rate of switchers with a prior

[16] Bird et al. (2019) obtain a similar result. They use U.S. loan data to study how private firms' voluntary information sharing affects their probability of switching lenders and hold-up problems in the loan market. In regressions without fixed effects they find that, if a borrower voluntarily shares information as part of a loan, it is seven percentage points more likely to switch lenders the next year. In regressions with firm and bank fixed effects, they find that the magnitude of the effect increases to 16 percentage points. The unconditional probability of switching lenders in their data sample is around 21%.

deposit relationship and switchers without a prior deposit relationship to the loan rate of non-switchers made by firms' inside banks, conditional on the specified matching variables. This corresponds to the matching strategy depicted in Figure 5. Matching on the ten variables listed in Column I of Table 4, we are left with 1,884 switching loans that are in 4,670 matched pairs with 3,157 non-switching loans (meaning that each switching loan is matched with approximately 2.5 comparable non-switching loans). From the switching loans, 30% of switchers had a prior deposit relationship with the new (outside) bank.

In Column I, the coefficient estimate of α suggests that, on average, switchers receive a loan rate discount of 76 bps, while the coefficient estimate of β indicates that switchers with a prior deposit relationships obtain an additional loan rate discount of 73 bps. Thus, switchers without a prior deposit relationships receive a loan rate discount of 76 bps while switchers with a prior deposit relationship receive a loan rate discount of 149 bps. This result highlights that switching firms who have a deposit relationship with the outside banks prior to establishing a new lending relationship receive a much larger loan rate discount. In fact, Table A4 in the Appendix shows that, if we were to omit the role of prior deposit relationships in the loan pricing of switching firms, we would estimate that switching firms receive an average loan rate discount of 99 bps.[17] This estimate clearly omits important heterogeneity related to the role of prior deposit relationships in bank switching.

In Column II, instead of matching using comparable loans of the switchers' inside banks, we match using comparable loans of the switchers' outside banks, which corresponds to the matching strategy depicted in Figure 6. This is an important advantage over the matching model in Column I. Since the comparison is now within the same bank during the same year, the loan rate differences between switching and non-switching loans cannot be attributed to unobserved heterogeneity with respect to the inside and the outside banks (such as differences in funding costs). In the rest of the paper, we will refer to this matching strategy as our benchmark model. Based on this matching strategy, we find that the estimated loan rate discount for switchers with a prior deposit relationships is 118 bps larger than for switchers without a prior deposit relationships. Note that, although this estimate is smaller than the one in Column I, it is statistically and economically significant. Specifically, in terms of economic magnitude, the 118 bps loan rate discount for switchers with a prior deposit relationship is

[17] This estimate is in line with Ioannidou and Ongena (2010) who estimate a 89 bps loan rate discount for Bolivia, and Bonfim et al. (2021) who estimate a 90 bps loan rate discount for Portugal. The reason that we find slightly larger loan rate discounts could be because hold-up problems are more pronounced in Norway. One observation in line with this reasoning is that Norwegian firms have fewer lending relationships (most firms have only one lending relationship), which increases banks' capability to capture borrowers (Farinha and Santos, 2002; Degryse and Ongena, 2008).

almost three times the average loan rate discount for switchers without a prior deposit relationship and is approximately one fifth of the average loan rate.

In Columns III to V, we subject our benchmark model to additional robustness tests. In Column III, we replace the credit rating that the switchers obtain from their new bank with the most recent rating they obtained from their inside banks prior to the switch. A potential advantage of this approach is that the inside banks' ratings might be more informative (as the inside bank may know the firm better), which could help better approximate the inside banks' unobserved offer to the switcher. This matching strategy leaves 2,400 observations and results in an average loan rate discount of 40 bps and an additional loan rate discount of 137 bps for switchers with a prior deposit relationship.

In Column IV we replace the inside banks' most recent credit rating with the inside banks' most recent loan rate. A potential advantage of matching on the loan rate instead of the credit rating is that credit ratings affect banks' loan loss provisioning (i.e., banks have to set aside more loan loss provisions for loans with worse credit ratings). Hence, banks that are concerned about their capital position could manipulate credit ratings to lower their risk-weighted assets (e.g., Behn et al., 2022; Bischof et al., 2022; Plosser and Santos, 2018), which would reduce the informativeness of credit ratings compared to loan rates (which do not affect banks' loan loss provisioning). In addition, matching on the loan rate should also control for the effect of the strength of switchers' relationships with their inside banks (i.e., switchers with strong relationships with their inside banks are more exposed to hold-up and thus receive worse inside offers). Matching on the loan rate yields an average loan rate discount of 67 bps and an additional loan rate discount of 128 bps for switchers with a prior deposit relationship.

In Column V, we also match directly on the strength of switchers' relationships with their inside banks prior to the switch. That is, we require that the strength of switchers' bank relationships with their inside banks prior to the switch is similar to the bank relationship strength of the matched non-switchers. To capture relationship strength we use four indicators (as in Ioannidou and Ongena, 2010): Prior Lending Relationship Length (i.e., the average length of prior lending relationships), Prior Multiple Lending Relationships (i.e., an indicator equal to one if prior to the switch the firm had outstanding loans with more than one lender), Prior Primary Lender (i.e., an indicator equal to one if prior to the switch at least one of the firm's inside banks is a primary lender),[18] and Prior Bank Relationships Scope (i.e., an indicator equal to one if prior to the switch the firm had a deposit and

[18]A bank is considered a primary lender of a firm if the value of loans from the bank is at least 50% of the firm's total loans.

lending relationship with its inside banks). Matching on these four bank relationship characteristics reduces the number of observations to 349. Nevertheless, the estimated coefficients remain similar, suggesting that other variables already capture the effect of bank relationship strength on the inside banks' unobserved loan offers.[19]

A potential concern with the regression model in Equation (2) is that we match switchers with non-switchers, and then compare the loan rate discount of switchers with and without a prior deposit relationship. This could lead to biased results in case switchers with and without a prior deposit relationship differ along certain dimensions (for instance, if banks assess switchers with a prior deposit relationship to be less risky on average than switchers without a prior deposit relationship). To address this concern, we apply an alternative matching approach. Recall that we are interested in the difference in loan rates between switchers with and without a prior deposit relationship. This means that we can directly match switchers with a prior deposit relationship to other (comparable) switchers without a prior deposit relationship, and then estimate Equation (3).

The results of this alternative matching strategy are presented in Column I of Table 5. This matching strategy reduces our estimation sample, but consistent with the results from Table 4, we find that switchers with a prior deposit relationship obtain a loan rate that is 53 bps lower than the loan rate of switchers without a prior deposit relationship. This result is statistically and economically significant. In addition, it should be stressed that these results are based on comparing switchers (with and without a prior deposit relationship) which are similar on all the variables of our benchmark matching model, including the credit rating that the new borrower received from the outside bank. This suggests that, even if a bank estimates the credit risk of two switching firms to be equal, the switching firm that had a prior deposit relationship with the new outside bank receives a lower loan rate than the switching firm that did not have a prior deposit relationship.

In Column II of Table 5, we refine our matching approach even further and match switchers that established a deposit relationship with the new bank prior to switching to other (comparable) switchers that established a deposit relationship with the new bank right after switching (i.e., in the year of the bank switch). This matching strategy reduces our sample to 75 observations. Nevertheless, we find that switchers with a prior deposit relationship obtain a loan rate that is 83 bps lower than the loan rate of switchers without a prior deposit relationship. In other words, having a *prior* deposit relationship

[19] An alternative empirical strategy is to split the matched sample into switchers with and without a prior deposit relationship, and to estimate the average loan rate discount for the two samples separately. The results from this approach are presented in Table A5 in Appendix and are quantitatively similar to the results in Table 4.

matters. We analyze the potential mechanisms underlying this result in Section 4.2, but it is worth mentioning that Column II of Table 5 suggests that our results are not simply due to banks' potential cross-selling incentives (Basten and Juelsrud, 2023; Qi, 2023) because, in this case, firms with a deposit relationship prior to switching should not necessarily obtain a larger loan rate discount than switchers with a deposit relationship right after switching.

In sum, our results show that having a prior deposit relationship with outside banks increases firms' propensity to switch lenders as well as the loan conditions that firms receive upon switching lenders. Below, we examine the potential mechanisms underlying these findings, and the implications that can be drawn from this.

4.2. Mechanisms

In this section, we examine the potential mechanisms underlying our results. Previous papers have argued that deposit relationships contain relevant information, including information on firms' payment behavior, that banks could use to assess firms' creditworthiness (e.g., see Black, 1975; Fama, 1985; Mester et al., 2007; Norden and Weber, 2010).[20] For one, based on the cash flowing through a firm's deposit account, a bank can learn about a firm's sales (Petersen and Rajan, 1994). Consistent with this reasoning, several empirical studies have shown that banks can use the information obtained from firms' deposit accounts—which is private, continuous, timely, hard information that cannot easily be manipulated—to monitor existing borrowers' creditworthiness and thereby improve loan outcomes (e.g., by predicting and preventing loan defaults, see Agarwal et al., 2018; Hibbeln et al., 2020; Mester et al., 2007; Norden and Weber, 2010; Puri et al., 2017). Considering that outside banks have an informational disadvantage vis-à-vis inside banks (Rajan, 1992; Sharpe, 1990; von Thadden, 2004), the information obtained from firms' deposit accounts could mitigate this informational disadvantage, which could increase firms' probability of switching and lead to better loan conditions for switching firms. Below, we provide several pieces of evidence in line with this conjecture.

[20] Apart from the information derived from firms' financial statements and information shared through the credit register, the most important source of information for banks to evaluate (potential) borrowers' creditworthiness is information gathered through bank relationships. In fact, a report by McKinsey (2019) states that "payments generate roughly 90 percent of banks' useful customer data."

4.2.1. The length and depth of prior deposit relationships

Research has shown that the information flow between a firm and a bank is an increasing function of the length and the depth of the firm-bank relationship (Bharath et al., 2011; Berger and Udell, 1995; Petersen and Rajan, 1994; Norden and Weber, 2010; Berger et al., 2021). Bharath et al. (2011) for instance show that longer lending relationships lead to lower loan rates, and that this effect is larger for informationally opaque borrowers. Hibbeln et al. (2020) also find that, in the context of consumer credit, banks can create informational synergies by obtaining private information from different accounts of the same borrower. In our context, this implies that, if prior deposit relationships reduce information asymmetries between firms and outside banks, the probability that firms switch lenders should be increasing in the length and depth of the outside deposit relationship. Similarly, the loan rate discount offered to switching firms should be increasing in the length and depth of their prior deposit relationship.

To test this conjecture, we re-estimate Equations (1) and (2), but we replace the dummy variable by a variable capturing the length or depth of the firm-bank deposit relationship. The former is measured as the number of years during which the switching firm and outside bank maintained a deposit relationship. The latter is measured either as the number of different deposit products underlying the deposit relationship or the amount of deposits held by the switching firm at the outside banks compared to the firms' total deposits.

The results for firms' propensity to switch lenders are presented in Table 6. All regressions include firm controls, loan controls, firm fixed effects, and bank×time fixed effects. In line with our conjecture, we find that the probability of switching lenders is increasing in the length and depth of a firms' deposit relationship with outside banks. For instance, Column I indicates that each one-year increase in the length of the outside deposit relationship increases firms' probability of switching lenders by 1 percentage point, and Column II indicates that each one-unit increase in the number of deposit products underlying the outside deposit relationship increases firms' probability of switching lenders by 3.6 percentage points.

The results for the loan rate discount obtained by switching firms is presented in Table 7. In line with the idea that prior deposit relationships mitigate information asymmetries, we find that switching firms' loan rate discount is increasing in the length and depth of the prior deposit relationship. Column II of Panel A, for instance, shows that each one-year increase in the length of firms' prior deposit relationship with outside banks results in an approximately 8 bps lower loan rate on the switching loan.

Panels B and C show that switching firms' loan rate discount is also increasing in the depth of the prior deposit relationship.

Overall, consistent with the idea that banks can obtain useful information from bank-firm deposit relationships, the results in Tables 6 and 7 imply that the informational gap between firms and outside banks is decreasing in the length and the depth of their deposit relationship.

4.2.2. The heterogeneous effects of prior deposit relationships

Theory posits that outside banks would be less willing to bid on loans to borrowers with greater information asymmetries or adverse selection problems (Rajan, 1992). This implies that, in case deposit relationships alleviate outside banks' informational gap, we would expect deposit relationships to be more important in cases where outside banks' informational gap is larger or adverse selection problems are more pronounced. We exploit three sources of heterogeneity to test this conjecture.

First, we exploit heterogeneity in firms' age as several studies have argued that information asymmetries are more severe for young firms (e.g., Beck et al., 2018; Zarutskie, 2006). Second, we exploit heterogeneity in firms' pledgeable assets as previous papers have shown that collateral mitigates adverse selection (Berger et al., 2011; Besanko and Thakor, 1987; Ioannidou et al., 2022).[21] Third, we exploit heterogeneity in bank competition based on the notion that competition increases adverse selection problems (Boot and Thakor, 2000; Degryse and Ongena, 2005; Stiglitz and Weiss, 1981). For each of these three sources of heterogeneity, we create a dummy variable that is equal to one for firms with greater information asymmetries or adverse selection problems. Specifically, the dummy variable is equal to one for young firms, firms with low pledgeable assets, and firms operating in localities with high bank competition.[22] The cutoff used to create each dummy variable is based on the sample median of the corresponding variables.

Based on this, we extend Equation (1) by including an interaction term that is equal to one for firms that suffer from greater information asymmetries or adverse selection problems and that have a deposit relationship with at least one outside bank. This interaction term allows us to assess whether the likelihood of switching lenders is larger for firms with greater information asymmetries or adverse

[21] Collateral can also act as a substitute for bank relationships in mitigating information asymmetries (Holmstrom and Tirole, 1997; Ioannidou et al., 2022).

[22] We measure local bank competition using a loan-based Herfindahl-Hirschman Index, which is calculated in two steps. In the first step, we compute the squared values of each bank's market share relative to the total market. In the second step, we sum the values calculated in the first step. Higher Herfindahl-Hirschman Index values represent a more concentrated (i.e., less competitive) lending market.

selection problems that have an outside deposit relationship compared to other firms that have an outside deposit relationship. The results are presented in Table 8. All regressions include firm controls, loan controls, firm fixed effects, and bank×time fixed effects. In line with our baseline results, we find that having a deposit relationship with at least one outside bank increases firms' probability of switching lenders. Further, in line with our conjecture, the coefficient estimates of the interaction terms show that this effect is larger for firms that face greater information asymmetries or adverse selection problems. Column I for instance shows that, on average, firms with an outside deposit relationship are 4.8 percentage points more likely to switch lenders the next year, and this effect increases to nearly 8 percentage points for young (informationally opaque) firms. Similarly, Columns II and III show that the impact of having an outside deposit relationship on firms' probability of switching lenders is larger for firms that have less pledgeable assets and firms that operate in areas with high bank competition.

We conduct a similar analysis for the loan rates offered by outside lenders to switching firms. Specifically, we split our data sample into firms with low and high information asymmetries or adverse selection problems and then re-estimate Equation (2) for each of those sub-samples. The results are presented in Table 9. This table also reports the difference between the coefficient estimates of the two sub-samples, and the chi-square statistic used to test whether this difference is statistically significant. We first focus on the coefficient estimates of the constant. Panels A and B respectively show that firms that are younger and have less pledgeable assets receive smaller loan rate discounts. These results are consistent with the idea that young firms' creditworthiness is more difficult to assess and that collateral mitigates adverse selection and moral hazard (e.g., Ioannidou et al., 2022). Panel C shows that switchers get higher loan rate discounts in areas with high bank competition, which is in line with evidence from previous papers (e.g., Degryse and Ongena, 2005). Turning to the coefficient estimates of the prior deposit relationship variable, we consistently find that the effect of having a prior deposit relationship on switching firms' loan rate discount is significantly larger for firms with greater information asymmetries or adverse selection problems. For instance, Panel A shows that having a prior deposit relationship increases the loan rate discount obtained by young firms by 133 bps compared to 80 bps for old firms. This difference is statistically significant at the 5% level. Panels B and C show similar results, confirming that having a deposit relationships before switching lenders is particularly relevant for firms that face adverse selection issues.

Taken together, the results presented in Tables 8 and 9 show that the effect of having a prior deposit relationship is stronger for borrowers and markets where information asymmetries and adverse selection

are more relevant. This is in line with our conjecture that having a prior deposit relationship mitigates outside banks' informational disadvantage and winner's curse in competing with inside banks.

4.2.3. Prior deposit relationships and banks' screening capability

In case deposit relationships provide relevant information about firms' creditworthiness, we would expect that having a prior deposit relationship improves banks' screening capability. Put differently, we would expect that prior deposit relationships improve banks' loan performance prediction. To test this hypothesis, we extend the approach from Weitzner and Howes (2021) to test how the credit rating of outside banks assigned to switchers predicts loan defaults, and whether this differs for switchers with and without a prior deposit relationship. This essentially allows us to examine whether outside banks' screening capability is better for switchers with a pre-existing deposit relationship.

Given that only a small fraction of loans are written off, we do not apply a matching strategy. Instead, we use all switching loan observations and estimate the following linear probability model:

$$\begin{aligned} Pr(Loan\ default)_{b,f,t+3} =& \alpha + \delta_1 Prior\ deposit\ relationship_{b,f,t} + \delta_2 Credit\ rating_{b,f,t} + \\ & \delta_3 (Prior\ deposit\ relationship \times Credit\ rating)_{b,f,t} + \gamma C_{b,f,t} + \epsilon_{b,f,t} \end{aligned} \tag{4}$$

where the outcome variable is a dummy equal to one if the loan is written off within the first three years after the bank switch.[23] $Prior\ deposit\ relationship_{b,f,t}$ is a dummy variable equal to one if the switcher had a prior deposit relationship with the new (outside) bank, and zero otherwise. $Credit\ rating_{b,f,t}$ is the credit rating assigned by the new bank to the new borrower at the time of the switch, and varies between zero and one, with higher values corresponding to a higher probability of default (and thus a worse credit rating). Since we use the credit rating assigned at the time of the switch, this variable captures information used in the bank's screening process, but not in the bank's monitoring process. $C_{b,f,t}$ is a vector of control variables, which consists of the variables used in our benchmark matching model (i.e., the loan amount, the loan type, the proportion of the loan collateralized, firm size, bank fixed effects, time fixed effects, firm sector fixed effects, firm legal type fixed effects, and firm locality fixed effects). The error term, $\epsilon_{b,f,t}$, is clustered at the firm level. In this regression model, δ_1 captures the potential difference in loan defaults between switchers with and without a prior deposit relationship, δ_2 captures banks' (average) screening capability, and δ_3 captures the potential difference in banks'

[23] The results are robust at a five-year horizon.

screening capability for switchers with and without a prior deposit relationship.

The results are presented in Table 10. In this table, Columns I and II report the regression results of estimating Equation (4) without and with control variables, respectively. First, focusing on the coefficient estimate of δ_1, our results indicate that switchers with a prior deposit relationship have a slightly lower probability of default, which is in line with previous papers showing that banks can use information from borrowers' deposit relationships to improve borrowers' loan performance (e.g., Mester et al., 2007; Norden and Weber, 2010). Second, the coefficient estimate of δ_2 is positive and large, indicating that the credit rating assigned at the time of the switch is a good predictor of a new borrower's future loan performance. For instance, a one standard deviation deterioration in *Credit rating* is associated with a 1.5 percentage points increase in a new borrower's probability of default, which corresponds to about 30% of the standard deviation of new borrowers' average probability of default. Finally, the coefficient estimate of δ_3 is positive and statistically significant, which indicates that the predictive ability of *Credit rating* is larger for new borrowers with a prior deposit relationship. Thus, in line with our conjecture, our results confirm that prior deposit relationships improve outside banks' screening capability.

4.3. Extensions

4.3.1. Other loan terms

Table 11 presents the results from estimating how prior deposit relationships affect other loan terms of switching loans. We estimate the effect on the proportion of the loan that is collateralized, the loan amount, and the loan type. For brevity, Table 11 only reports the results using the matching variables used in the benchmark model and the loan rate[24] (but Tables A6 to A8 in the Appendix also show that these results hold using each of the five matching strategies that we applied in Table 4). We first focus on the coefficient estimates of α across the three columns. These estimates indicate that, on average, switching loans have a lower collateralization rate, a lower loan amount, and a lower probability of being a credit line, which is consistent with the results from Bonfim et al. (2021). Turning to the coefficient estimates of β, Column I shows that the collateral requirements of switching loans do not depend on whether the switcher has a prior deposit relationship with the new (outside) bank. Column II indicates that switchers with a prior deposit relationship obtain larger loan amounts than switchers without a

[24]Obviously, we do not match on the outcome of interest used in the corresponding regression models.

prior deposit relationship, which is in line with the notion that firms with prior deposit relationships receive better loan conditions. Column III shows that switchers with a prior deposit relationships are more likely to obtain a credit line, which accords with research showing that deposit relationships are particularly useful to monitor credit lines (Norden and Weber, 2010). Taken together, we find that switchers with a prior deposit relationship receive lower loan rates and larger loan amounts, without being subject to stricter collateral requirements.

4.3.2. Matching variables

The matching variables used in our analysis are very similar to the matching variables used in the seminal paper by Ioannidou and Ongena (2010). These variables account for differences across lenders, borrowers, loan characteristics, relationship characteristics, and macroeconomic conditions. However, these variables do not account for differences across deposit characteristics, which could be relevant in banks' loan pricing decisions. In Table A9 in the Appendix, we address this issue and enrich our matching model with a set of deposit characteristics. For comparison, Column I presents the benchmark model. In Columns II to IV, we gradually enrich our matching model with three deposit characteristics: the deposit rate that the firm earns at the bank, the number of deposit relationships that a firm maintains, and the deposit amount that the firm deposits at the bank. First, matching on the deposit rate allows to account for banks' potential cross-selling incentives (Basten and Juelsrud, 2023; Qi, 2023).[25] Second, matching on the number of deposit relationships controls for the exclusiveness and completeness of firm-bank deposit relationships (i.e., the exclusiveness and completeness of banks' screening and monitoring rights) (Hauswald and Marquez, 2006; Marquez, 2002). Third, matching on the deposit amount takes into account potential effects related to the role of deposits as a source of bank funding (Berlin and Mester, 1999; Kashyap et al., 2002) or the role of deposits as a form of collateral (Hellweg, 1961; Uchida, 2003). The results in Table A9 show that our results do not change as we enrich our matching model with deposit characteristics. In fact, the economic relevance of having a prior deposit relationship increases (compared to the benchmark model), which further supports that our results are not subject to omitted variable bias.[26]

[25] Note that we do not observe the actual deposit rate, but we can impute it. In particular, for every firm-bank pair, our data records the end-of-year outstanding deposit amount and the interest received on the account during the year. Consequently, we can impute the deposit rate received by a firm f from its bank b in year t by dividing the interest amount received throughout year t by the average of the stocks of deposits at the end of year $t-1$ and year t (as in Basten and Juelsrud, 2023; Iyer et al., 2019).

[26] The average loan rate discount also remains stable across the different columns, and is similar to the average loan rate discount from Table 4.

In a similar robustness test, in Table A10 in Appendix we use a larger set of firm-specific matching variables. For comparison, we present the benchmark model in Column I. In Columns II to IV, we gradually enrich our matching model with three firm-specific variables: Firm leverage (measured as debt over total assets), profitability (measured as earnings before interest and taxes over total assets), and sector (based on two-digit SIC codes). Even though the number of observations drops from 5,376 in Column I to 474 in Column IV, our results remain quantitatively similar to our baseline results, which confirms the robustness of our findings.

4.3.3. Loan rate cycle

In general, we have focused on the loan rate offered at the time firms switch lenders. Based on this analysis, we find that switchers with a prior deposit relationship receive better loan conditions than switchers without a prior deposit relationship. However, this analysis does not take into account potential differences in the loan rate obtained over the course of the new lending relationships. For instance, it could be that switchers with a (prior) deposit relationships are more likely to be held up by the new bank (Sharpe, 1990). That is, over time, the new bank could more rapidly raise the loan rate of switchers with a (prior) deposit relationship, which could offset the benefit from the lower loan rate obtained at the time of the switch.

To empirically examine this, we follow the approach of Ioannidou and Ongena (2010) and investigate switchers' loan rate cycle. In particular, we trace the switchers over time at their new bank, and compute the spread between the loan rate on the switching loan and the loan rate on future loans that the switchers obtain from the new bank after the switch. Thus, we compare loans from the same bank to the same borrower over the course of the new lending relationship. In addition to matching on bank and borrower identity, we also match on the variables used in our benchmark model, which includes borrowers' credit rating and loan conditions (meaning that we compare only the loans to switchers that remained with the new bank and whose rating did not change after the switch). This matching exercise yields 1,069 switching loans and 1,763 comparable future loans.

Using this sample, we split our sample into switchers with and without a prior deposit relationship at the time of the switch, and we group the corresponding matches into four one-year periods after the switch. For each of these four groups, we then regress the spreads on a constant and time dummies (allowing the spreads to depend on other time-specific conditions). The results are reported in Table A11 in the Appendix, which reports the coefficient estimates of the constant. In general, the results

suggest that the loan rate cycle of switchers with and without a prior deposit relationship is very similar. For both samples, we find that the new bank gradually increases the loan rate over the course of the lending relationship (as in Ioannidou and Ongena, 2010). For instance, four years after the switch, the loan rate of switchers without a prior deposit relationship is 9 bps higher than at the time of the switch and the loan rate of switchers with a prior deposit relationship is 11 bps higher than at the time of the switch. Overall, this suggests that our baseline results are not attributable to differences in the loan rate cycle of switchers with and without a prior deposit relationship at the new bank.

4.3.4. Inside banks' response

In our main analysis, we focus on how having a prior deposit relationships with outside banks affects the loan conditions that outside banks offer to switching firms. We now turn to the inside banks and study how they respond to borrowers having deposit relationships with outside banks. Theoretically, it is unclear whether and how inside banks would respond. On the one hand, by reducing the informational disadvantage of outside banks, having a deposit relationship with outside banks could increase the likelihood of receiving outside bids and hence increase lender competition (Sharpe, 1990; von Thadden, 2004). This implies that establishing a deposit relationship with outside banks could induce inside banks to offer better loan terms. One the other hand, research has shown that obtaining credit from an outside bank can trigger a decrease in inside banks' willingness to lend to a firm, due to concerns about coordination problems and higher indebtedness (Bizer and DeMarzo, 1992; Bolton and Scharfstein, 1996; Degryse et al., 2016; Parlour and Rajan, 2001). This implies that establishing a deposit relationship with outside banks could induce inside banks to cut credit.

To test these opposing predictions, we analyze how inside banks respond to firms' decision to have a deposit relationship with outside banks (without necessarily obtaining credit from those banks). Specifically, we slightly adjust our baseline matching model to see how the loan terms offered by a firm's inside bank change after the firm starts a deposit relationship with another outside bank (similar to Bird et al., 2019).[27]

[27]We proceed in three steps. First, we identify firms that start a deposit relationship with outside banks and match the loans of those firms with all similar loans granted to other comparable firms at the same inside bank. Second, we calculate the difference between the change in interest rate on loans granted to firms that started a deposit relationship with another bank and each matched loan. Third, we regress the difference on a constant. The corresponding regression model is:

$$\Delta R_{deposit\ relationship\ with\ outside\ bank} - \Delta R_{matched} = \alpha + \epsilon \tag{5}$$

where $\Delta R_{deposit\ relationship\ with\ outside\ bank}$ is the change in interest rate on loans granted to firms that started a deposit relationship with outside banks in year t, and $\Delta R_{matched}$ is the change in interest rate on loans granted to

The results are reported in Table A12 in the Appendix. Panels A and B show the results for changes in interest rates and credit, respectively. Across the different columns, we estimate the change in interest rates or credit from year $t-1$ to year t and $t+1$, respectively, where t corresponds to the year in which a firm started a deposit relationship with outside banks. Panel A shows that inside banks decrease the loan rates offered to borrowers that start a deposit relationship with outside banks. Column (2) of Panel A for instance indicates that, after starting a deposit relationship with outside banks, borrowers obtain 30 bps lower loan rates than similar borrowers that did not start a deposit relationship with outside banks. Turning to Panel B, we do not find significant changes in credit. Put differently, inside banks do not seem to change the amount of credit offered to firms that start a deposit relationship with outside banks.[28]

Overall, Table A12 shows that firms are offered lower loan rates by their inside banks after starting a deposit relationship with outside banks. Although this reduction in loan rates is smaller than the loan rate discount that firms can obtain from switching to outside banks, these results are consistent with the idea that having a deposit relationship with outside banks increases lender competition (Sharpe, 1990; von Thadden, 2004). Moreover, these results provide further evidence that having a deposit relationship with outside banks is in fact beneficial to borrowers as it mitigates hold-up problems (Bird et al., 2019; Schenone, 2010).

4.3.5. Within-firm matching strategy

In our main analysis, we apply two matching strategies. In the first one, we identify bank switches and use a matching model to compare the loan conditions obtained by switching firms with and without a prior deposit relationship to the loan conditions obtained by comparable non-switching firms. In the second one, we identify bank switches and use the same matching model to compare the loan conditions obtained by switching firms with a prior deposit relationship to the loan conditions obtained by comparable switching firms without a prior deposit relationship. Both approaches enable us to determine whether switchers with a prior deposit relationship receive different loan conditions than switchers without a prior deposit relationship, but the second approach is more restrictive than the first one.

comparable firms that did not start a deposit relationship with outside banks. α and ϵ represent a constant and the error term, respectively

[28] In unreported results, we also study whether the deposit rate offered by a firm's inside bank changes after the firm starts a deposit relationship at another outside bank. We do not find evidence for this.

In this robustness test, we apply a third matching strategy that is based on comparing the loan conditions on switching and non-switching loans obtained by the same firm in the same year. This within-firm analysis is similar to the first approach applied in our main analysis, but instead of matching a switching loan from a switching firm with a comparable non-switching loan from a non-switching firm, we match a switching loan from a switching firm with a concurrent non-switching loan from that switching firm (also see Bonfim et al., 2021). This allows to mitigate that our results are driven by unobserved firm-specific characteristics in the year of the bank switch.

The results are presented in Table A13 in the Appendix. Across the different columns, we report the list of matching variables used in the matching model. In the second column, this list includes an indicator variable equal to one if the firm and the bank have a deposit relationship in the year of the matching exercise, which allows to control for general differences in loan conditions offered to borrowers with a without a deposit relationship.[29] The number of observations declines substantially, but the results are similar to our baseline results. We find that, on average, switchers receive a loan rate discount, but this loan rate discount is significantly larger for switchers that have a prior deposit relationship with the outside banks.

4.3.6. Matching model

In our baseline results, we use coarsened exact matching (as in Bonfim et al., 2021), but Table A14 in Appendix shows that our results also hold using propensity score matching. In contrast to coarsened exact matching, which relies on matching firms that share exactly the same characteristics, propensity score matching relies on matching similar firms. This means that propensity score matching results in a larger number of matches, as can be seen from Table A14. Despite these technical differences, the results using propensity score matching are very similar to our baseline results, confirming the robustness of our findings.

4.3.7. Bank switching definition

In our baseline results, we use the operational definition of lender switching from Ioannidou and Ongena (2010). Based on this definition, a firm switches lenders if it obtains a loan from a bank with which it

[29] In general, this leads to the switching loans from switchers with a prior deposit relationship at the outside bank being matched with concurrent non-switching loans from those switchers at other banks with which they have a deposit relationship, and switching loans from switchers without a prior deposit relationship at the outside bank being matched with concurrent non-switching loans from those switchers at other banks with which they do not have a deposit relationship.

did not have a lending relationship during the previous twelve months (see Section 3.1). This definition relies on the assumption that key inside information becomes inadequate within one year (Ioannidou and Ongena, 2010). However, one could be concerned about the validity of this assumption. For instance, a firm could have obtained a loan from an outside bank in year $t-2$ or $t-3$, but we would still consider a loan obtained in year t to be a switching loan. This could be particularly problematic if firms that have a prior deposit relationship with the outside bank are more likely to be firms that obtained credit from the outside banks at an earlier point in time. In that case, the coefficient estimate of β in our baseline regression could be picking up the effect of having had a prior lending relationship with the outside bank at an earlier point in time.

To mitigate this concern, we re-estimate our results using a stricter lender switching definition. Specifically, we assume the following two conditions for a new loan to be classified as a switching loan. First, the new loan should be obtained from a bank with which the firm did not have a lending relationship ever before. That is, based on the deposit and loan account data from the Norwegian Tax Administration, a new loan is classified as a switching loan if the firm and the bank did not have a prior lending relationship since the year 2000. This condition is much stricter than our previous condition and ensures that we are focusing on truly "new" lending relationships. Second, as before, the firm must have had at least one lending relationship in the previous twelve months with at least one other bank. The results based on this alternative definition are presented in Tables A15 and A16 in the Appendix and are very comparable to the results from Tables 3 and 4, respectively, confirming the robustness of our findings.

5. Conclusion

Theoretical papers have highlighted that, in the process of lending to a firm, the incumbent (inside) bank gains an informational advantage over other (outside) banks (Rajan, 1992; Sharpe, 1990; von Thadden, 2004). This informational advantage makes it difficult for borrowers to switch lenders as outside banks face a winner's curse in competing with the inside bank, which in turn allows the inside bank to hold up borrowers. In this paper, we show that firms can mitigate outside banks' informational disadvantage through the formation of deposit relationships, which can attenuate the hold-up problem in the loan market.

Using unique data on firm-bank deposit and lending relationships from Norway, we document that

firms switching to a new lender often have a prior deposit relationship with their new outside bank. This suggests that deposit relationships play an important role in lender switching. Consistent with this, we show that having a deposit relationship with outside banks significantly increases firms' propensity to switch lenders. Moreover, we show that, when firms switch lenders, switching firms that had a prior deposit relationship with the outside banks are offered significantly better loan conditions than switching firms that did not have such a relationship. In line with informational hold-up theory, we find that these effects are due to the fact that prior deposit relationship reduce information asymmetries and adverse selection problems.

Our findings have important implications for our understanding of hold-up problems in the loan market. First, our results indicate that hold-up problems may be larger than previously thought (or, stated differently, switching lenders may be more difficult than previously thought). Second, our results highlight that reducing information asymmetries — for instance by facilitating deposit competition or adopting open banking initiatives — is critical to facilitating bank switching and thereby mitigating hold-up problems in the loan market (He et al., 2023; Parlour et al., 2022).

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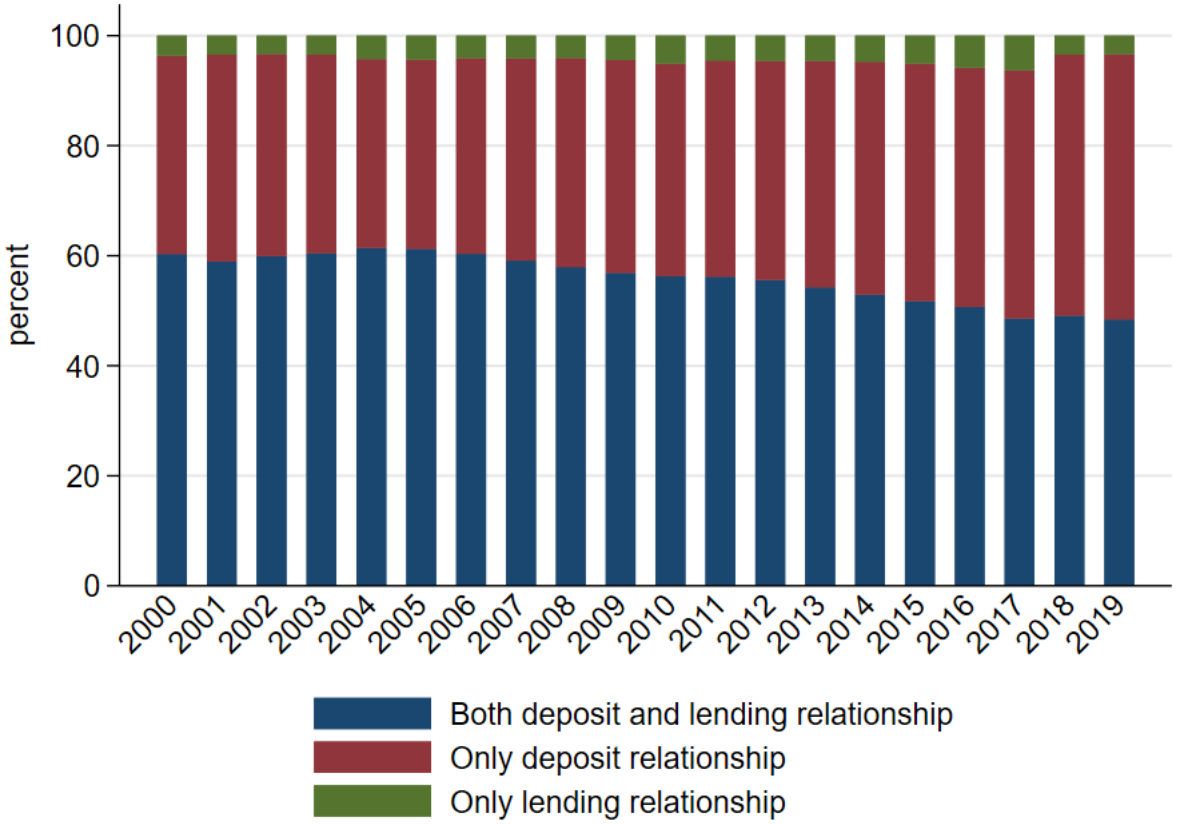
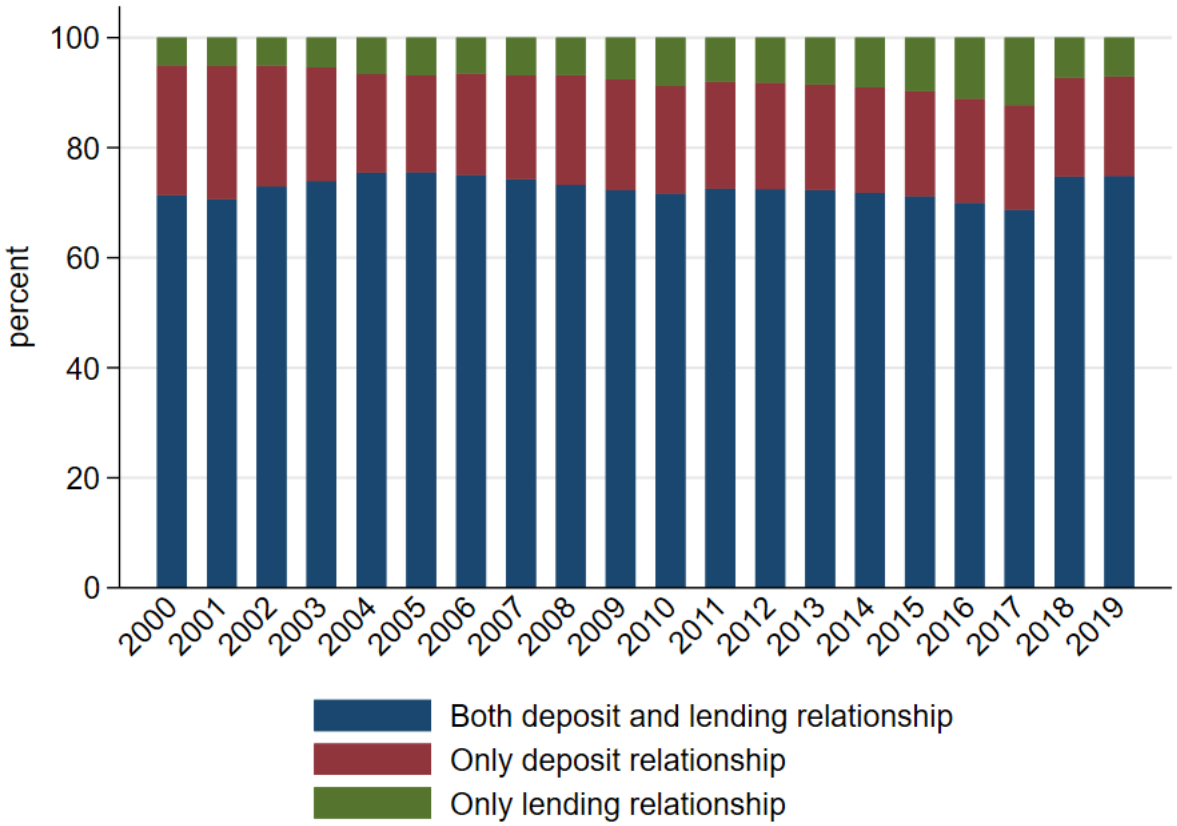
Figure 1: The structure of firm-bank relationships



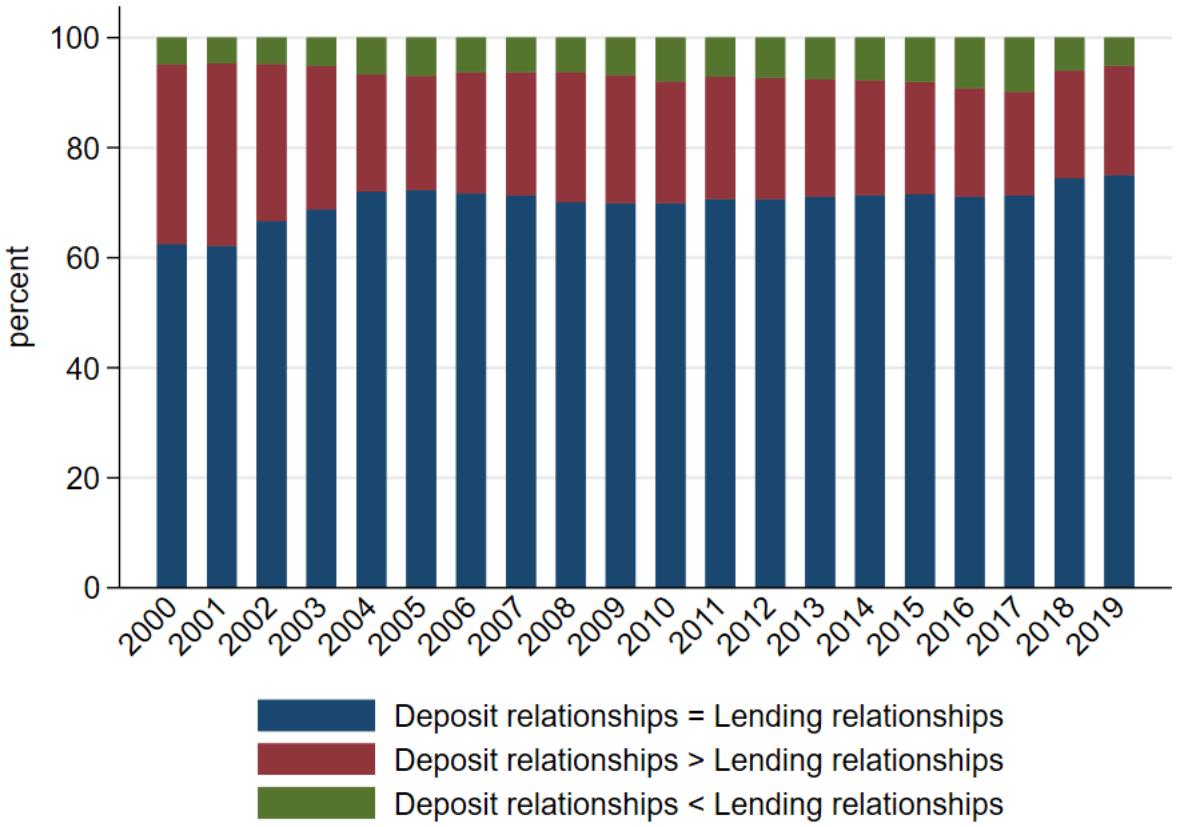
Note: This figure uses data on the deposit and lending relationships of all firm-bank pairs in Norway to show the proportion of firm-bank relationships that consists of both a deposit and a lending relationship in blue, the proportion of firm-bank relationships that consists of only a deposit relationship in red, and the proportion of firm-bank relationships that consists of only a lending relationship in green. The sample period ranges from 2000 until 2019.

Figure 2: The structure of firm-bank relationships, for firms with at least one lending relationship



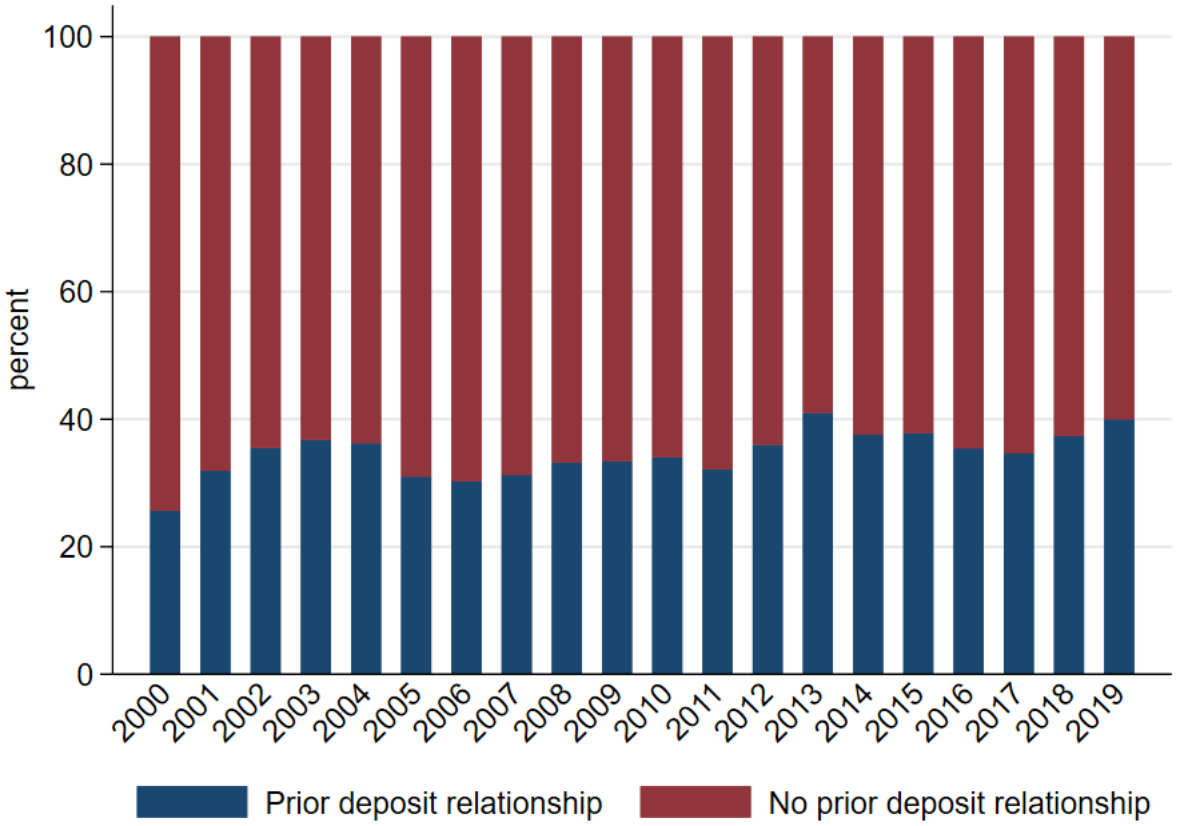
Note: This figure uses data on the deposit and lending relationships of all firm-bank pairs in Norway to show the proportion of firm-bank relationships that consists of both a deposit and a lending relationship in blue, the proportion of firm-bank relationships that consists of only a deposit relationship in red, and the proportion of firm-bank relationships that consists of only a lending relationship in green. The data sample used to construct this figure is restricted to firms with at least one lending relationship, i.e., firms that in a given year borrow from at least one bank in the loan market. The sample period ranges from 2000 until 2019.

Figure 3: The number of lending and deposit relationships per firm, for firms with at least one lending relationship



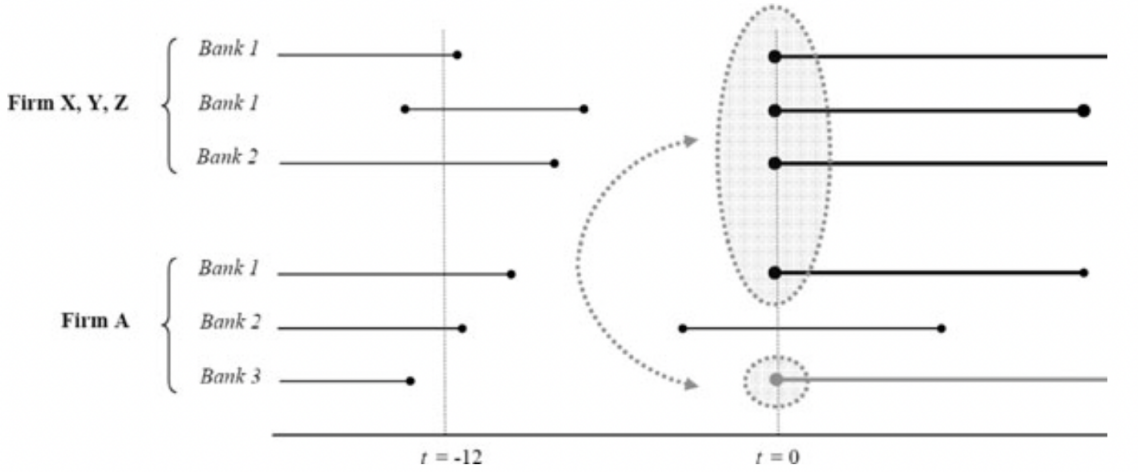
Note: This figure uses data on the deposit and lending relationships of all firm-bank pairs in Norway to show the proportion of firms that maintain as many deposit relationships as lending relationship in blue, the proportion of firms that maintain more deposit relationships than lending relationships in red, and the proportion of firms that maintains fewer deposit relationships than lending relationships in green. The data sample used to construct this figure is restricted to firms with at least one lending relationship, i.e., firms that in a given year borrow from at least one bank in the loan market. The sample period ranges from 2000 until 2019.

Figure 4: The proportion of switchers having a deposit relationship with outside banks prior to the bank switch



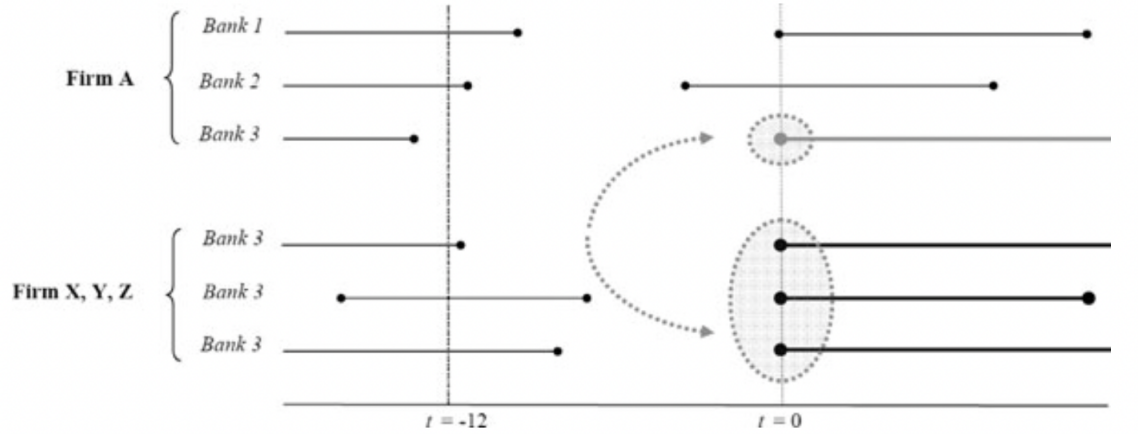
Note: This figure uses data on the deposit and lending relationships of all firm-bank pairs in Norway to show the proportion of switchers that had a deposit relationship with new (outside) banks prior to obtaining a (switching) loan from those banks in blue, and the proportion of switchers that did not have a deposit relationship with new (outside) banks prior to obtaining a (switching) loan from those banks in red. Following the definition from Ioannidou and Ongena (2010), a loan is classified as a switching loan if it satisfies the following two conditions: First, the loan should be obtained from a bank with which the firm did not have a lending relationship during the previous twelve months. Second, the firm must have had at least one lending relationship in the previous twelve months with at least one other bank. The data sample used to construct this figure is restricted to firms with at least one lending relationship, i.e., firms that in a given year borrow from at least one bank in the loan market. The sample period ranges from 2000 until 2019.

Figure 5: Switching versus non-switching loans at the switcher's inside bank



Note: This figure displays the matching strategy that compares the loan rate of the switching loans to the loan rate of comparable loans from the switcher's inside banks at the time of the switch. The loan granted by Bank 3 to Firm A is the switching loan; all other loans are non-switching loans. Source: Ioannidou and Ongena (2010).

Figure 6: Switching versus non-switching loans at the switcher's outside bank



Note: This figure displays the matching strategy that compares the loan rate of the switching loans to the loan rate of comparable non-switching loans that the switcher's outside bank originates at the time of the switch. The loan granted by Bank 3 to Firm A is the switching loan; all other loans are non-switching loans. Source: Ioannidou and Ongena (2010).

Tables

Table 1: Summary statistics for firms with and without an outside deposit relationship

	Firms with outside deposit relationship (N=77,915)			Firms without outside deposit relationship (N=255,907)		
	Mean	Median	SD	Mean	Median	SD
Loan rate	4.901***	4.574***	3.726***	5.237	4.950	3.093
Credit rating	0.027***	0.007***	0.095***	0.030	0.008	0.099
ln(Loan amount)	13.23***	13.13***	2.317***	13.16	13.10	1.927
Credit line	0.494***	0.000	0.500	0.462	0.000	0.499
Proportion of loan collateralized	134.1***	81.66***	265.5***	148.0	95.67	254.8
Public company	0.004***	0.000	0.064***	0.001	0.000	0.033
Size	9.072***	8.902***	1.875***	8.488	8.401	1.651
Debt/TA	76.72***	71.52***	55.16***	83.37	75.03	60.99
EBIT/TA	3.948***	6.122***	31.57***	2.584	5.275	32.29
Fixed assets/TA	31.28***	23.10***	27.46***	32.26	24.63	27.62
Switch	0.187***	0.000	0.390***	0.158	0.000	0.033

Note: This table reports the mean, median, and standard deviation of loan and firm characteristics for firms with and without an outside deposit relationship. The differences in means are assessed using the Student's t-test. The differences in medians are assessed using the Wilcoxon–Mann–Whitney test for continuous variables and Pearson's chi-square test for categorical variables. The differences in standard deviations are assessed using Levene's test. The table indicates whether the differences between the corresponding mean, median, and standard deviation are significant at the 10%, 5%, and 1% levels using *, **, and ***, respectively. The comparison group is the group of firms without an outside deposit relationship.

Table 2: Summary statistics for switching and non-switching firms

	Switchers with prior deposit relationship (N=8,539)			Switchers without prior deposit relationship (N=14,462)			Non-switchers (N=310,101)		
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
Loan rate	3.846***	3.634***	3.717***	5.233	4.300***	4.311***	5.194	4.902	3.164
Credit rating	0.025***	0.007***	0.081***	0.021***	0.004***	0.086***	0.029	0.007	0.097
ln(Loan amount)	13.71***	13.82***	2.472***	12.72***	12.67***	2.056***	13.20	13.12	2.002
Credit line	0.709***	1.000***	0.454***	0.216***	0.000***	0.412***	0.476	0.000	0.499
Proportion of loan collateralized	161.9**	100.0	300.5***	97.48***	75.54***	208.2***	148.4	95.36	258.8
Public company	0.004***	0.000	0.062***	0.002	0.000	0.041	0.001	0.000	0.038
Size	9.021***	8.894***	1.705	8.902***	8.750***	1.648***	8.461	8.339	1.721
Prior deposit relationship length	7.956***	7.000***	5.712***	0.000***	0.000***	0.000***	5.095	3.000	5.997

Note: This table reports the mean, median, and standard deviation of loan and firm characteristics for switching firms with a prior deposit relationship, switching firms without a prior deposit relationship , and non-switching firms. The differences in means are assessed using the Student's t-test. The differences in medians are assessed using the Wilcoxon–Mann–Whitney test for continuous variables and Pearson's chi-square test for categorical variables. The differences in standard deviations are assessed using Levene's test. The table indicates whether the differences between the corresponding mean, median, and standard deviation are significant at the 10%, 5%, and 1% levels using *, **, and ***, respectively. The comparison group is the group of non-switchers.

Table 3: Deposit relationships and the likelihood of switching lenders

	I Pr(Switch)	II Pr(Switch)	III Pr(Switch)	IV Pr(Switch)	V Pr(Switch)
Outside deposit relationship$_{t-1}$	0.0161***	0.0777***	0.0683***	0.0632***	0.0611***
	(0.0026)	(0.0038)	(0.0038)	(0.0037)	(0.0037)
Observations	307,374	307,374	307,374	307,374	307,374
Adjusted R-squared	0.0258	0.2281	0.2483	0.2594	0.2695
Firm controls	Yes	Yes	Yes	Yes	Yes
Loan controls	Yes	Yes	Yes	Yes	Yes
Firm FE	No	Yes	Yes	Yes	Yes
Time FE	No	No	Yes	Yes	No
Bank FE	No	No	No	Yes	No
Bank × Time FE	No	No	No	No	Yes

Note: This table estimates how having a prior deposit relationship with outside banks affects firms' probability of switching lenders. The outcome variable is a dummy variable equal to one if firm f switches to an outside bank at time t. The independent variable of interest is a dummy variable equal to one if firm f had a deposit relationship with at least one outside bank at time $t-1$. The vector of firm controls includes firms' size, leverage ratio, EBIT to total assets, and fixed assets to total assets, and a dummy variable equal to one for public companies. The vector of loan controls includes the loan rate, loan amount, the proportion of loan collateralized, the probability of loan default, and a dummy variable equal to one for credit lines. Standard errors are clustered at the firm level and reported in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

Table 4: Deposit relationships and the effects of switching lenders

Matching variables	I	II	III	IV	V
	Loan rate	Loan rate	Loan rate	Loan rate	Loan rate
Year	Yes	Yes	Yes	Yes	Yes
Inside bank	Yes				
Outside bank		Yes	Yes	Yes	Yes
Credit rating	Yes	Yes			
Region	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes
Legal structure	Yes	Yes	Yes	Yes	Yes
Size	Yes	Yes	Yes	Yes	Yes
Loan amount	Yes	Yes	Yes	Yes	Yes
Loan type	Yes	Yes	Yes	Yes	Yes
Proportion of loan collateralized	Yes	Yes	Yes	Yes	Yes
Prior credit rating from inside banks			Yes		
Loan rate on prior inside loans				Yes	
Prior relationship length					Yes
Prior multiple bank relationships					Yes
Prior primary lender					Yes
Prior bank relationship scope					Yes
Number of switching loans	1,884	2,309	1,223	698	235
Number of non-switching loans	3,157	3,703	1,858	978	325
Number of observations	4,670	5,376	2,400	1,192	349
Proportion of switching loans with a prior deposit relationship	30%	29%	28%	33%	26%
Constant	-0.7644***	-0.4772***	-0.4050***	-0.6745***	-0.1783
	(0.0869)	(0.0638)	(0.0930)	(0.0956)	(0.2061)
Prior deposit relationship	-0.7303***	-1.1864***	-1.3791***	-1.2861***	-1.7373***
	(0.1804)	(0.1672)	(0.2087)	(0.2653)	(0.6249)

Note: This table reports the estimated spread between the loan rate on switching loans to firms with and without a prior deposit relationship and non-switching loans. Across the different columns, we report the variables used in the matching procedure. All variables are defined in Table A1 in Appendix. We regress the spreads on a constant and a dummy variable equal to one if the firm and the outside bank had a prior deposit relationship. We report the coefficient of the constant and the dummy variable. We weigh each observation by one over the total number of comparable non-switching loans per switching loan. Standard errors are clustered at the firm level and reported in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

Table 5: Deposit relationships and the effects of switching lenders: Comparing switchers to switchers

	I Loan rate	II Loan rate
Comparison group	Switchers with a deposit relationship prior to switching vs. Other switchers	Switchers with a deposit relationship prior to switching vs. Other switchers with a deposit relationship after switching
Number of switching loans with prior deposit relationship	251	64
Number of switching loans without prior deposit relationship	257	55
Number of observations	356	75
Constant	-0.5301**	-0.8392***
	(0.2215)	(0.2887)

Note: This table reports the estimated spread between the loan rate on switching loans to firms with a prior deposit relationship and switching loans to firms without a prior deposit relationship. The variables used in the matching procedure are those from our benchmark model, as explained in Section 4.1. All variables are defined in Table A1 in the Appendix. We regress the spreads on a constant and report the coefficient of the constant. We weigh each observation by one over the total number of comparable switching loans without prior deposit relationship per switching loan with prior deposit relationship. Standard errors are clustered at the firm level and reported in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

Table 6: Deposit relationships and the likelihood of switching lenders: The length and depth of prior deposit relationships

	I Pr(Switch)	II Pr(Switch)	III Pr(Switch)
Outside deposit relationship length$_{t-1}$	0.0104***		
	(0.0006)		
Outside deposit relationship depth$_{t-1}^{number\ of\ deposit\ products}$		0.0360***	
		(0.0021)	
Outside deposit relationship depth$_{t-1}^{share\ of\ total\ deposits}$			0.1132***
			(0.0068)
Observations	307,374	307,374	307,374
Adjusted R-squared	0.2703	0.2700	0.2695
Firm controls	Yes	Yes	Yes
Loan controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Bank × Time FE	Yes	Yes	Yes

Note: This table estimates how the length and depth of prior deposit relationship with outside banks affects firms' probability of switching lenders. The outcome variable is a dummy variable equal to one if firm f switches to an outside bank at time t. The independent variable of interest is the length (Column I) or the depth (Columns II and III) of the deposit relationship that firm f had with outside banks at time $t-1$. The vector of firm controls includes firms' size, leverage ratio, EBIT to total assets, and fixed assets to total assets, and a dummy variable equal to one for public companies. The vector of loan controls includes the loan rate, loan amount, the proportion of loan collateralized, the probability of loan default, and a dummy variable equal to one for credit lines. Standard errors are clustered at the firm level and reported in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

Table 7: Deposit relationships and the effects of switching lenders: The length and depth of prior deposit relationships

	I	II	III	IV	V
	Loan rate	Loan rate	Loan rate	Loan rate	Loan rate
Number of switching loans	1,884	2,309	1,223	698	235
Number of non-switching loans	3,157	3,703	1,858	978	325
Number of observations	4,670	5,376	2,400	1,192	349
Proportion of switching loans with a prior deposit relationship	30%	29%	28%	33%	26%
Panel A: Prior deposit relationship length					
Constant	-0.8689***	-0.6415***	-0.5854***	-0.8355***	-0.2037
	(0.0816)	(0.0635)	(0.0910)	(0.1007)	(0.2118)
Prior deposit relationship length	-0.0620***	-0.0798***	-0.1031***	-0.1188***	-0.2677***
	(0.0214)	(0.0210)	(0.0211)	(0.0383)	(0.0786)
Panel B: Prior deposit relationship depth (number of deposit products)					
Constant	-0.8916***	-0.5221***	-0.4292***	-0.6619***	-0.1774
	(0.1023)	(0.0635)	(0.0911)	(0.0987)	(0.2118)
Prior deposit relationship depth	-0.1764***	-0.3703***	-0.4673***	-0.4792***	-0.5736***
	(0.0520)	(0.0498)	(0.0648)	(0.0837)	(0.1540)
Panel C: Prior deposit relationship depth (share of total deposits)					
Constant	-0.8399***	-0.5049***	-0.4722***	-0.6360***	-0.2496
	(0.0820)	(0.0638)	(0.0896)	(0.0980)	(0.2136)
Prior deposit relationship depth	-1.2911***	-2.5651***	-2.6765***	-2.9180***	-3.0434***
	(0.3675)	(0.2919)	(0.3304)	(0.3694)	(0.9182)

Note: This table reports the estimated spread between the loan rate on switching loans to firms with and without a prior deposit relationship and non-switching loans. Across the different columns, the variables used in the matching procedure correspond to those from Table 4. All variables are defined in Table A1. We regress the spreads on a constant, a variable capturing the length (Panel A) or the depth (Panels B and C) of the prior deposit relationship of the firm and the outside bank. We report the coefficient of the constant and the deposit relationship variables. We weigh each observation by one over the total number of comparable non-switching loans per switching loan. Standard errors are clustered at the firm level and reported in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

Table 8: Deposit relationships and the likelihood of switching lenders: Heterogeneous effects

	I Pr(Switch)	II Pr(Switch)	III Pr(Switch)
Outside deposit relationship$_{t-1}$	0.0478***	0.0448***	0.0581***
	(0.0047)	(0.0046)	(0.0041)
Outside deposit relationship$_{t-1}$ × Young firm$_{t-1}$	0.0304***		
	(0.0076)		
Outside deposit relationship$_{t-1}$ × Low pledgeable assets$_{t-1}$		0.0339***	
		(0.0063)	
Outside deposit relationship$_{t-1}$ × High bank competition$_{t-1}$			0.0100*
			(0.0060)
Observations	307,374	307,374	307,374
Adjusted R-squared	0.2697	0.2697	0.2695
Firm controls	Yes	Yes	Yes
Loan controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Bank × Time FE	Yes	Yes	Yes

Note: This table estimates how having a prior deposit relationship with outside banks affects firms' probability of switching lenders and how this effects depends on the information asymmetries and adverse selection that firms face. The different measures of information asymmetries and adverse selection are explained in 4.2.2. The outcome variable is a dummy variable equal to one if firm f switches to an outside bank at time t. The independent variable of interest is a dummy variable equal to one if firm f had a deposit relationship with at least one outside bank at time $t-1$. The vector of firm controls includes firms' size, leverage ratio, EBIT to total assets, and fixed assets to total assets, and a dummy variable equal to one for public companies. The vector of loan controls includes the loan rate, loan amount, the proportion of loan collateralized, the probability of loan default, and a dummy variable equal to one for credit lines. Standard errors are clustered at the firm level and reported in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

Table 9: Deposit relationships and the effects of switching lenders: Heterogeneous effects

	I	II	III
	Loan rate	Loan rate	Difference
Panel A			
		Firm age	
	Young	Old	
Constant	-0.2403*	-0.5248***	0.2845***
	(0.1411)	(0.0924)	(χ^2=10.34)
Prior deposit relationship	-1.3310***	-0.7930***	-0.5380**
	(0.3054)	(0.2049)	(χ^2=6.30)
Observations	2,274	3,102	
Panel B			
		Firm pledgeable assets	
	High	Low	
Constant	-0.2653**	-0.1037***	-0.1580**
	(0.1306)	(0.4539)	(χ^2=4.39)
Prior deposit relationship	-0.6523**	-1.3399***	0.6876***
	(0.2698)	(0.2439)	(χ^2=9.88)
Observations	1,930	3,466	
Panel C			
		Bank competition	
	High	Low	
Constant	-0.5171***	-0.1888*	-0.3283***
	(0.1095)	(0.1054)	(χ^2=14.46)
Prior deposit relationship	-1.1770***	-0.7055**	-0.4715**
	(0.2119)	(0.3318)	(χ^2=4.33)
Observations	3,139	2,173	

Note: This table reports the estimated spread between the loan rate on switching loans to firms with and without a prior deposit relationship, and how this spread differs depending on the information asymmetries and adverse selection that firms face.. The different measures of information asymmetries and adverse selection are explained in 4.2.2. The variables used in the matching procedure are those from our benchmark model, as explained in Section 4.1. All variables are defined in Table A1 in the Appendix. We regress the spreads on a constant and a dummy variable equal to one if the firm and the outside bank had a prior deposit relationship. We report the coefficient of the constant and the dummy variable. We weigh each observation by one over the total number of comparable non-switching loans per switching loan. Standard errors are clustered at the firm level and reported in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

Table 10: Deposit relationships and bank screening

	I Pr(Loan default)	II Pr(Loan default)
Prior deposit relationship	-0.0041***	-0.0053***
	(0.0014)	(0.0017)
Credit rating	0.1780***	0.1962***
	(0.0320)	(0.0373)
Prior deposit relationship × Credit rating	0.2135***	0.1982***
	(0.0666)	(0.0745)
Controls	No	Yes
Number of observations	23,001	23,001
Adjusted R-squared	0.1066	0.1065

Note: This table reports the degree to which the credit rating assigned by banks to switching firms can predict switching firms' future loan performance. The controls include the loan amount, loan type, the proportion of the loan collateralized, firm size, bank fixed effects, time fixed effects, firm sector fixed effects, firm legal type fixed effects, and firm locality fixed effects. Standard errors are clustered at the firm level and reported in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

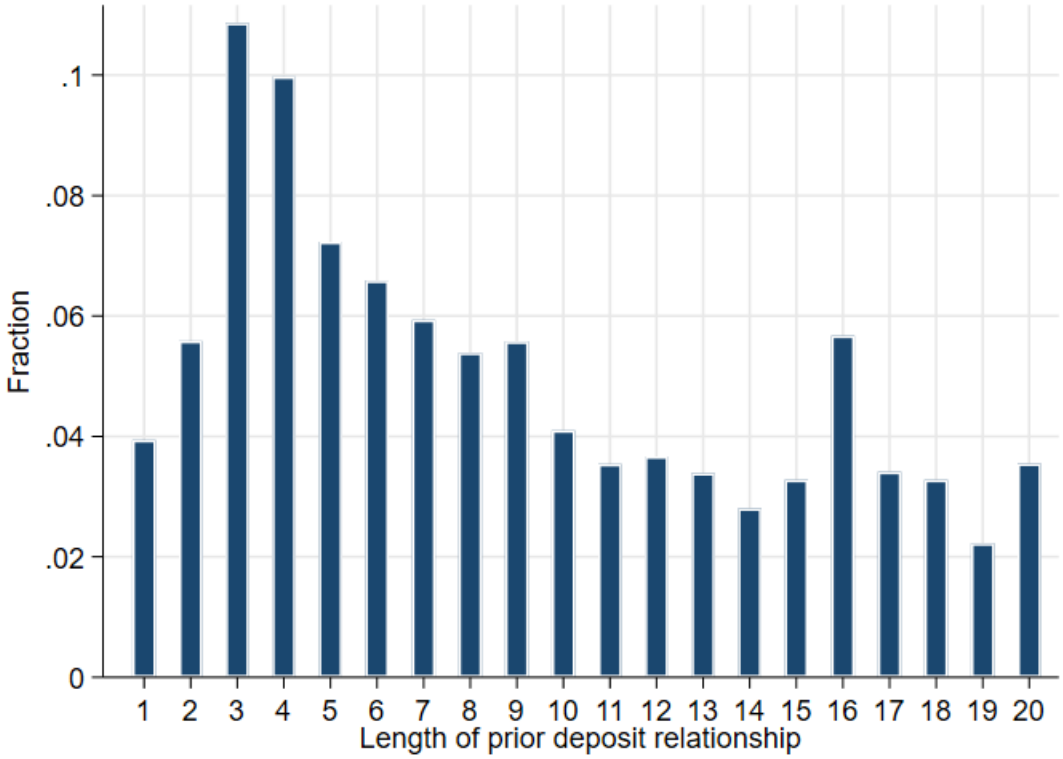
Table 11: Deposit relationships and the effects of switching lenders: Other loan terms

	I	II	III
Matching variables	Loan collateralized	ln(Loan amount)	Pr(Credit line)
Year	Yes	Yes	Yes
Outside bank	Yes	Yes	Yes
Credit rating	Yes	Yes	Yes
Region	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Legal structure	Yes	Yes	Yes
Size	Yes	Yes	Yes
Loan rate	Yes	Yes	Yes
Loan amount	Yes		Yes
Loan type	Yes	Yes	
Proportion of loan collateralized		Yes	Yes
Number of switching loans	2,292	4,622	2,249
Number of non-switching loans	3,377	7,957	3,159
Number of observations	4,514	14,795	4,074
Proportion of switching loans with a prior deposit relationship	36%	34%	35%
Constant	-18.2634***	-0.2053***	-0.0337***
	(2.5002)	(0.0269)	(0.0075)
Prior deposit relationship	10.8016	0.2096***	0.0328**
	(6.6369)	(0.0511)	(0.0161)

Note: This table reports the estimated difference between the loan terms on switching loans to firms with and without a prior deposit relationship and non-switching loans. The variables used in the matching procedure are those from our benchmark model, as explained in Section 4.1. All variables are defined in Table A1 in the Appendix. We regress the loan terms on a constant and a dummy variable equal to one if the firm and the outside bank had a prior deposit relationship. We report the coefficient of the constant and the dummy variable. We weigh each observation by one over the total number of comparable non-switching loans per switching loan. Standard errors are clustered at the firm level and reported in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

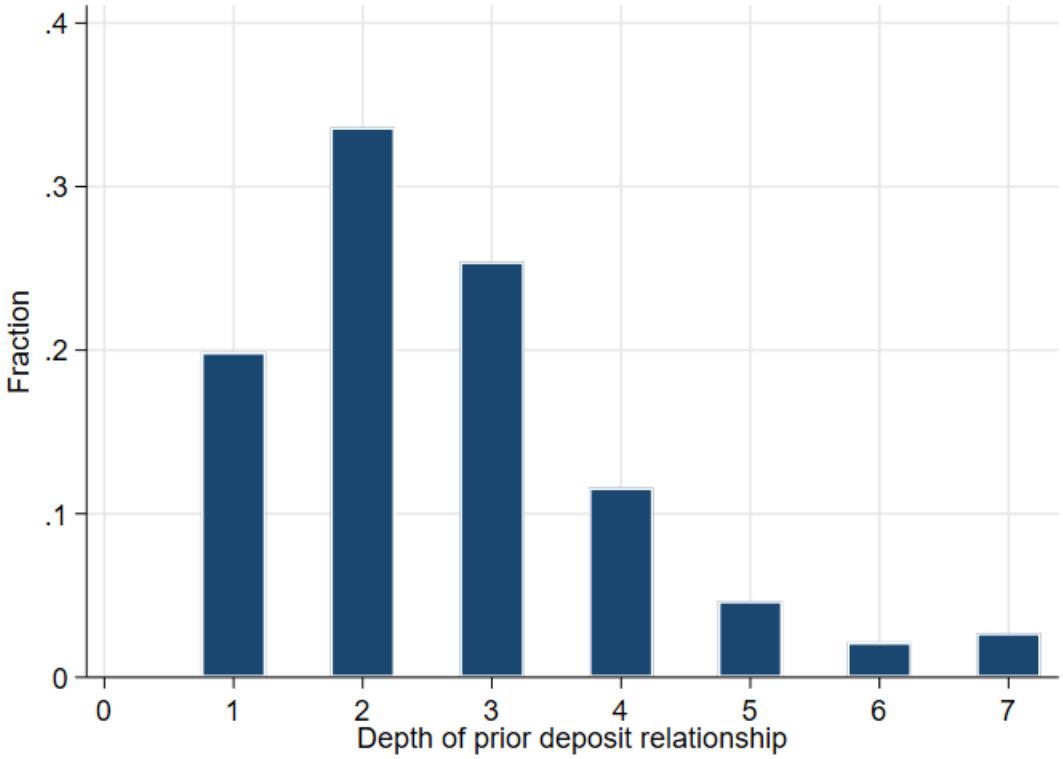
Appendix

Figure A1: The distribution of the length of prior deposit relationships of switchers



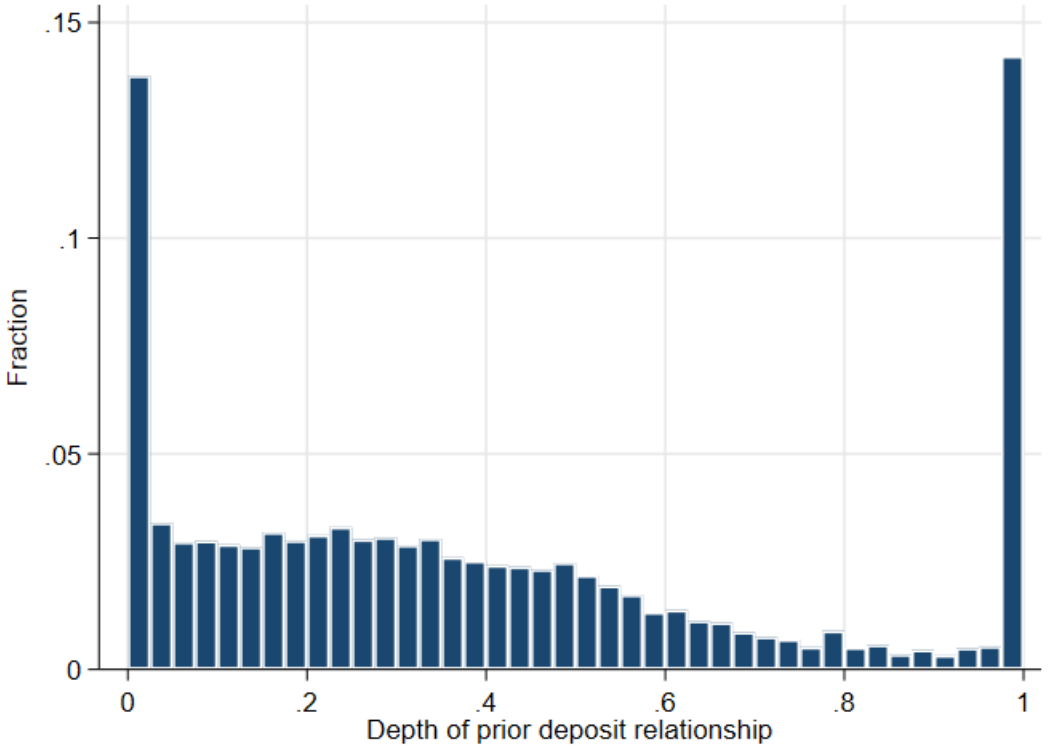
Note: This figure uses data on the deposit and lending relationships of all firm-bank pairs in Norway to show the distribution of the length of the prior deposit relationship of switchers that had a prior deposit relationship with new (outside) banks before obtaining a loan from those banks. The length of the prior deposit relationship is measured as the number of years during which the firm and the bank have maintained a deposit relationship. Following the definition from Ioannidou and Ongena (2010), a loan is classified as a switching loan if it satisfies the following two conditions: First, the loan should be obtained from a bank with which the firm did not have a lending relationship during the previous twelve months. Second, the firm must have had at least one lending relationship in the previous twelve months with at least one other bank. The data sample used to construct this figure is restricted to firms with at least one lending relationship, i.e., firms that in a given year borrow from at least one bank in the loan market. The sample period ranges from 2000 until 2019.

Figure A2: The distribution of the depth of prior deposit relationships of switchers



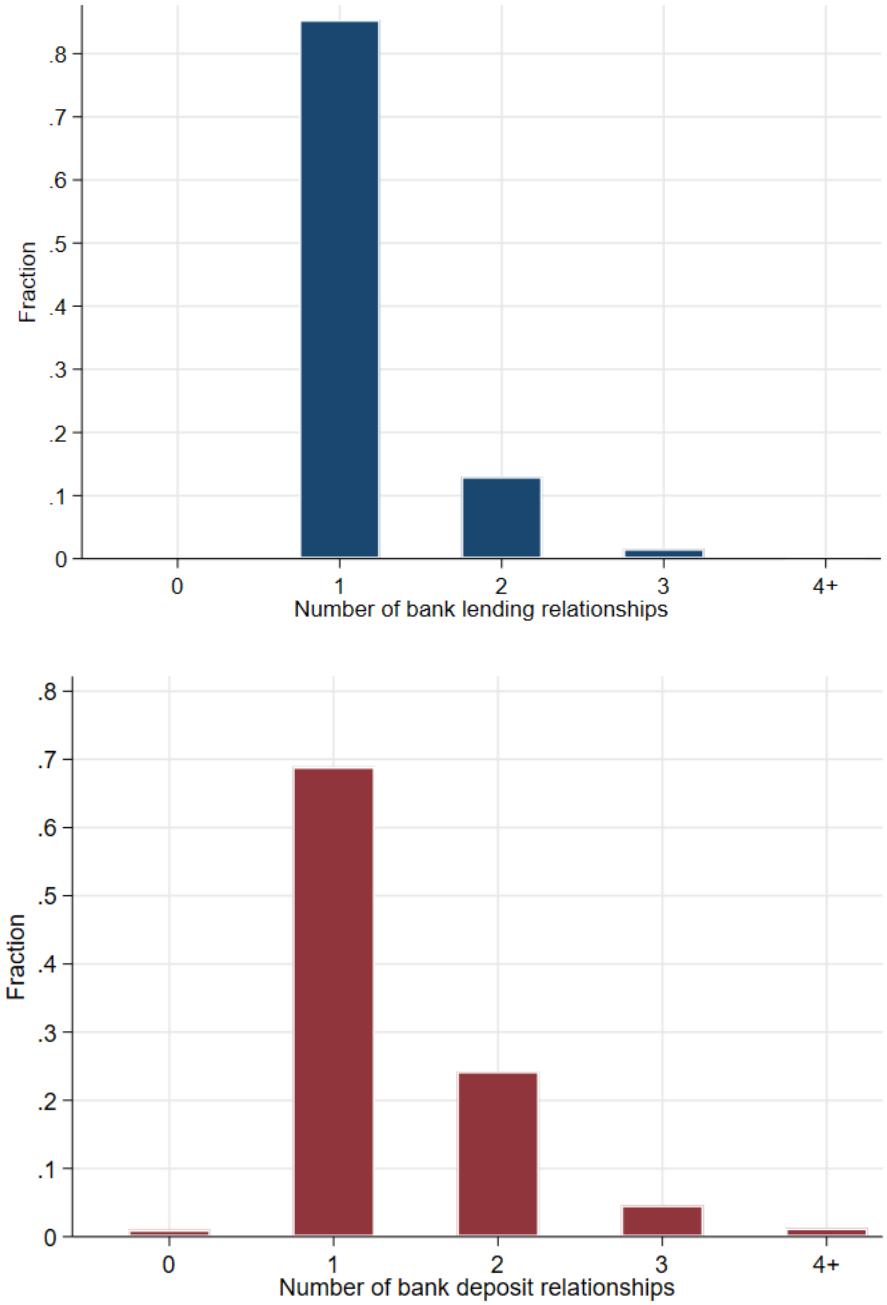
Note: This figure uses data on the deposit and lending relationships of all firm-bank pairs in Norway to show the distribution of the depth of the prior deposit relationship of switchers that had a prior deposit relationship with new (outside) banks before obtaining a loan from those banks. The depth of the prior deposit relationship is measured as the number of products (or accounts) underlying the deposit relationship. Following the definition from Ioannidou and Ongena (2010), a loan is classified as a switching loan if it satisfies the following two conditions: First, the loan should be obtained from a bank with which the firm did not have a lending relationship during the previous twelve months. Second, the firm must have had at least one lending relationship in the previous twelve months with at least one other bank. The data sample used to construct this figure is restricted to firms with at least one lending relationship, i.e., firms that in a given year borrow from at least one bank in the loan market. The sample period ranges from 2000 until 2019.

Figure A3: The distribution of the depth of prior deposit relationships of switchers



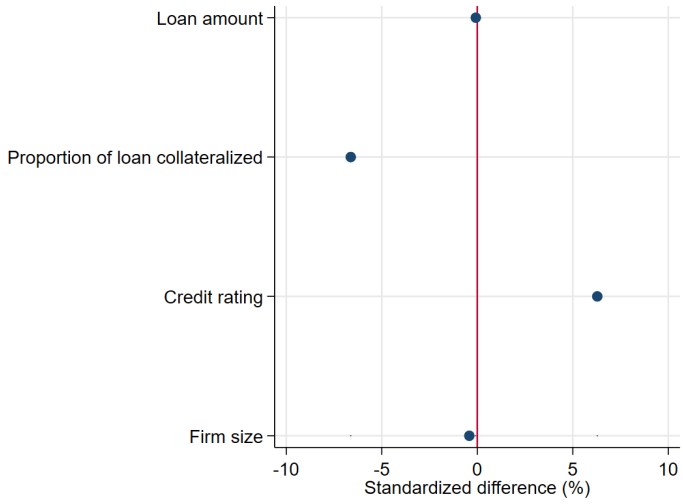
Note: This figure uses data on the deposit and lending relationships of all firm-bank pairs in Norway to show the distribution of the depth of the prior deposit relationship of switchers that had a prior deposit relationship with new (outside) banks before obtaining a loan from those banks. The depth of the prior deposit relationship is measured as the share of deposits held by the switchers at the outside bank compare to the total deposits held by the switchers. Following the definition from Ioannidou and Ongena (2010), a loan is classified as a switching loan if it satisfies the following two conditions: First, the loan should be obtained from a bank with which the firm did not have a lending relationship during the previous twelve months. Second, the firm must have had at least one lending relationship in the previous twelve months with at least one other bank. The data sample used to construct this figure is restricted to firms with at least one lending relationship, i.e., firms that in a given year borrow from at least one bank in the loan market. The sample period ranges from 2000 until 2019.

Figure A4: The distribution of the number of lending and deposit relationships per firm, for firms with at least one lending relationship



Note: This figure uses data on the deposit and lending relationships of all firm-bank pairs in Norway to show the distribution of the number of deposit and lending relationships that firms maintain over our sample period. The distribution of the number of lending relationships is depicted in the top figure (in blue), the distribution of the number of deposit relationships is depicted in the bottom figure (in red). The data sample used to construct this figure is restricted to firms with at least one lending relationship, i.e., firms that in a given year borrow from at least one bank in the loan market. The sample period ranges from 2000 until 2019.

Figure A5: Balance test for continuous variables used in the matching strategies of Table 4



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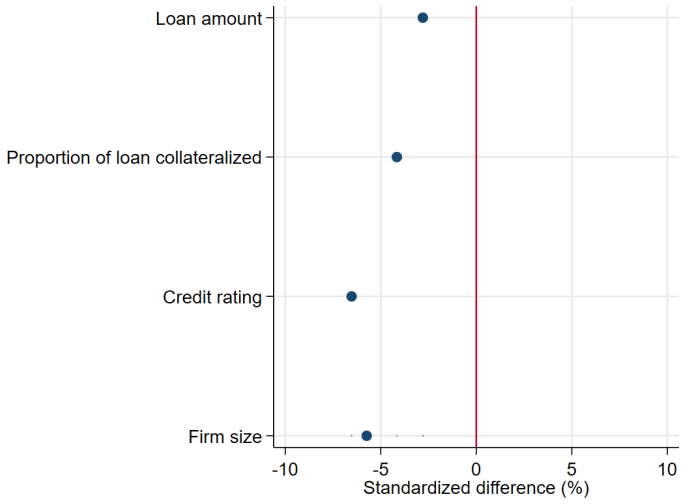
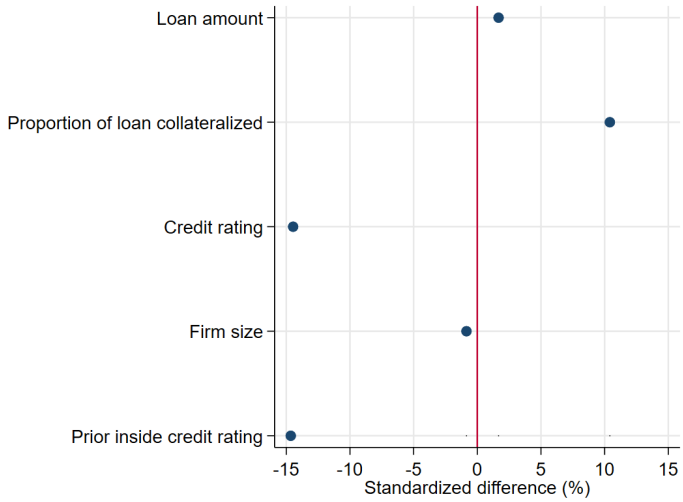
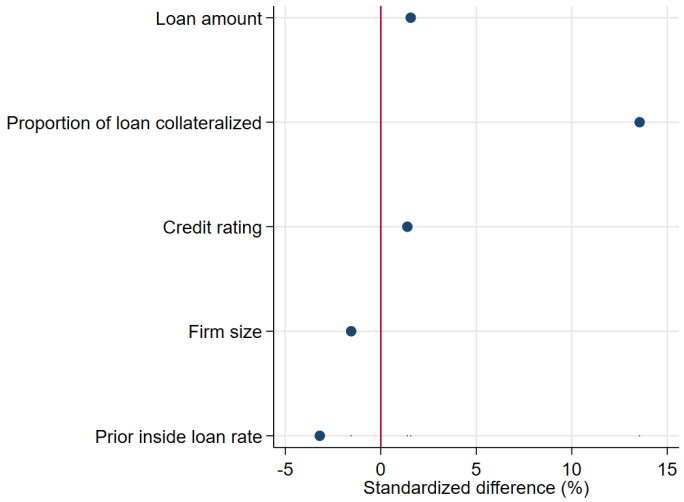


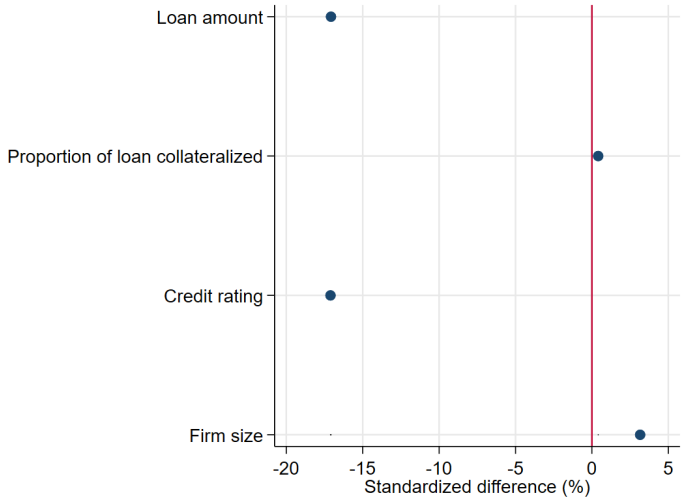
II



III



IV



V

Note: This figure presents the balance test statistics for the continuous variables used in our benchmark matching model, as explained in Section 4.1.

Table A1: Matching variables

Category	Variable	Categories	Possible values
Macro	Year	6	2014, 2015, 2016, 2017, 2018, 2019
Bank	Inside bank	2	=1 if the firm had a lending relationship with the bank in the last 12 months, 0 otherwise
Bank	Outside bank	2	=1 if the firm did not have a lending relationship with the bank in the last 12 months, 0 otherwise
Firm	Firm	74,295	=1 per firm identity, 0 otherwise
Firm	Locality	359	Locality where the firm is registered
Firm	Industry	15	Industry in which the firm operates (based on 2-digit SIC code)
Firm	Legal structure	2	Private limited-liability company, Public limited-liability company
Firm	Credit rating	2	=1 if the matched firms have a similar credit rating, 0 otherwise
Firm	Size	2	=1 if the matched firms have similar size (based on the logarithm of total assets), 0 otherwise
Loan	Amount	2	=1 if the matched loans have a similar loan amount, 0 otherwise
Loan	Type	2	=1 if the matched loans have the same loan type (i.e., credit line or not), 0 otherwise
Loan	Collateral	2	=1 if the matched loans have similar ratios of collateral value to loan value, 0 otherwise
Firm	Prior inside credit rating	2	= 1 if the matched firms have a similar rating as the loan switchers' most recent inside rating that existed prior to the loan switch, 0 otherwise
Firm	Prior inside loan rate	2	=1 if the matched inside loans have similar loan rates as the loan switcher's most recent inside loan prior to the loan switch, 0 otherwise
Firm	Prior multiple lending relationships	2	=1 if the firm has outstanding loans with more than one bank, 0 otherwise
Relationship	Prior bank relationship scope	2	=1 if the firm has both a deposit and lending relationship with a bank, 0 otherwise
Relationship	Prior lending relationship length	21	The length of a bank–firm relationship in years

Table A2: Additional summary statistics for switching and non-switching loans

	Switchers with prior deposit relationship (N=8,539)			Switchers without prior deposit relationship (N=14,462)			Non-switchers (N=310,101)		
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
Loan rate	3.846***	3.634***	3.717***	5.233	4.300***	4.311***	5.194	4.902	3.164
Credit rating	0.025***	0.007***	0.081***	0.021***	0.004***	0.086***	0.029	0.007	0.097
ln(Loan amount)	13.708***	13.816***	2.472***	12.723***	12.672***	2.056***	13.204	13.122	2.002
Credit line	0.709***	1.000***	0.454***	0.216***	0.000***	0.412***	0.476	0.000	0.499
Proportion of loan collateralized	161.88**	100.00	300.49***	97.48***	75.54***	208.21***	148.42	95.36	258.82
Pr(Loan written off)	0.005***	0.000	0.067***	0.001***	0.000	0.037***	0.007	0.000	0.082
Proportion of loan written off	0.111***	0.000	2.006***	0.031***	0.000	0.962***	0.204	0.000	2.697
Deposit rate	0.384***	0.120***	0.560***	0.000***	0.000***	0.000***	0.220	0.044	0.457
ln(Deposit amount)	11.816***	12.985***	4.319***	0.000***	0.000***	0.000***	7.836	10.942	6.407
Prior number of deposit relationships	1.646***	1.000***	0.845***	1.296***	1.000***	0.621***	1.337	1.000	0.642
Prior deposit relationship length	7.956***	7.000***	5.712***	0.000***	0.000***	0.000***	5.095	3.000	5.997
Prior deposit relationship depth	2.648***	2.000***	1.391***	0.000***	0.000***	0.000***	1.661	2.000	1.672
Public company	0.004***	0.000	0.062***	0.002	0.000	0.041	0.001	0.000	0.038
Age	16.782***	14.000***	13.493***	14.315*	11.000	12.570	14.164	11.000	12.607
Size	9.021***	8.894***	1.705	8.902***	8.750***	1.648***	8.461	8.339	1.721
Debt/TA	75.994***	70.925***	50.348***	79.110***	75.056***	46.350***	82.479	73.969	63.372
EBIT/TA	4.404***	6.405***	29.050***	3.944***	5.586	28.213***	2.759	5.564	33.639
Pr(Multiple lending relationships)	0.765***	1.000***	0.424***	0.765***	1.000***	0.424***	0.316	0.000	0.465
Pr(Bank relationship scope)	0.960***	1.000***	0.195***	0.180***	0.000***	0.384***	0.658	1.000	0.474
Pr(Primary lender)	0.775***	1.000***	0.418***	0.557***	1.000***	0.497***	0.904	1.000	0.295

Note: This table reports the mean, median, and standard deviation for the main loan and firm characteristics used in the analysis. The differences in means are assessed using the Student's t-test. The differences in medians are assessed using the Wilcoxon–Mann–Whitney test for continuous variables and Pearson's chi-square test for categorical variables. The differences in standard deviations are assessed using Levene's test. The table indicates whether the differences between the corresponding mean, median, and standard deviation are significant at the 10%, 5%, and 1% levels using *, **, and ***, respectively.

Table A3: The percentage of non-switching and switching loan observations across sectors

	Switchers with prior deposit relationship	Switchers without prior deposit relationship	Non-switchers
Accomodation services	0.033	0.034	0.048
Agriculture	0.017	0.022	0.023
Business services	0.049	0.053	0.051
Construction	0.275	0.288	0.243
Cultural activity and entertainment	0.011	0.013	0.016
Electricity	0.008	0.006	0.006
Health and social services	0.029	0.030	0.039
Industry	0.107	0.117	0.098
Information and communication	0.030	0.026	0.028
Retail trade	0.250	0.234	0.261
Mining and Extraction	0.008	0.010	0.007
Other services	0.013	0.012	0.020
Professional and scientific services	0.081	0.070	0.085
Transport and storage	0.080	0.080	0.071
Water supply	0.007	0.006	0.005

Note: This table reports the percentage if switching and non-switching loan observations across sectors. Following the definition from Ioannidou and Ongena (2010), a loan is classified as a switching loan if it satisfies the following two conditions: First, the loan should be obtained from a bank with which the firm did not have a lending relationship during the previous twelve months. Second, the firm must have had at least one lending relationship in the previous twelve months with at least one other bank.

Table A4: The effects of switching lenders

Matching variables	I Loan rate	II Loan rate	III Loan rate	IV Loan rate	V Loan rate
Year	Yes	Yes	Yes	Yes	Yes
Inside bank	Yes				
Outside bank		Yes	Yes	Yes	Yes
Credit rating	Yes	Yes			
Region	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes
Legal structure	Yes	Yes	Yes	Yes	Yes
Size	Yes	Yes	Yes	Yes	Yes
Loan amount	Yes	Yes	Yes	Yes	Yes
Loan type	Yes	Yes	Yes	Yes	Yes
Proportion of loan collateralized	Yes	Yes	Yes	Yes	Yes
Prior credit rating from inside banks			Yes		
Loan rate on prior inside loans				Yes	
Prior relationship length					Yes
Prior multiple bank relationships					Yes
Prior primary lender					Yes
Prior bank relationship scope					Yes
Number of switching loans	1,884	2,309	1,223	698	235
Number of non-switching loans	3,157	3,703	1,858	978	325
Number of observations	4,670	5,376	2,400	1,192	349
Constant	-0.9961*** (0.0771)	-0.7864*** (0.0630)	-0.7825*** (0.0861)	-1.0472*** (0.1014)	-0.5961*** (0.2168)

Note: This table reports the estimated spread between the loan rate on switching and non-switching loans. Across the different columns, we report the variables used in the matching procedure. All variables are defined in Table A1 in the Appendix. We regress the spreads on a constant and report the coefficient of the constant. We weigh each observation by one over the total number of comparable non-switching loans per switching loan. Standard errors are clustered at the firm level and reported in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

Table A5: Deposit relationships and the effects of switching lenders: Estimation using sub-samples

	I	II	III	IV	V
	Loan rate	Loan rate	Loan rate	Loan rate	Loan rate
Number of switching loans	1,884	2,309	1,223	698	235
Number of non-switching loans	3,157	3,703	1,858	978	325
Number of observations	4,670	5,376	2,400	1,192	349
Proportion of switching loans with a prior deposit relationship	30%	29%	28%	33%	26%
Switching loans without prior deposit relationship	-0.7644***	-0.4772***	-0.4050***	-0.6745***	-0.1783
	(0.0869)	(0.0638)	(0.0930)	(0.0956)	(0.2059)
Switching loans with prior deposit relationship	-1.4948***	-1.6635***	-1.7841***	-1.9606***	-1.9156***
	(0.1567)	(0.1546)	(0.1864)	(0.2479)	(0.5935)

Note: This table reports the estimated spread between the loan rate on switching loans to firms with and without a prior deposit relationship and non-switching loans. All variables are defined in Table A1 in the Appendix. We split the sample of switching and non-switching loans into sub-samples of switchers with and without a prior deposit relationship, and regress the spreads on a constant for each sub-sample. We report the coefficient of the constant for each sub-sample. We weigh each observation by one over the total number of comparable non-switching loans per switching loan. Standard errors are clustered at the firm level and reported in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

Table A6: Deposit relationships and the effects of switching lenders: Loan collateral

Matching variables	I Loan collateralized	II Loan collateralized	III Loan collateralized	IV Loan collateralized	V Loan collateralized
Year	Yes	Yes	Yes	Yes	Yes
Inside bank	Yes				
Outside bank		Yes	Yes	Yes	Yes
Credit rating	Yes	Yes			
Region	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes
Legal structure	Yes	Yes	Yes	Yes	Yes
Size	Yes	Yes	Yes	Yes	Yes
Loan amount	Yes	Yes	Yes	Yes	Yes
Loan type	Yes	Yes	Yes	Yes	Yes
Loan rate	Yes	Yes	Yes		Yes
Prior credit rating from inside banks			Yes		
Loan rate on prior inside loans				Yes	
Prior relationship length					Yes
Prior multiple bank relationships					Yes
Prior primary lender					Yes
Prior bank relationship scope					Yes
Number of switching loans	1,067	2,292	647	891	100
Number of non-switching loans	1,483	3,377	875	1,286	111
Number of observations	1,866	4,514	1,014	1,610	114
Proportion of switching loans with a prior deposit relationship	25%	36%	26%	36%	15%
Constant	-20.6683***	-18.2634***	-22.9055***	-32.7889***	-10.1600
	(7.4921)	(2.5002)	(2.6893)	(5.6684)	(11.2627)
Prior deposit relationship	2.9613	10.8016	0.4499	-6.9810	-89.1258
	(13.9872)	(6.6369)	(10.5383)	(10.7933)	(98.4342)

Note: This table reports the estimated difference between the loan collateral on switching loans to firms with and without a prior deposit relationship and non-switching loans. Across the different columns, we report the variables used in the matching procedure. All variables are defined in Table A1 in the Appendix. We regress the difference on a constant and report the coefficient of the constant. We weigh each observation by one over the total number of comparable non-switching loans per switching loan. Standard errors are clustered at the firm level and reported in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

Table A7: Deposit relationships and the effects of switching lenders: Loan amount

Matching variables	I	II	III	IV	V
	Loan amount	Loan amount	Loan amount	Loan amount	Loan amount
Year	Yes	Yes	Yes	Yes	Yes
Inside bank	Yes				
Outside bank		Yes	Yes	Yes	Yes
Credit rating	Yes	Yes			
Region	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes
Legal structure	Yes	Yes	Yes	Yes	Yes
Size	Yes	Yes	Yes	Yes	Yes
Loan type	Yes	Yes	Yes	Yes	Yes
Loan rate	Yes	Yes	Yes		Yes
Proportion of loan collateralized	Yes	Yes	Yes	Yes	Yes
Prior credit rating from inside banks			Yes		
Loan rate on prior inside loans				Yes	
Prior relationship length					Yes
Prior multiple bank relationships					Yes
Prior primary lender					Yes
Prior bank relationship scope					Yes
Number of switching loans	2,029	4,622	2,305	2,779	276
Number of non-switching loans	3,841	7,957	3,770	4,618	363
Number of observations	5,779	14,795	5,666	7,340	406
Proportion of switching loans with a prior deposit relationship	23%	34%	34%	33%	24%
Constant	-0.1152***	-0.2053***	-0.1999***	-0.2810***	-0.4070***
	(0.0437)	(0.0269)	(0.0383)	(0.0393)	(0.0934)
Prior deposit relationship	0.2416***	0.2096***	0.1476**	0.0850	0.1341***
	(0.0933)	(0.0511)	(0.0703)	(0.0781)	(0.0581)

Note: This table reports the estimated difference between the loan amount on switching loans to firms with and without a prior deposit relationship and non-switching loans. Across the different columns, we report the variables used in the matching procedure. All variables are defined in Table A1 in the Appendix. We regress the difference on a constant and report the coefficient of the constant. We weigh each observation by one over the total number of comparable non-switching loans per switching loan. Standard errors are clustered at the firm level and reported in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

Table A8: Deposit relationships and the effects of switching lenders: Loan type

Matching variables	I Pr(Credit line)	II Pr(Credit line)	III Pr(Credit line)	IV Pr(Credit line)	V Pr(Credit line)
Year	Yes	Yes	Yes	Yes	Yes
Inside bank	Yes				
Outside bank		Yes	Yes	Yes	Yes
Credit rating	Yes	Yes			
Region	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes
Legal structure	Yes	Yes	Yes	Yes	Yes
Size	Yes	Yes	Yes	Yes	Yes
Loan amount	Yes	Yes	Yes	Yes	Yes
Loan rate	Yes	Yes	Yes		Yes
Proportion of loan collateralized	Yes	Yes	Yes	Yes	Yes
Prior credit rating from inside banks			Yes		
Loan rate on prior inside loans				Yes	
Prior relationship length					Yes
Prior multiple bank relationships					Yes
Prior primary lender					Yes
Prior bank relationship scope					Yes
Number of switching loans	921	2,249	557	761	85
Number of non-switching loans	1,289	3,159	713	1,060	95
Number of observations	1,658	4,074	813	1,295	98
Proportion of switching loans with a prior deposit relationship	27%	35%	27%	35%	16%
Constant	-0.0960***	-0.0337***	-0.0586***	-0.0757***	-0.0214
	(0.0170)	(0.0075)	(0.0142)	(0.0141)	(0.0297)
Prior deposit relationship	0.3310***	0.0328**	0.0226	0.0857**	0.1548*
	(0.0369)	(0.0161)	(0.0437)	(0.0378)	(0.0836)

Note: This table reports the estimated difference between the loan type on switching loans to firms with and without a prior deposit relationship and non-switching loans. Across the different columns, we report the variables used in the matching procedure. All variables are defined in Table A1 in the Appendix. We regress the difference on a constant and report the coefficient of the constant. We weigh each observation by one over the total number of comparable non-switching loans per switching loan. Standard errors are clustered at the firm level and reported in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

Table A9: Deposit relationships and the effects of switching lenders: Accounting for deposit contract terms

Matching variables	I Loan rate	II Loan rate	III Loan rate	IV Loan rate
Year	Yes	Yes	Yes	Yes
Outside bank	Yes	Yes	Yes	Yes
Credit rating	Yes	Yes	Yes	Yes
Region	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Legal structure	Yes	Yes	Yes	Yes
Size	Yes	Yes	Yes	Yes
Loan amount	Yes	Yes	Yes	Yes
Loan type	Yes	Yes	Yes	Yes
Proportion of loan collateralized	Yes	Yes	Yes	Yes
Deposit rate		Yes	Yes	Yes
Prior number of deposit relationships			Yes	Yes
Deposit amount				Yes
Number of switching loans	2,309	1,757	1,493	1,030
Number of non-switching loans	3,703	2,811	2,392	1,635
Number of observations	5,376	4,161	3,439	2,223
Proportion of switching loans with a prior deposit relationship	29%	16%	12%	6%
Constant	-0.4772*** (0.0638)	-0.4090*** (0.0656)	-0.4235*** (0.0720)	-0.2677*** (0.0922)
Prior deposit relationship	-1.1864*** (0.1672)	-1.4188*** (0.2413)	-1.5261*** (0.2863)	-1.4288** (0.6155)

Note: This table reports the estimated spread between the loan rate on switching loans to firms with and without a prior deposit relationship and non-switching loans. Across the different columns, we report the variables used in the matching procedure. All variables are defined in Table A1 in the Appendix. We regress the spreads on a constant and a dummy variable equal to one if the firm and the outside bank had a prior deposit relationship. We report the coefficient of the constant and the dummy variable. We weigh each observation by one over the total number of comparable non-switching loans per switching loan. Standard errors are clustered at the firm level and reported in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

Table A10: Deposit relationships and the effects of switching lenders: Accounting for firm characteristics

Matching variables	I Loan rate	II Loan rate	III Loan rate	IV Loan rate
Year	Yes	Yes	Yes	Yes
Outside bank	Yes	Yes	Yes	Yes
Credit rating	Yes	Yes	Yes	Yes
Region	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Legal structure	Yes	Yes	Yes	Yes
Size	Yes	Yes	Yes	Yes
Loan amount	Yes	Yes	Yes	Yes
Loan type	Yes	Yes	Yes	Yes
Proportion of loan collateralized	Yes	Yes	Yes	Yes
Leverage		Yes	Yes	Yes
Profitability			Yes	Yes
Sector			Yes	
Number of switching loans	2,210	1,343	681	371
Number of non-switching loans	3,524	1,908	849	453
Number of observations	5,376	2,357	951	474
Proportion of switching loans with a prior deposit relationship	29%	27%	27%	25%
Constant	-0.4772*** (0.0638)	-0.4910*** (0.0849)	-0.4588*** (0.1237)	-0.6354*** (0.1721)
Prior deposit relationship	-1.1864*** (0.1672)	-1.2363*** (0.2169)	-0.9818*** (0.3144)	-1.1871*** (0.4328)

Note: This table reports the estimated spread between the loan rate on switching loans to firms with and without a prior deposit relationship and non-switching loans. Across the different columns, we report the variables used in the matching procedure. All variables are defined in Table A1 in the Appendix. We regress the spreads on a constant and a dummy variable equal to one if the firm and the outside bank had a prior deposit relationship. We report the coefficient of the constant and the dummy variable. We weigh each observation by one over the total number of comparable non-switching loans per switching loan. Standard errors are clustered at the firm level and reported in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

Table A11: Deposit relationships and the effects of switching lenders: The loan rate cycle after switching

	I	II	III	VI
Periods since switching lenders	1 year	2 years	3 years	4 years
Panel A				
	Without prior deposit relationship			
Number of observations	542	412	256	117
Constant	-0.0163	0.0465*	0.0131	0.0921**
	(0.0208)	(0.0249)	(0.0412)	(0.0377)
Panel B				
	With prior deposit relationship			
Number of observations	204	88	52	31
Constant	-0.1060	0.0568	-0.1317	0.1173*
	(0.0708)	(0.0883)	(0.1347)	(0.0712)

Note: This table presents the spread between the loan rate on the switching loan and the loan rate on loans after switching obtained by the switching borrower from the outside bank. In addition to matching on bank and borrower identity, we also match on the variables used in our benchmark model, as explained in Section 4.1. All variables are defined in Table A1 in the Appendix. We group the corresponding matches in four one-year periods since the switching loan. Then, for each of the four groups, we regress the spreads on a constant and calendar-time dummies. We report the coefficients of the constant. Standard errors are clustered at the firm level and reported in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

Table A12: Deposit relationships and the effects of switching lenders: Inside banks' response

Panel A	ΔLoan rate$_{[t-1,t]}$	ΔLoan rate$_{[t-1,t+1]}$
Number of observations	819	532
Constant	-0.2643**	-0.2916**
	(0.1294)	(0.1245)
Panel B	Δln(Loan amount)$_{[t-1,t]}$	Δln(Loan amount)$_{[t-1,t+1]}$
Number of observations	1,181	671
Constant	-0.0613	-0.0030
	(0.0516)	(0.0592)

Note: This table presents the change in loan terms that firms receive from their incumbent banks after opening a deposit account with another outside bank. In Panels and B, the outcome variables are the change in loan rates and the change in credit, respectively. In addition to matching on bank and borrower identity, we also match on the variables used in our benchmark model, as explained in Section 4.1. All variables are defined in Table A1 in the Appendix. We regress the change in loan terms on a constant and report the coefficient of the constant. Standard errors are clustered at the firm level and reported in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

Table A13: Deposit relationships and the effects of switching lenders: Within-firm analysis

Matching variables	I Loan rate	II Loan rate
Year	Yes	Yes
Firm	Yes	Yes
Credit rating	Yes	Yes
Region	Yes	Yes
Industry	Yes	Yes
Legal structure	Yes	Yes
Size	Yes	Yes
Loan amount	Yes	Yes
Loan type	Yes	Yes
Proportion of loan collateralized	Yes	Yes
Deposit relationship		Yes
Number of observations	1,042	585
Proportion of switching loans with a prior deposit relationship	28%	17%
Constant	-0.5717***	-0.2353*
	(0.1219)	(0.1272)
Prior deposit relationship	-0.7209**	-0.8386*
	(0.3431)	(0.4714)

Note: This table presents the spread between the loan rate on the switching loan and the loan rate on concurrent non-switching loans obtained by the switching firms. Across the different columns, we report the variables used in the matching procedure. All variables are defined in Table A1 in the Appendix. We regress the spreads on a constant and a dummy variable equal to one if the firm and the outside bank had a prior deposit relationship. We report the coefficient of the constant and the dummy variable. We weigh each observation by one over the total number of comparable non-switching loans per switching loan. Standard errors are clustered at the firm level and reported in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

Table A14: Deposit relationships and the effects of switching lenders: Alternative matching model

	I Loan rate	II Loan rate	III Loan rate	IV Loan rate	V Loan rate
Number of switching loans	10,146	10,553	6,716	8,285	2,272
Number of non-switching loans	10,404	10,460	6,762	8,254	2,253
Number of observations	13,251	12,758	8,188	9,973	2,539
Proportion of switching loans with a prior deposit relationship	32%	35%	30%	35%	25%
Constant	-0.1746***	-0.4811***	-0.4286***	-0.3922***	-0.3580***
	(0.0621)	(0.0361)	(0.0441)	(0.0398)	(0.0758)
Prior deposit relationship	-1.4003***	-1.1430***	-0.6195***	-1.2073***	-0.4612**
	(0.1102)	(0.0791)	(0.0954)	(0.0870)	(0.1847)

Note: This table reports the estimated spread between the loan rate on switching loans to firms with and without a prior deposit relationship and non-switching loans. All variables are defined in Table A1 in the Appendix. The matching procedure used is propensity score matching. We regress the spreads on a constant and a dummy variable equal to one if the firm and the outside bank had a prior deposit relationship. We report the coefficient of the constant and the dummy variable. We weigh each observation by one over the total number of comparable non-switching loans per switching loan. Standard errors are clustered at the firm level and reported in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

Table A15: Deposit relationships and the likelihood of switching lenders: Alternative bank switching definition

	I Pr(Switch)	II Pr(Switch)	III Pr(Switch)	IV Pr(Switch)	V Pr(Switch)
Outside deposit relationship$_{t-1}$	0.0078***	0.0438***	0.0295***	0.0280***	0.0266***
	(0.0020)	(0.0033)	(0.0032)	(0.0032)	(0.0032)
Observations	307,374	307,374	307,374	307,374	307,374
Adjusted R-squared	0.0155	0.1651	0.1924	0.1956	0.1997
Firm controls	Yes	Yes	Yes	Yes	Yes
Loan controls	Yes	Yes	Yes	Yes	Yes
Firm FE	No	Yes	Yes	Yes	Yes
Time FE	No	No	Yes	Yes	No
Bank FE	No	No	No	Yes	No
Bank × Time FE	No	No	No	No	Yes

Note: This table estimates how having a prior deposit relationship with outside banks affects firms' probability of switching lenders. The outcome variable is a dummy variable equal to one if firm f switches to an outside bank at time t. The independent variable of interest is a dummy variable equal to one if firm f had a deposit relationship with at least one outside bank at time $t-1$. The vector of firm controls includes firms' size, leverage ratio, EBIT to total assets, and fixed assets to total assets, and a dummy variable equal to one for public companies. The vector of loan controls includes the loan rate, loan amount, the proportion of loan collateralized, the probability of loan default, and a dummy variable equal to one for credit lines. Standard errors are clustered at the firm level and reported in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

Table A16: Deposit relationships and the effects of switching lenders: Alternative bank switching definition

	I	II	III	IV	V
	Loan rate	Loan rate	Loan rate	Loan rate	Loan rate
Number of switching loans	807	1,712	883	475	180
Number of non-switching loans	1,518	2,780	1,338	683	232
Number of observations	1,871	3,785	1,610	799	254
Proportion of switching loans with a prior deposit relationship	38%	11%	11%	12%	14%
Constant	-0.5790***	-0.3962***	-0.3498***	-0.6279***	-0.2517
	(0.1478)	(0.0686)	(0.0990)	(0.1087)	(0.2201)
Prior deposit relationship	-0.7842***	-0.5857**	-0.9362**	-0.9298***	-1.0053*
	(0.2393)	(0.2866)	(0.3655)	(0.3487)	(0.5303)

Note: This table reports the estimated spread between the loan rate on switching loans to firms with and without a prior deposit relationship and non-switching loans. The sample used in these regressions is restricted to switching loans of firms that never had a prior lending relationship with the outside bank. All variables are defined in Table A1 in the Appendix. We regress the spread on a constant and report the coefficient of the constant. We weigh each observation by one over the total number of comparable non-switching loans per switching loan. Standard errors are clustered at the firm level and reported in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.