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Do non-bank lenders mitigate credit supply shocks? Evidence from a major bank exit

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Abstract

We study the transmission of credit supply shocks to firms by exploiting the unexpected exit of the third-largest lender in the Irish business lending market in 2020 and a unique matched firm-lender dataset that covers both banks and non-bank financial institutions. We find that borrowers of the exiting bank receive less credit along both the extensive and intensive margin in the period after the announcement, highlighting that credit supply is not perfectly substitutable across lenders. However, we show that this negative credit supply shock is partly mitigated by non-bank lenders. Borrowers of the exiting bank are more likely to borrow from non-banks following the shock, with the effects driven by business loan facilities, and stronger among riskier firms.

JEL codes: G21, G23, G30, G32
Keywords: credit supply, non-bank lending, banking relationships.

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Non-technical summary

Banks play a critical role in facilitating economic activity through the provision of external financing to businesses. Disruptions or shocks to banks' willingness, or ability, to provide loan financing to the real economy can therefore have knock-on implications for the wider economy. One way in which these consequences of weaker bank credit supply can be mitigated or avoided is through the substitution of financing sources to other lenders, who can fill unmet credit demand after negative shocks to credit supply. In the past decade, a growing evidence base has shown that non-bank financial intermediaries, those entities that do not take deposits and are therefore subject to a different regulatory regime to retail banks, are playing an ever-more important role in financing the economy and filling financing gaps left by retail banks.

In this paper, we provide novel evidence tracing out a negative shock to credit supply to Irish businesses, along with the role that non-bank lenders play in mitigating this shock. We study the announcement in late 2020 by Ulster Bank's parent group, Natwest Group Plc, that it was reviewing its operations in Ireland. This was followed in the spring of 2021 by the confirmation that Ulster Bank's activity was indeed being wound down in Ireland.

We first estimate the probability of a new loan drawdown, comparing the period before and after September 2020, and comparing borrowers with Ulster Bank loans in the two years before the announcement (the treatment group) with a control group of borrowers unaffected by Ulster Bank's exit. We estimate that these borrowers are 3 percentage points less likely to draw down a new loan in the period after the announcement when compared to other unaffected borrowers.

The importance of banking relationships can be inferred from these results: if bank credit was perfectly substitutable across lenders, one would expect that Ulster Bank's customers could seamlessly transition to other lending sources in the period after the announcement. Our findings that they are less likely than the control group to access new lending suggests there is indeed value within the client-bank relationship, and that transitioning to new lending relationships comes with a cost.

We then confirm that, in line with a growing international literature, non-bank lenders represent an alternate source of financing to which Ulster Bank's borrowers were at least partially able to substitute. Our results suggest that both the probability of getting a new loan and the size of loan volumes were greater among the Ulster Bank customers who switched to non-bank sources of financing in the period after the exit

announcement. These patterns are strongest among business lending, rather than in the asset finance and leasing segments where non-banks are typically more dominant in Ireland.

Finally, we show that the size of the negative credit supply shock and the mitigating role played by non-banks were larger among smaller, more leveraged, and less liquid firms, in line with previous findings internationally and domestically that non-banks are more likely to finance riskier firms.

There are numerous policy conclusions from our work: firstly that disruptions to banks' provision of financing to the real economy do come with costs for borrowers, who cannot perfectly substitute to other sources of borrowing; secondly that non-banks can indeed play a role in filling financing gaps that emerge when bank credit supply is restricted; thirdly that riskier firms, typically less likely to be able to access bank financing, are more likely to substitute towards non-bank sources of finance, which may bring both benefits in terms of growth as well as greater medium-to-longer term risk.

1 Introduction

Shocks to bank credit supply can have negative real effects if borrowers cannot obtain funding from alternative sources. A large literature shows that firms cannot easily substitute contractions in bank credit that result from their lenders' balance sheet vulnerabilities during crises or policy shocks (see Güler et al., 2021, for a review). In this paper, we document the role of non-bank lenders in offsetting the effects of the unexpected exit of the third-largest retail bank from the Irish market in 2022. To do so, we exploit credit registry data that covers both bank and non-bank lenders, which allows us to trace out the implications of the credit supply shock across the entire universe of credit providers, rather than banks alone, which have been the focus of most previous work.

Non-bank lending to the real economy has increased substantially since the 2008 Global Financial Crisis (GFC), owing to technological advancements, tighter regulation of bank lending, and expanding risk appetite and financing gluts in the era of unconventional monetary policy. While a growing literature documents the implications of this growth in non-bank intermediation on large corporate businesses (Irani et al., 2021; Aldasoro et al., 2023; Elliott et al., 2023; Fleckenstein et al., 2023), our data allows us to understand the importance of this sector for the entire universe of borrowers in a market. Similar studies using data beyond the large corporate sector include Gopal and Schnabl (2022), who document the rising importance of finance companies in small business lending in the USA, and Cucic and Gorea (2023) who show that non-bank lending can attenuate monetary contractions using Danish data on household and business lending, conversely to the findings of Fleckenstein et al. (2023) on non-bank lending cyclicality. At the same time, the non-bank sector in Ireland is significant, accounting for around 30% of lending to small businesses (Heffernan et al., 2021). This, coupled with the unexpected exit of a large bank, represents a unique setting to study the role of non-bank lending in mitigating shocks to bank credit supply.

In our first headline result, we show that the bank exit constituted a significant credit supply shock for its customers. Treated firms (those borrowing from the exit bank in the two years before the exit) are around 3 per cent less likely to receive a new credit agreement in the two years post-exit as compared to a control group, which includes all other firms with a credit product from other lenders. The credit supply shock is sizable given an average probability of obtaining a loan of 10 per cent

in a given quarter for our sample of firms. Exit bank customers also receive lower credit amounts or credit limits and have significantly lower debt exposure (outstanding debt) after the shock.

This result confirms the findings of previous literature on the importance of bank lending relationships. As our shock relates to a specific bank's exit, the findings that this lender's customers are unable to fully substitute towards other lenders on either the extensive or intensive margin provides direct evidence of the value of lending relationships, without the need to use proxies for relationship strength such as geographical distance (DeYoung et al., 2008; Degryse and Ongena, 2005) or length or intensity of the relationship at the time of the shock (Iyer et al., 2014; Sette and Gobbi, 2015). We, therefore, confirm that there are frictions in switching across lenders and that business credit is not perfectly substitutable across providers.

Studying credit product types, we find that our results, particularly on the extensive margin, hold across overdraft facilities, asset financing, and business loans; however, on the intensive margin, the largest shock occurs in the business loan market.

Our second headline result is that the negative credit supply shock was mitigated by borrowing from non-banks. Empirically, we deploy a triple diff-in-diff framework and find that treated firms are more likely than control firms to borrow from non-banks in the post-exit period as compared to the pre-period. The substitution effect operates on both the extensive and intensive margins. We also show that the share of non-bank lending in total lending is significantly higher among treated firms in the post-exit period. Moreover, on the intensive margin, non-bank substitution is mainly driven by business loans, and less so by contract types in which non-banks are more specialized.

Our third headline result relates to borrower heterogeneity, both in the negative credit supply shock, as well as in the ability of non-bank lenders to absorb this shock. In both cases, our estimated effects are stronger for smaller, more leveraged, and less liquid businesses. These findings confirm that borrower balance sheets are important both in determining the transmission of credit supply shocks and that non-bank lenders are more likely to provide financing to riskier borrowers.

Our results are robust across a wide range of fixed effects estimations that are aimed at isolating the effect of credit demand. Our baseline specifications include firm, time and lender-type fixed effects. We then gradually saturate the model with two- and three-way fixed effects. Following Degryse et al. (2019), we compare firms in the same two-digit NACE industry as well as the same county, and within the same

time period (quarter or month) to shut down the credit demand channel. The most stringent specification includes firm-month fixed effects and exploits a smaller sample of borrowers that have a relationship or obtain new credit from both a bank and a non-bank financial institution within a small period of time (a quarter or a month).

We contribute to several streams of the literature. First, there is a large body of empirical work studying the transmission of credit supply shocks (Güler et al., 2021). This is usually achieved through exploiting natural experiments such as crises or policy changes together with cross-sectional variation in vulnerabilities or exposure to these exogenous shocks across (i) borrowers (Duchin et al., 2010; Chava and Purnanandam, 2011; Chodorow-Reich, 2014), (ii) financial institutions (Ivashina and Scharfstein, 2010; Jiménez et al., 2012; Cingano et al., 2016; Bofondi et al., 2018) or (iii) regions (Peek and Rosengren, 2000; Huber, 2018). We bring new evidence to this literature by exploiting a unique setting in which a large financial institution exits a market and studying the impact of this shock to credit supply by directly identifying affected customers and following their lending behaviour after the exit announcement.

Similar evidence is provided in Bonfim et al. (2021) who exploit branch closures in Portugal and show that, even if, local markets remain competitive, firms receive worse credit conditions when their main lender leaves the market.

Our work also contributes to a large literature that investigates the role of banking relationships discussed above. A large theoretical literature argues that information frictions make bank-lender relationships valuable and prevent firms from mitigating the effects of a decrease in credit supply from a single bank by resorting to borrowing from a different lender or directly from bonds or equity markets (Sharpe, 1990; Dell'Ariccia and Marquez, 2004). Our results confirm empirically the importance of such banking relationships, by documenting a significant disruption in the credit supply of exit bank customers. Moreover, we show a substitution towards borrowing from non-banks as a result of the bank credit supply shock.

This complements a growing empirical literature on the rise of non-bank financial intermediaries, in particular following the 2008 Global Financial crisis. Irani et al. (2021) show that the tightening of bank capital regulation in the USA has led to a rise in non-bank lending to large corporations, particularly among weakly capitalized banks and when capital is scarce. Chernenko et al. (2022) show that supervisory restrictions on bank lending to riskier borrowers can explain the majority of the non-bank lending to mid-market firms over 2010-2015, with non-banks particularly important for riskier firms. Closest to our work is Gopal and Schnabl (2022), who use data from the USA

to show that tighter bank capital regulation since the GFC has led to a substitution in SME financing towards non-bank intermediaries such as finance companies. Our finding that non-banks can absorb credit supply shocks complements evidence from global syndicated markets, where Elliott et al. (2023) show that non-bank lenders partly absorb US monetary shocks by increasing dollar credit to non-US companies.

Our study also provides a clear example of the cross-border transmission of banking retrenchment on credit supply in a small open economy. In this way, we add to the literature that shows how shocks to bank health and strategy in home countries can impact the real economy in other jurisdictions. Popov and Udell (2012), for example, use survey evidence to examine the impact of bank health on small firms' access to credit across different jurisdictions. De Haas and Van Horen (2013) also document how adverse changes in financial conditions result in significant declines in cross-border lending and a renewed focus on home market lending.

The remainder of this paper is organized as follows. Section 2 describes the Irish business credit market and the credit registry data we employ. Section 3 presents the empirical strategy and section 4 the results. Finally, section 5 concludes.

2 Institutional background and data

The business credit market in Ireland is highly concentrated, with three commercial banks (Allied Irish Banks, Bank of Ireland, and Ulster Bank) originating around 65% of new bank lending volumes during the period 2019-2021. These lenders have been long established in the Irish market, being incorporated or descendant from banks incorporated between 1783 and 1836, and maintain extensive nationwide branch networks. Ulster Bank – the principal lender of interest in this paper – was acquired in 1917 by the London County & Westminster Bank of London and remained a subsidiary of what became the present-day NatWest Group (Drea, 2014).

The event we study in this paper is the exit of Ulster Bank from the Irish business credit market. In September 2020, NatWest Group announced that it would commence a review of its Ulster Bank operations in Ireland. The announcement was unexpected by market participants and was reported widely in the media, with labour unions and consumer advocates requesting policy action to mitigate the adverse

effects on borrowers, depositors, as well as Ulster Bank staff (Brennan, 2020).[1] In February 2021, NatWest announced the outcome of the review and confirmed their intention to close Ulster Bank (Brennan, 2021). Ulster Bank remains a regulated entity in the Irish market and continued to manage relationships with existing borrowers while it arranged the sale of its portfolio of assets to competitors. In the months following the announcement, Ulster Bank remained reasonably active in issuing new loans in some market segments. However, despite this, the widespread public opinion and media coverage in the months following the announcement was that the exit represented a significant disruption in the availability of credit among Ulster Bank's borrowers (Moore, 2021). As such, we believe that the announcements in September 2020 and February 2021 are appropriate dates from which to ascribe a credit supply shock pertaining to Ulster Bank's borrowers.

The broader Irish economic and banking context is one marked by a large boom, bust and recovery. The property market crash in Ireland from 2008 to 2012 and the deep accompanying recession resulted in major impairment of the Irish banking sector, including that of Ulster Bank (Whelan, 2014). From 2013 to 2020, the Irish economy underwent a remarkable recovery, driven initially by the strength of exports from the multinational sector, but becoming more broad-based as the decade went on. This period in Irish banking was characterised by non-performing loan (NPL) resolution, capital building, tightening macroprudential policy and microprudential supervision, low interest rates, weak profitability, and economic recovery. Unemployment rates fell from a peak of 16% in 2012 to 5% on the eve of the COVID-19 pandemic, while house prices appreciated by over 100% during the same period. Banks' NPL ratios fell from above 30% to below 5%, with lenders availing both of options to sell portfolios to financial markets, as well as borrowers' financial recovery and active loan restructuring and modification (Donnery et al., 2018).

Readers may be concerned about the endogeneity of the decision to exit the market, in particular, that features of the borrowers of Ulster Bank drove the decision, and that these may pollute our estimates of the credit supply shock. We take comfort from the reasons cited by NatWest for closing Ulster Bank (which related to operating costs, legacy troubled loans, weak profitability, and the size of the Irish market), and

[1] Investor reports prior to September 2020 have no mention of the decision to review operations in Ireland. See, for example, the half-year reports in July 2020 available https://investors.natwestgroup.com

an analysis of the books of Ulster Bank relative to competitors, which confirms that Ulster Bank's borrowers appear similar to those of other local banks on a number of dimensions up to 2020. Our assessment is that the closure of Ulster Bank was the result of an analysis of global operations of a large multinational bank, which pinpointed weak profitability and weak prospects, along with high fixed costs, most of which relate to broader structural issues facing Irish banks during the past decade, as the reason to wind down operations [2] We do not believe there is evidence that Ulster Bank had particular features that differentiated it from other incumbents, which would pose concerns for empirical identification. This view is supported by the fact that Ireland's only other foreign-owned retail bank, KBC Bank Ireland, also announced its decision to leave the Irish market in 2021, citing similar reasons.[3] Our identification rests on the assumption that the Ulster Bank exit announcement was unexpected, and was not caused by features of its borrower population that would lead to differential borrowing dynamics after the exit.

To study the effects of the announced exit of Ulster Bank, we use a comprehensive dataset on bank-firm level credit data sourced from Ireland's Central Credit Register (CCR). Lenders in Ireland are required to submit credit data on household or business loans with balances or credit limits of €500 or more. Importantly, this requirement applies to both banks and non-banks. Banks in our sample include the main retail bank groups and some small local credit unions, but exclude international banks that mainly specialize in loan syndicate participation and lending to large foreign multinationals operating in Ireland. Non-bank lenders, on the other hand, specialize in asset finance and working capital provision and have accounted for 30% of small business lending during 2019-2020 (Heffernan et al., 2021). Gaffney and McGeever (2022) show that non-bank borrowers in Ireland tend to be, on average, younger, have higher leverage, and have lower liquidity as compared to bank borrowers. This is consistent with the findings of Chernenko et al. (2022) for mid-market US firms. Nonetheless, non-bank lenders represent an important competitive threat to traditional banks in Ireland: in

[2]Irish banks' weak profitability prior to COVID-19 mirrored European performance, being driven by tightening net interest margins on loan books as deposits spent longer at the zero lower bound (CBI, 2019).

[3]KBC Bank Ireland was at this point a residential mortgage lender with minimal exposure to non-financial corporations.

Table 1: Types of credit arrangements

	Overall sample	Banks	Non-banks	Exit Bank
Asset Finance	33%	24%	51%	25%
Business Loan	23%	31%	13%	27%
Overdraft	16%	26%	5%	29%
Credit Card	12%	18%	0%	15%
Other	7%	1%	14%	2%
Trade Finance	7%	1%	17%	2%
Syndicated Loans	1%	0%	0%	1%
Total number of contracts	649,703	341,279	269,129	38,048

The table presents the percentage of contacts in each category. Banks include the main retail banks as well as credit unions (excludes international banks), while Non-banks include real-estate finance specialists, general lending companies, high-cost money lenders, community lenders and other non-banks. Overdraft includes: Business Overdraft; Business Revolving Facility; Asset finance: Business Hire Purchase and Business Leasing. Trade finance includes: Letter of Credit; Stocking Finance; Supply Chain Finance; Invoice discounting.

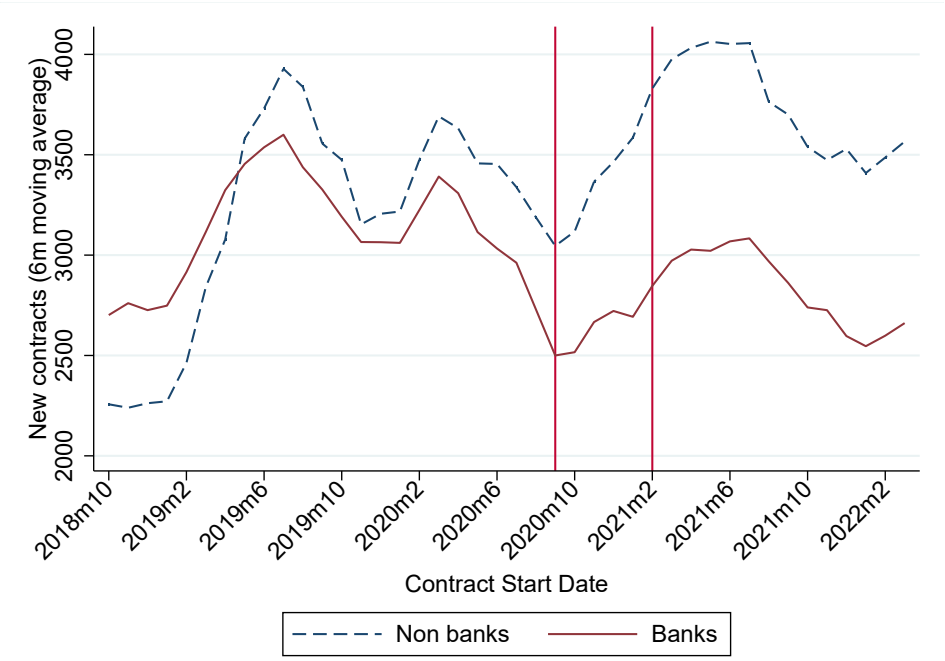
the six months to March 2022, a quarter of SME credit applications were made to non-bank lenders.[4]

Our sample consists of 362 credit institutions, out of which six are the main retail banks, 154 are credit unions and 202 are non-bank lenders. Non-bank lenders include asset finance specialists, real-estate finance specialists, and general lending companies, but also high-cost money lenders, community lenders and investment funds. We observe a total of 204,317 firms with at least one credit product in our sample and 649,703 unique credit arrangements. Our sample period begins in 2018Q3 and ends in 2022Q2, with monthly observations on new credit volumes for each lender-firm group. From June 2019 onwards we also observe total outstanding debt and monthly repayments for each borrower, which we employ in some of our specifications. For each contract, we observe its product type, outstanding balance, credit limit, whether or not it is currently delinquent, as well as some key characteristics such as interest rate type and level. Product types include term loans, credit cards, overdraft and revolving facilities, leasing and hire purchases, letters of credit, stocking finance, supply chain finance, invoice discounting, and syndicated loans.

Table 1 shows the distribution of contract types across different lender categories, as well as the exit bank. It highlights the concentration of non-banks in Ireland in

[4]See the 2022 survey results of Ireland's SME Credit Demand Survey, available at:https://www.gov.ie/en/publication/51315-sme-credit-demand-survey-october-2021-to-march-2022/.

Figure 1: New contracts by bank and non-bank lenders



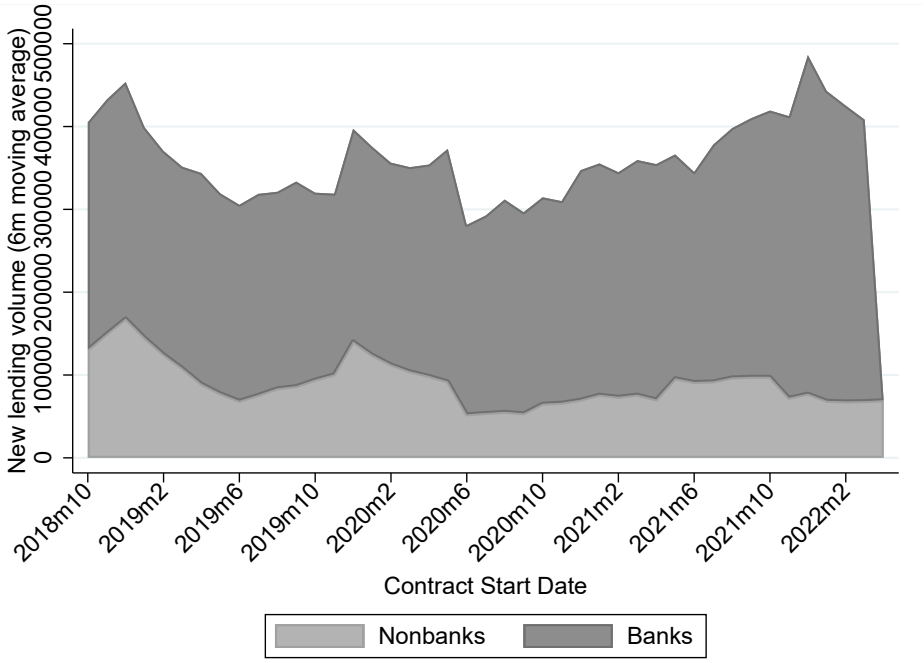
The figure shows the 6-month moving average of the number of new contracts by lender type. Banks include the main retail banks as well as credit unions, while Non-banks include asset finance specialists, real-estate finance specialists, general lending companies, high-cost money lenders, community lenders and other non-banks.

asset finance, however, these lenders also offer all other types of credit arrangements, with the exception of credit cards and syndicated loans. Note also that Ulster Bank's product distribution is very similar to the overall banking sector during our sample period. This mitigates concerns about specialization in their loan portfolio, which could lead to unobservable matching to certain types of firms that are also more likely to borrow from non-bank lenders.

We present next some descriptive statistics on the evolution of aggregate lending by type of institution, as well as for the exit bank. First, Figure 1 shows the evolution of new contracts by banks and non-banks over the sample period. [5] A sharp decline in new lending occurred after March 2020 reflecting the COVID-19 lockdown, with a trough reached in October 2020. Aggregate new credit arrangements gradually picked up afterward, with a sharper increase among non-banks. Figure 1 also highlights the

[5]Note that the large increase in new contracts by non-banks at the end of 2018 is the result of the introduction of trade finance contracts in the Central Credit Registry.

Figure 2: Evolution of new lending volumes



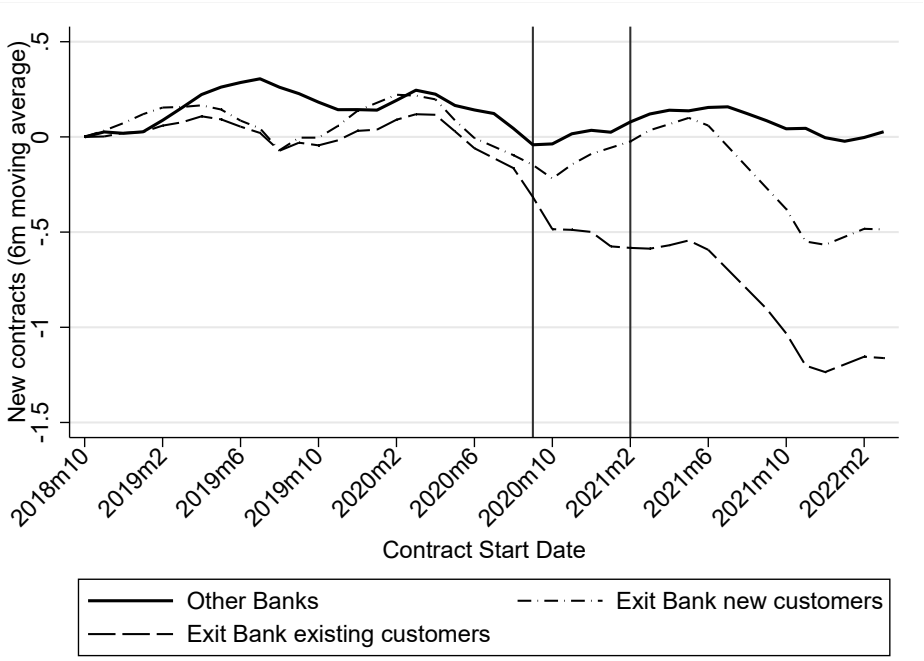
The figure shows the 6-month moving average of the volume (in euro) of new contracts by lender type. Banks include the main retail banks as well as credit unions, while Non-banks include asset finance specialists, real-estate finance specialists, general lending companies, high-cost money lenders, community lenders and other non-banks.

two key dates surrounding the exit of Ulster Bank, i.e., the announcement of the review of operations in September 2020 and the official exit decision in January 2021.

Figure 2 shows the evolution of lending volumes (in euro) by banks versus non-banks. We winsorize loan volumes at the 99th percentile throughout the analysis to account for the presence of a few large loans. While non-banks are responsible for a higher number of new credit contracts (see Figure 1), these are, on average, smaller-sized loans, and, as such, the aggregate loan volume by non-banks only constitutes about a third of new lending volumes, on average. Overall, Figures 1 and 2 suggest a similar evolution of bank and non-bank lending over the sample period considered.

We turn next to the evolution of new lending for our exit bank. In Figure 3 we show the evolution of new credit contracts, indexed to October 2018. We distinguish between existing customers, i.e., those with prior credit arrangements with Ulster Bank at the time the new credit is granted as well as new customers for whom the new credit is also their first contract with Ulster Bank. Figure 3 shows a significant

Figure 3: New contracts by exit bank



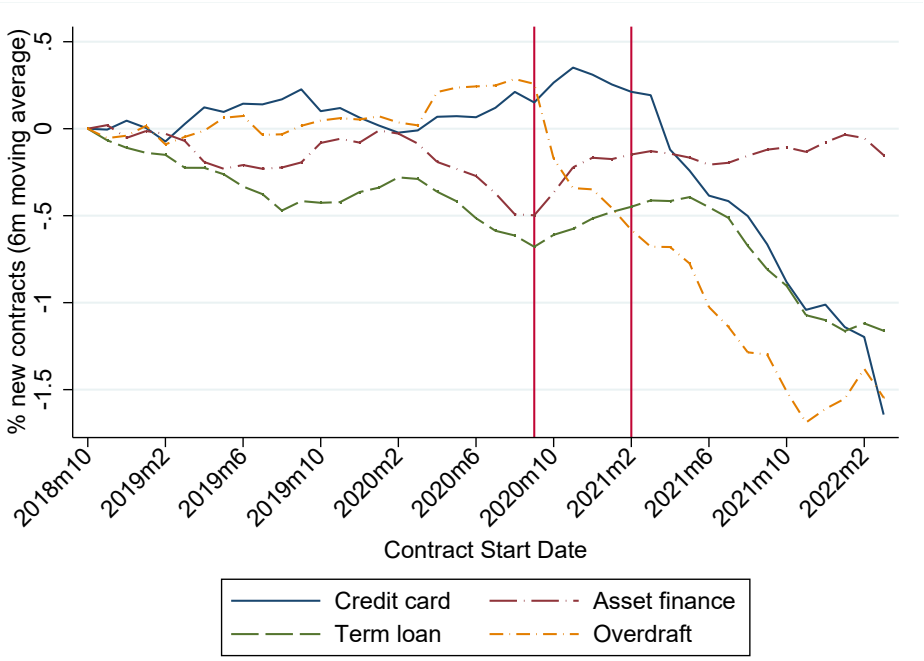
The figure shows the growth rate of new contracts for the exit bank (relative to October 2018). Existing customers represent customers with an existing credit contract in a given period, while new customers are those who initiate their first credit agreement in a given period.

drop in new contracts starting with March 2020, which, unlike the aggregate market developments in Figure 1, does not recover after September 2020, but continues a sustained drop until the end of the sample period.[6]

To compare the evolution of new lending by our exit bank relative to the rest of the market, we show in Figure 4 the percentage of Ulster Bank's new contracts as a share of all new contracts granted by banks for each contract type, indexed to October 2018. This figure clearly highlights the sizable drop in new lending activity around the two announcement dates. With the exception of the asset finance arm of Ulster Bank, which remains relatively stable, new contracts across all other types of credit arrangements plummeted following the two announcements. Moreover, given the specialization of non-bank lenders in asset finance, the fact that the exit bank maintains its operations in this type of product is reassuring, as it implies that any

[6]Figure 3 excludes asset finance contracts, which are originated by Lombard Ireland, an arm of Ulster Bank that continued its functioning in Ireland.

Figure 4: New contracts by type



The figure shows the percentage of new contracts, by type, granted by the exit bank as a share of all new contracts granted by banks in the same period relative to October 2018, which is taken as the baseline period.

substitution we observe towards non-banks will not be necessarily driven by firm specialization in this particular product type. Overall, the evidence in Figures 3 and 4 points to a significant reduction in credit for the Ulster Bank following the September announcement date and supports our difference-in-difference identification strategy.

3 Identification strategy

We employ two identification strategies to isolate the effect of the credit supply shock. The first employs industry-location-time fixed effects as in Degryse et al. (2019) to isolate the effects of the supply shock using both single- and multi-bank firms. The second strategy focuses on the sub-sample of firms borrowing from both banks and non-banks together with firm-month fixed effects to pin down credit demand (Khwaja and Mian, 2008). Our motivation for employing both strategies is driven by the high concentration of single-lender firms in Ireland. Around 80% of firms in our sample borrow from only one provider and around 15% of firms borrow from both a bank

and non-bank lender. A dual approach to identification will allow us to present results including the entire universe of firms, as well as for the more restricted sample of firms with multiple lenders for which we can employ more stringent firm-time fixed effects for identification.

Our first empirical strategy looks at whether exit bank customers experienced credit constraints following the exit announcement. To this end, we estimate a standard difference-in-difference model as follows:

$$y_{i,t} = \beta Treat_i \times Post_t + \alpha_i + \delta_t + \epsilon_{i,t}, \tag{1}$$

where $y_{i,t}$ represents our outcome of interest (such as: whether the firm has obtained a new loan, new lending volume, or total outstanding debt) for firm i at time t. We define our treatment variable, $Treat_i$, as firms that have had a credit relationship with the exit bank in the one year prior to the exit announcement (September 2020). Credit relationships include any type of credit product new or outstanding during this year. $Post_t$ is a dummy variable taking the value of 1 after September 2020 and zero prior to this date. The baseline specification includes firm and time-fixed effects, which we then saturate with higher-order fixed effects. In particular, we include industry-location-time fixed effects that have been shown in Degryse et al. (2019) to reliably capture credit demand. Location is defined as the county of registration of the business (there are a total of 26 counties in Ireland), while industry corresponds to the 2-digit NACE code. Throughout all specifications, we cluster standard errors at the firm level to account for within-firm correlation in the error term, but all results are robust to including only heteroskedasticity-robust standard errors.

We make several identifying assumptions. The first is that, as we have previously argued, the exit decision was not driven by a notably lower performance of the exit bank customers compared to the other borrowers in our sample. More specifically, we are assuming that there is no matching between being a customer of the exit bank and unobservable firm characteristics that affect loan demand (i.e., customers of the exit bank had poorer performance and loan demand prior to exit). Table 2 and Figure 5 support this claim. First, Table 2 shows some balance sheet characteristics of our treatment and control groups at the end of 2019. On average, treated firms tend to be larger, but less leveraged, and have identical levels of outstanding debt as well as liquidity ratios (the latter measured as current assets to current liabilities).

Table 2: Descriptive statistics

	Treated		Control		
	Mean	Std. dev.	Mean	Std. dev.	t-test
Total Assets (mil. euro)	3.21	8.72	1.81	6.44	-21.98
Leverage	0.74	0.63	0.81	0.72	10.28
Liquidity	2.22	2.62	2.29	2.82	2.62
Outstanding debt (mil. euro)	0.18	1.56	0.16	3.25	-0.78
Number of COVID-19 wage subsidies	3.45	2.3	3.54	2.28	3.27

The table presents descriptive statistics of firm characteristics. Balance sheet variables are observed at the end of 2019. Outstanding debt is the average over 2019-2022. The number of COVID-19 wage subsidies represents the number of quarters the firm has availed of COVID-19 subsidies over the period 2020Q2-2022Q1. The last column shows the t-statistics of a t-test of the difference in means between the treatment and control groups.

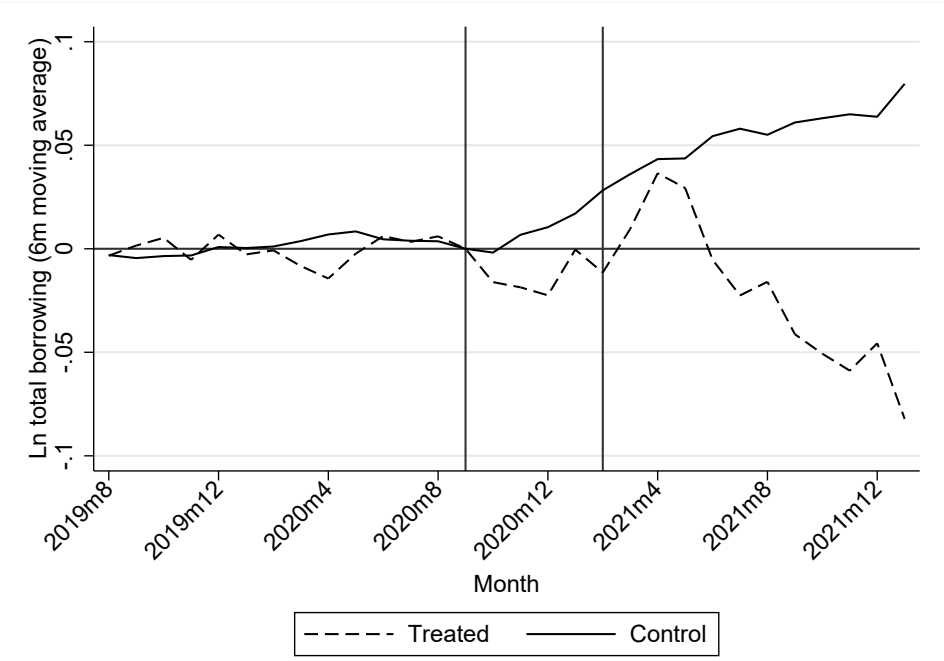
Importantly, they have received a significantly lower number of COVID-19 subsidies[7] over the period 2020-2021, which previous research on the behaviour of Irish firms has shown to be highly correlated to past and future firm performance (McCann et al., 2023). This suggests that treated firms do not necessarily have weaker balance sheets or a higher debt overhang prior to the exit announcement which could explain any lower credit demand in the post-exit period.

Furthermore, Figure 5 shows the evolution of aggregate outstanding credit amounts (in log) by treated and control groups. To ease comparability, we normalize the y-axis such that the logarithm of total credit is zero at the time of the shock. As such, the figure illustrates the log-ratio of total credit in a given month relative to September 2020 and values can be readily interpreted as growth rates in credit relative to the baseline period. We observe no sizeable difference in the percentage change in credit before the shock between the two groups, confirming the parallel trend assumption. However, after the shock, there is a significant divergence in the percentage change in lending in each observed month.

Our second empirical strategy is a triple diff-in-diff methodology where we compare lending outcomes among treated and control firms in the post versus the pre-exit period and across bank and non-bank lenders. Specifically, our baseline specification is:

[7]The largest state support given to firms during the COVID-19 pandemic was a non-repayable wage subsidy grant scheme. See Durante and McGeever (2022)

Figure 5: Evolution of outstanding debt

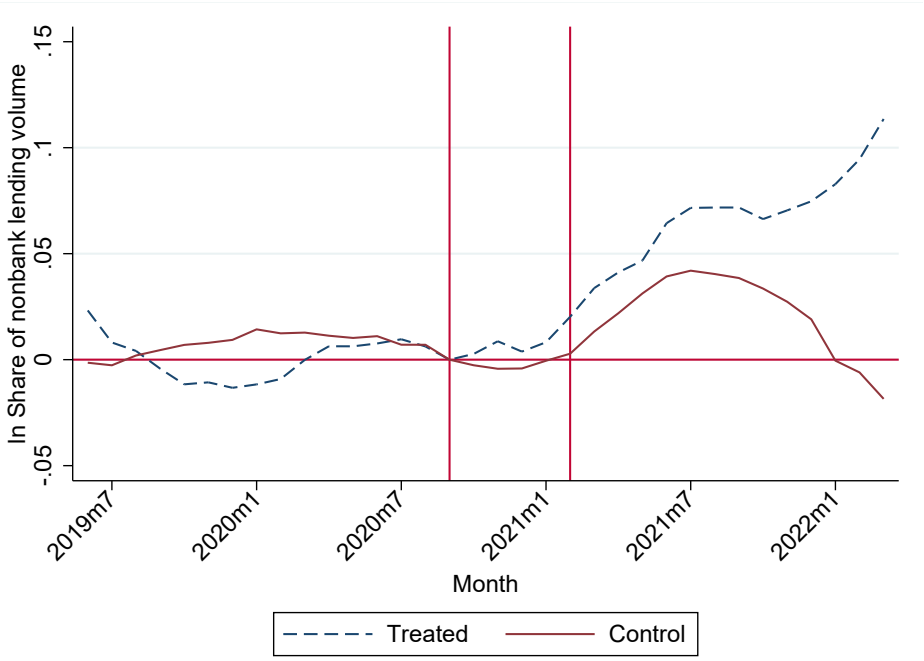


The figure shows the time series evolution of aggregate outstanding credit amounts by treated and control. We normalize the y-axis so that the logarithm of total credit is zero at the time of the shock, i.e., the time series illustrates the log-ratio of total credit in a given month relative to September 2020. The y-axis values can then be readily interpreted as growth rates in credit relative to the shock.

$$y_{i,l,t} = \beta Treat_i \times Post_t \times Nonbank_l + \alpha_i + \delta_t + \gamma_l + \epsilon_{i,l,t}, \tag{2}$$

where $y_{i,l,t}$ represents our outcome of interest (such as: whether the firm has obtained a new loan, new lending volume, total outstanding debt) for firm i from lender type l at time t. We consider two lender types: bank and non-banks, and, as such, the $Nonbank_l$ indicator equals one if the lender is a non-bank and zero otherwise. Non-banks include asset finance specialists, money lenders, and other non-bank lenders. We define our treatment variable the same as before, that is, firms with any credit arrangement with the exit bank from September 2019 to September 2020. $Post_t$ is a dummy variable taking the value of 1 after September 2020 and zero prior to this date. Our baseline specification includes firm (α_i), time (δ_t) and lender-type fixed effects (γ_l). We then augment the model to include industry-location-time fixed effects, as well as firm-time fixed effects.

Figure 6: Evolution of the share of outstanding debt from non-banks



The figure shows the time series evolution of the share of outstanding credit serviced by non-banks in the treated and control. To ease comparability, we normalize the y-axis such that the share is forced to be zero at the time of the shock, i.e., the time series illustrates the log ratio of the share of non-bank credit in a given month relative to September 2020. The y-axis values can then be readily interpreted as growth rates in this share relative to the baseline period.

The key identification assumption behind this second empirical strategy is that there is no matching between being a customer of exit bank and unobservable firm characteristics that affect loan demand from non-bank lenders (i.e., customers of exit bank are more likely to specialize in products offered predominantly by non-banks). The fact that the exit bank did not close its asset finance operations in Ireland, which is also the main specialization of non-banks, is reassuring. Moreover, our rich dataset allows us to exploit variation within-firm across lender types separately for each product type, which further mitigates any specialization concerns. Finally, we observe that about 21% Exit Bank customers also have a relationship with a non-bank lender, which is comparable to the 15% of firms in the entire sample.

Furthermore, Figure 6 shows the evolution of the share of outstanding credit serviced by non-banks in the treated and control. Same as before, we normalize the y-axis such that the share is forced to be zero at the time of the shock and the series

represents growth rates in this share relative to the baseline period. We observe that prior to the shock, the share of outstanding debt serviced by non-banks had a similar evolution for treated and control firms. However, after the exit announcement, the growth in this share is considerably larger among the exit bank customers. This trend suggests a substitution from bank to non-bank lending following the credit supply shock.

4 Results

We start by investigating how new borrowing responds to the credit supply shock among our treated firms, followed by an analysis of outstanding lending volumes. We then turn to an investigation of the substitution between bank and non-bank lending.

4.1 Are exit bank customers credit constrained?

To assess whether exit bank customers are indeed credit-constrained, we start by looking at treated firms' probability of receiving a new credit arrangement in the post versus pre-exit periods.

Table 3 presents the results from estimating Eq. (1) for different outcome variables. Columns (1) and (2) estimate a linear probability model that looks at whether a firm receives a new credit arrangement. As such, the dependent variable is an indicator variable equal to one if firm i receives a new debt contract in period t. We define a period t in this analysis as a quarter, given that new contracts are not very frequent and not many firms borrow from both a bank and a non-bank in the same month, which is essential for our Khwaja and Mian (2008) identification strategy. More precisely, the analysis in this section is based on a balanced panel at the firm-quarter level observations over the period 2018 (quarter 3) to 2022 (quarter 1), with the dependent variable taking the value of one in quarters when a new contract starts and zero in the quarters with no new borrowing. We control for firm and quarter fixed effects in column (1), while column (2) includes industry-location-time fixed effects.

We find that exit bank customers are indeed less likely to receive a new credit agreement as compared to control firms in the period after the announcement. The estimates in columns (1)-(2) suggest a between 2.2-3% lower probability of obtaining a new credit arrangement. On average, around 10% of borrowers in our sample apply

for a new loan, implying a sizeable marginal effect on the treated group. Columns (3)-(4) look at the intensive margin, where the dependent variable is the Euro values of the credit limit or loan volumes of new debt approved in a quarter. The point estimates suggest new credit amounts are around €5,500 lower for treated firms in the post as compared to the pre-exit period. Again, the economic effect is large given an average new debt volume of around €10,000 in our sample.[8]

One concern with our identification strategy is that the treatment and control groups differ along several characteristics (see Table 2). Although the fact that treated firms tend to be larger, more liquid and less leveraged than the control group would bias the diff-in-diff coefficient in the opposite direction (that is, towards treated firms being less credit-constrained after the shock), we check the robustness of our results using matching techniques. We use a re-weighting method that guarantees that the treatment and control groups are similar in terms of average size, which is the most significant difference between the two groups. Specifically, we employ the entropy balance re-weighting algorithm of Hainmueller (2012), which allows us to obtain a treatment and control sample that are indistinguishable in terms of average total assets. The results are presented in Appendix Table 10 and support our main results. The size of the coefficients is also qualitatively similar to the main estimations in Table 3.

Next, Figure 7 presents the event study analysis corresponding to the difference-in-difference model in Eq. (1). Specifically, we replace the $Treat_i \times Post_t$ parameter with the full set of treatment-by-quarter interactions:

$$y_{i,j,c,t} = \sum_{t \neq 2019Q4} \beta_t^{DD} \times \mathbb{1}(Quarter_t) \times Treat_i + \alpha_i + \delta_{i,c,t} + \epsilon_{i,j,c,t}, \tag{3}$$

[8]This small average volume of new debt contracts is due to the large number of quarters with no new debt granted (zero values) in our sample. In Appendix Table 9 we use alternative estimation methods to account for this skewed distribution of our data. In particular, in columns (1)-(2) of Table 9, we estimate Eq. (1) using a Poisson pseudo-maximum likelihood regression as opposed to a linear model, which accounts for the count nature of our dependent variable and has been shown to be well-behaved when the proportion of zeros in the sample is very large (Silva and Tenreyro, 2011). The magnitude of the effect is larger in this case, with treated firms receiving between €7,500-7,900 lower credit volumes or limits in the post versus pre-exit period.

Table 3: New credit

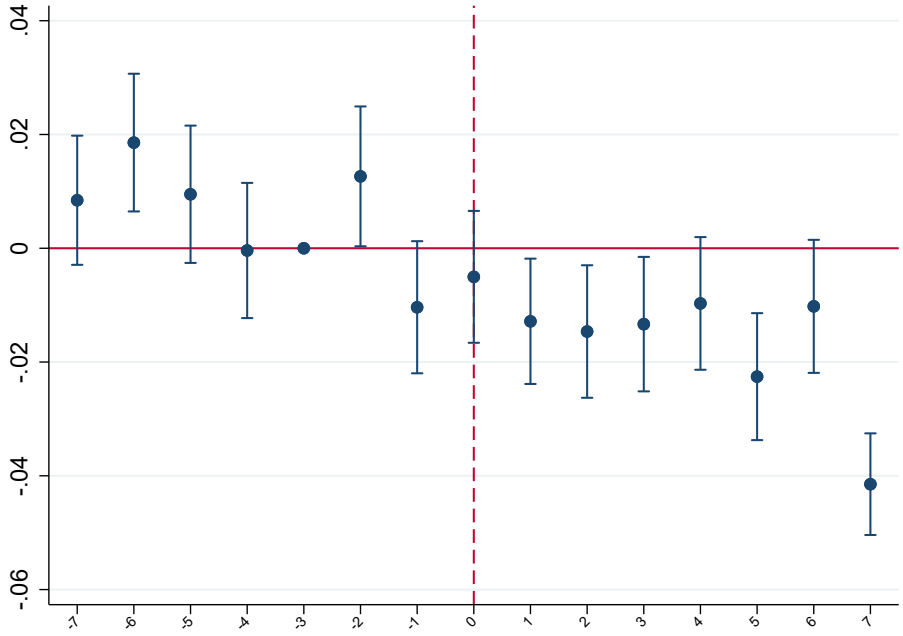
Dependent variable:	$\mathbb{1}\{$New debt $> 0\}$		New debt volume	
	(1)	(2)	(3)	(4)
Post $\times$ Treated	-0.030***	-0.022***	-5,569.7***	-5,956.8***
	(0.002)	(0.002)	(920.052)	(1,195.495)
Observations	1,796,664	1,087,512	1,796,664	1,087,512
R-squared	0.117	0.138	0.157	0.175
Mean of Y	0.10	0.10	10,645	10,645
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes		Yes	
Industry-Location-Time FE		Yes		Yes

The table presents OLS estimates of Eq. (1). The dependent variable in columns (1)-(2) is an indicator variable equal to one if firm i receives a new debt contract in a given quarter, while in columns (3)-(4) it is the loan volume or credit limit of new debt received in a given quarter. $Treated$ is a dummy equal to one if firm i had a credit relationship with the exit bank in the one year prior to the exit announcement. $Post$ is a dummy variable taking the value of 1 after Q3 2020 and zero prior to this date. Standard errors clustered at the firm level in parenthesis. ***,**,* represent significance at 1, 5 and 10% levels, respectively.

where $y_{i,j,c,t}$ is an indicator variable equal 1 if firm i in county c and industry j obtained a new loan arrangement in quarter t. The identifying assumptions in Section 3 are the same, so we control in this specification for firm α_i and industry $\times$ location $\times$ time fixed effects, $\delta_{j,c,t}$ to absorb aggregate credit demand conditions and firm time-invariant characteristics. We consider as baseline the last quarter of 2019 (2019Q4), as the quarter prior to the announcement (2020Q2) is also the one most affected by the COVID-19 pandemic and aggregate loan volumes hit their trough in this period (see Figures 1 and 2). This implies that in all other periods, the change in the control group's time trend is used to estimate the counterfactual change in the treatment group. Given the contraction in credit supply documented in Table 3, we expect β_t^{DD} to not be statistically significant from zero in the period prior to the announcement (2020Q3) and statistically lower than zero in the period after.

The estimated β_t^{DD} coefficients in Figure 7 show markedly different time trends in access to new credit between the exit bank customers and the control group. In particular, most coefficients in the pre-exit period are either not statistically significant from zero or positive. In the post-exit period, a stark divergence emerges between the two groups with most coefficients being statistically lower than zero after 2020Q3. Moreover, this significantly lower probability of obtaining new credit is consistently estimated across most of the seven post-exit quarters, with later quarters showing an

Figure 7: Event-study coefficients



The figure shows the coefficients β_t^{DD} in Eq. (3). 95% confidence intervals calculated using firm-level clustered standard errors are depicted. The vertical dashed line marks the exit announcement in 2020Q3.

even stronger effect. This suggests the contraction in credit supply among exit-bank customers is persistent.[9]

As our dataset allows us to distinguish different credit products, we investigate next whether the contraction in credit supply is heterogeneous across different types of credit arrangements. Table 4 presents the estimates of Eq. (1) for each type of credit arrangement separately. Panel A of Table 4 looks at the probability of obtaining a new debt contract, while Panel B looks at the volume of debt for new contracts issued. The results show consistent estimates across most specifications. Overall, we find robust estimates of a lower probability of obtaining a new asset finance loan,

[9]The persistence of the effect is confirmed in Appendix Table 11, where we re-estimate the results in Table 3, using an alternative definition of the post period based on the second announcement date in January 2021. Specifically, we define an indicator variable, $Post_2$, equal to one from 2021 quarter 1 to 2022 quarter 2, and zero in all quarters prior to 2021 (namely from 2018-2020). The results are consistent, and, in line with Figure 7, show that the magnitude of the effect is comparable to our baseline results when we consider a later date as the start of the post-exit period.

Table 4: New credit by contract type

Loan Type	Overdraft	Asset finance	Business loan	Trade finance
	(1)	(2)	(3)	(4)
Panel A: Probability of obtaining credit				
Post × Treated	-0.002**	-0.014***	-0.006***	0.000
	(0.001)	(0.002)	(0.001)	(0.000)
Observations	1,087,512	1,087,512	1,087,512	1,087,512
R-squared	0.079	0.183	0.105	0.306
Panel B: New Debt volumes				
Post × Treated	-32.9**	-669.4***	-4,153.4***	355.2
	(15.463)	(200.202)	(820.071)	(307.775)
Observations	1,087,512	1,087,512	1,087,512	1,087,512
R-squared	0.081	0.267	0.114	0.577
Firm FE	Yes	Yes	Yes	Yes
Ind-Loc-Time FE	Yes	Yes	Yes	Yes

Table presents estimates of Eq. (1) by product type. The dependent variable in Panel A is a dummy equal to 1 if firm i receives a new debt contract in a given quarter, while in Panel B it is the loan volume of credit limit of new debt received in a given quarter. $Treated$ is a dummy equal to one if firm i had a credit relationship with the exit bank in the one year prior to the exit announcement. $Post_t$ is a dummy variable taking the value of 1 after 2020 Q3 and zero prior to this date. Standard errors clustered at the firm level in parenthesis. ***,**,* represent significance at 1, 5 and 10% level, respectively.

overdraft facility, as well as general business loan. The results for the intensive margin are rather small in magnitude with the exception of business loans, where the effect is comparable to the overall effect in Table 3.

In a world in which relationships have no value, and switching across credit providers is frictionless for borrowers, one would expect to be unable to reject the null hypothesis of an Ulster Bank customer indicator having an effect of zero, i.e. whether a business banked with Ulster Bank or not in the pre period, the probability and size of credit agreements in the $post$ period should be the same as for customers of other lenders. However, we robustly reject this null hypothesis, consistently finding statistically significant negative effects for $post$ period borrowers that are due to the firm being a pre period customer of Ulster Bank. It is hard to rationalize these results without recourse to the importance of relationships.

4.2 Substitution between bank and non-bank credit

We next investigate whether the decrease in credit supply was partly mitigated by increased lending activity by non-banks. We start by looking at the probability of obtaining new credit. Table 5 shows the estimates of Eq. (2), where the dependent variable is an indicator variable equal to one if the firm obtained a credit contract in columns (1)-(3) and new debt volumes in columns (4)-(6). The triple interaction term is positive, confirming that non-banks play a role in mitigating the negative effects of the credit supply shock resulting from Ulster Bank's exit. The probability of receiving a new contract, among those affected by the exit in the $post$ period, is between 2-4 percent higher for those borrowing from non-banks compared to those borrowing from other banks, according to the estimates of columns (1) and (3) using alternate identification strategies. On the intensive margin, we find again that non-banks play a quantitatively meaningful role, with the treatment effect for the size of new debt contracts being between €25-34,000 higher for a non-bank versus a bank loan.[10]

One key identifying assumption in Khwaja and Mian (2008) is that firms are indifferent between borrowing from two banks. This condition may not hold in the presence of banks' specialization (Paravisini et al., 2015; Ivashina et al., 2020). Our dataset allows us to mitigate this concern by estimating Eq. (2) for each product type separately. The data requirement is much stricter in running this specification, as we only consider firms that borrow from banks and non-banks across each product type.

Table 6 shows the estimates of Eq. (2) for different product types, while controlling for firm-quarter fixed effects. It shows that the disproportional lending from non-banks is driven by business loans. As such, we find that the substitution towards non-bank lending is driven by business segments traditionally dominated by banks and less so within product types in which non-banks are mainly specialized in Ireland, such as asset finance (see Table 1).

4.2.1 Outstanding debt volumes

Our estimations thus far have looked at new loan volumes. An alternative empirical strategy is to look at outstanding debt in each period. Our loan-level dataset also contains monthly debt service and outstanding debt for all types of credit products.

[10]Appendix Table 10 shows that there results are robust to the Hainmueller (2012) re-weighting algorithm.

Table 5: New debt: substitution between bank and non-bank borrowing

Dependent variable	$1\{NewDebt > 0\}$			New debt volume (€)		
	(1)	(2)	(3)	(4)	(5)	(6)
Treated × Post × Nonbank	0.034***	0.020***	0.038***	22,376.8***	23,718.4**	30,439.4**
	(0.003)	(0.004)	(0.012)	(8,459.5)	(9,440.2)	(12,018.9)
Treated × Post	-0.030***	-0.019***		-6,541.7***	-7,182.2***	
	(0.001)	(0.002)		(874.1)	(1,129.5)	
Post × Nonbank	0.001	0.005***	-0.005	-1,661.7	-1,928.7	-1,617.3
	(0.001)	(0.001)	(0.005)	(2,075.6)	(2,695.9)	(2,944.8)
Treated × Nonbank	-0.107***	-0.084***	-0.077***	-10,229.0	-20,189.9***	7,602.2
	(0.005)	(0.005)	(0.011)	(6,404.8)	(5,833.8)	(10,524.2)
Observations	1,796,664	1,087,512	126,798	1,796,664	1,087,512	126,798
R-squared	0.473	0.483	0.447	0.167	0.186	0.516
Firm FE	Yes	Yes		Yes	Yes	
Time FE	Yes			Yes		
Industry-Location-Time FE		Yes			Yes	
Firm X Time FE			Yes			Yes

Table presents estimates of Eq. (2). The dependent variable in columns (1)-(3) is a dummy equal to 1 if firm i receives a new debt contract in a given quarter, while in columns (4)-(6) it is the loan volume of credit limit of new debt received in a given quarter. $Treated$ is a dummy equal to one if firm i had a credit relationship with the exit bank in the one year prior to the exit announcement. $Post_t$ is a dummy variable taking the value of 1 after 2020 Q3 and zero prior to this date. Nonbank is a dummy variable from non-bank financial corporations. Standard errors clustered at the firm level in parentheses. ***,**,* represent significance at 1, 5 and 10% level, respectively.

As such, we can investigate changes in volumes of outstanding debt as well. We first re-estimate the model in Eq. (1) using the monthly outstanding debt levels as the dependent variable. As before, we winsorize all debt volume at the 99th percentile to exclude some very large loans. The results are presented in columns (1) and (2) of Table 7, where we control for firms and time fixed effects in column (1) and industryXlocationXtime fixed effects in column (2). Consistent with the previous results, we find that the treated firms see a decrease in outstanding debt in the post-exit period as compared to control firms. We then investigate whether this contraction in credit supply is partly mitigated by an increase in borrowing from non-banks. To do so, we compute the share of borrowing from non-banks in total borrowing of firm i in month t. We then estimate Eq. (1) using this share of non-bank borrowing as a dependent variable. The results are presented in columns (3)-(4) of Table 7. In line with the results so far and Figure 6, we find that treated firms have a higher share of non-bank borrowing as compared to control in the pre-exit period. In terms of magnitude, exit bank customers increase their share of borrowing from non-banks in

Table 6: New loan volumes by type of loan contract: non-bank substitution

	(1) Overdraft	(2) Asset finance	(3) Business loans	(4) Trade finance
Treated x Post x Nonbank	431.2**	2,258.4	16,428.6***	1,826.7
	(203.8)	(2,574.3)	(5,426.6)	(16,810.9)
Post x Nonbank	1,112.5***	1,430.1*	-6,151.2***	1,214.6
	(69.044)	(736.1)	(1,970.29)	(4,944.7)
Treated x Nonbank	-120.6	7,584.2***	-5,971.4*	20,402.5**
	(110.6)	(1,613.3)	(3,510.2)	(10,194.9)
Observations	126,798	126,798	126,798	126,798
R-squared	0.508	0.569	0.496	0.501
Firm x Month FE	Yes	Yes	Yes	Yes
Bank Type FE	Yes	Yes	Yes	Yes

The dependent variable is volume of new loans of firm i in month t. $Treated$ is a dummy equal to one if firm i had a credit relationship with the exit bank in the one year prior to the exit announcement. $Post_t$ is a dummy variable taking the value of 1 after 2020Q3 and zero prior to this date. Non-bank is a dummy variable equal to one for non-bank financial institutions. Robust standard errors in parentheses. ***,**,* represent significance at 1, 5 and 10% level, respectively.

total borrowing by about 3%, on average (given an increase of 0.05% in column (5) and average share of 17%).

We then turn to estimate the triple diff-in-diff model in Eq. 2 that will allow us to control for firm-time fixed effects to completely absorb from demand-side conditions. The results using the monthly debt volumes are presented in columns (1)-(2) of Table 8 using the two main fixed-effects identification strategies. The treatment effect in column (5) shows that treated firms borrow €29,000 more from non-banks as compared to banks in the post versus the pre-exit period. Columns (3)-(6) split the sample by types of credit contracts. We find the substitution towards non-bank borrowing is driven by business loans (column (3)) and less so by other types of credit such as asset finance, overdrafts and trade finance.

4.3 Heterogeneous treatment effects

We investigate next whether the effects uncovered differ across firms with different balance sheet characteristics. Specifically, we estimate Eq. (1) and (2) for different subsamples of firms based on their size, liquidity, and leverage. In Figures 8a and 8b,

Table 7: Outstanding monthly debt volumes and the share of nonbank lending

Dependent variable:	Outstanding debt volume		Share of nonbank lending	
	(1)	(2)	(3)	(4)
Post × Treated	-18,775.5***	-12,135.2***	0.003***	0.005***
	(3,538.7)	(4,687.1)	(0.001)	0.001)
Observations	7,858,420	4,008,702	7,858,420	4,008,702
R-squared	0.768	0.724	0.863	0.782
Mean of Y	116,253	116,253	0.17	0.17
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes		Yes	
Bank Type FE	Yes	Yes	Yes	Yes
Ind-loc-time FE		Yes		Yes

Table presents estimates of Eq. (2). The dependent variable is the total amount of debt outstanding of firm i in month t. $Treated$ is a dummy equal to one if firm i had a credit relationship with the exit bank in the one year prior to the exit announcement. $Post_t$ is a dummy variable taking the value of 1 after 2020Q3 and zero prior to this date. Nonbank is a dummy variable for equal 1 for non-bank financial institutions. Standard errors clustered at the firm level in parentheses ***,**,* represent significance at 1, 5 and 10% levels, respectively.

we show the coefficient estimate of β in Eq. (1) (figure a)) and Eq. (2) (figure b)), where the dependent variable is an indicator equal to 1 if the firm has received a new credit facility in a given quarter. All estimations control for firm and industry-location-quarter fixed effects. We split firms based on the median values of their total assets, leverage and liquidity (measured as the ratio of current assets to current liabilities) at the end of December 2019 and present the β coefficient for each sub-sample.

The figure shows sizable differences across the two groups (see also Appendix Table 12). Notable, smaller, more leveraged and less liquid firms see a large contraction in credit supply in the post-exit period (the coefficient estimate is around 25-30% larger in magnitude for this group). The substitution towards non-banks also seems more pronounced in this group, as across all estimations, smaller firms, those with higher leverage and less liquidity, appear to have a higher probability of obtaining credit from non-banks in the post- versus the pre-exit period.

Table 8: Outstanding monthly debt volumes: by contract types

Dependent variable	Overall debt		Business loans	Asset Finance	Overdraft	Trade finance
	(1)	(2)	(3)	(4)	(5)	(6)
Post × Treated × Nonbank	14,070.9***	28,995.8*	392,627.3***	-7,063.2	-2,597.4	-12,349.7
	(5,044.0)	(15,826.5)	(72,618.1)	(9,905.2)	(5,247.8)	(329,517.5)
Post × Treated	-15,954.0***					
	(2,953.1)					
Post × Nonbank	-4,508.3***	-5,428.0	-8,103.5	-1,694.7	1,560.5**	68,880.7
	(1,455.5)	(3,346.9)	(18,433.9)	(3,133.1)	(727.4)	(95,769.2)
Treated × Nonbank	-148,197.4***	-103,555.8***	-325,841.2***	-66,934.7***	-1,036.0	543,042.4**
	(4,329.3)	(10,943.7)	(55,187.7)	(7,271.3)	(4,613.3)	(263,927.0)
Observations	4,008,702	1,990,020	86,628	180,354	47,730	1,364
R-squared	0.724	0.573	0.788	0.710	0.539	0.776
Mean of Y	116,253	159,827	561,756	58,574	10,969	1,123,000
Firm FE	Yes					
Time FE	Yes					
Bank Type FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm x Month FE		Yes	Yes	Yes	Yes	Yes

Table presents estimates of Eq. (2). The dependent variable is the total amount of debt outstanding of firm i in month t. $Treat_i$ is a dummy equal to one if firm i had a credit relationship with the exit bank in the one year prior to the exit announcement. $Post_t$ is a dummy variable taking the value of 1 after September 2020 and zero prior to this date. Nonbank is a dummy variable for equal 1 for non-bank financial institutions. Standard errors clustered at the firm level in parentheses ***,**,* represent significance at 1, 5 and 10% levels, respectively.

5 Conclusion

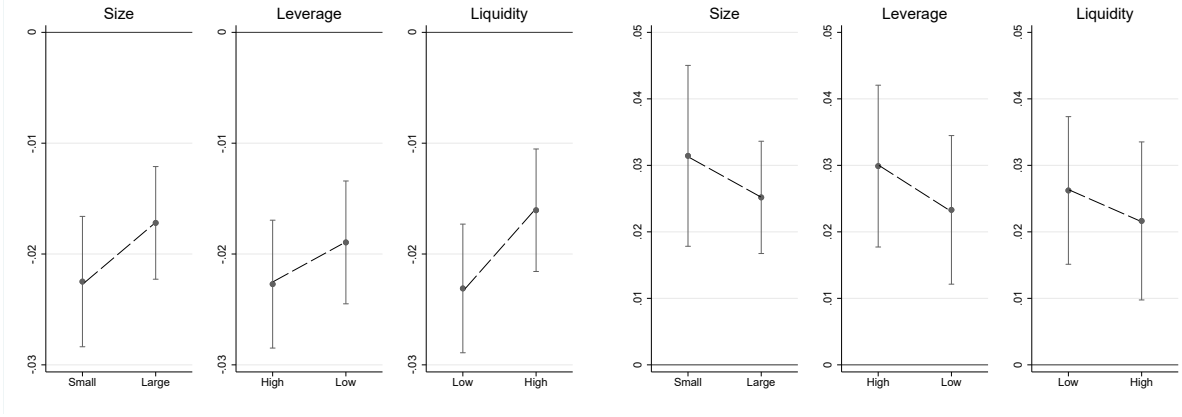
We study the impact of a major bank exit from the Irish business credit market on firms' access to credit. Our setting exploits the unexpected announcement in 2020 that the parent of Ireland's third-largest retail bank was considering plans to withdraw from the Irish market. We study the effects of this announcement using matched lender-firm loan data from the Central Bank of Ireland's Central Credit Register (CCR). These data uniquely cover both bank and non-bank lenders, allowing us to trace out the implications of the credit supply shock across the entire population of Irish businesses, as well as, the whole universe of credit providers, rather than banks alone, which are the focus of studies using credit registry data in other jurisdictions.

We find that borrowers of the exiting bank are less likely to receive new credit following the exit announcement, indicating that the exit of a lending bank does represent a negative credit supply shock for its borrowers. We also find evidence, however, of a substitution effect whereby non-bank lenders increased their lending to treated firms and partially mitigated the impact of the credit supply shock. Unlike other papers that rely on measures of bank-level exposure to various shocks and crisis events, in our study, we directly identify affected borrowers through their pre-exit

Figure 8: Heterogeneous treatment effects

(a) Likelihood of obtaining a new credit

(b) Non-bank substitution



The figure shows the coefficient estimate of β in Eq. (1) (Figure a)) and Eq. (2) (Figure b)), for different subsamples of firms based on their size (measured as the log of Total assets), leverage and liquidity (measured as the ratio of current assets to current liabilities). The subsamples are based on the median values of these balance sheet characteristics (see also Table 12).

relationships with Ulster Bank, the lender announcing its exit from the Irish market in 2020.

Using borrower balance sheet characteristics, we uncover heterogeneity that is consistent with previous literature. Smaller, more leveraged, and less liquid businesses are both more likely to experience a negative credit supply shock as a result of the exit, as well as being more likely to borrow from non-bank lenders in response to the shock.

Our results complement the recent findings of Gopal and Schnabl (2022) that non-bank lenders played a key role in supporting business credit supply in the post-GFC era of banking retrenchment in the United States. In our case, we do not rely on variation at county or regional level to identify the source of bank retrenchment: rather, we can directly trace out the transmission of a credit supply shock on the borrowers of the exiting bank, creating control groups of similar firms borrowing from other lenders, and observing differential paths for non-bank borrowing after the shock. Importantly, our paper also confirms the findings of a large previous literature: in spite of the mitigating role of non-bank lenders, the overall effect of Ulster Bank's exit is still negative, in that its borrowers struggled more than others to access new credit, pointing to the value inherent in banking relationships.

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A Additional results

Table 9: Poisson pseudo-maximum likelihood regression

	(1)	(2)	(3)	(4)
Post × Treated	-0.218***	-0.244***	-0.4***	
	(0.046)	(0.051)	(0.062)	
Post × Nonbank			-0.1***	0.0
			(0.044)	(0.089)
Treated × Nonbank			-1.5***	-0.4***
			(0.103)	(0.155)
Post × Treated × Nonbank			0.5***	0.4**
			(0.104)	(0.172)
Observations	1,389,671	786,060	786,109	121,136
Firm FE	Yes	Yes	Yes	
Time FE	Yes			
Industry-Location-Time FE		Yes	Yes	
Firm X Time FE				Yes

The table presents Poisson pseudo-maximum likelihood regression estimates of Eq. (1). The dependent variable is the loan volume or credit limit of new debt received in a given quarter by a firm. $Treated$ is a dummy equal to one if firm i had a credit relationship with the exit bank in the one year prior to the exit announcement. $Post_t$ is a dummy variable taking the value of 1 after September 2020 and zero prior to this date. Robust standard errors in parenthesis. ***,**,* represent significance at 1, 5 and 10% levels, respectively.

Table 10: Entropy balancing

Dependent variable	$\mathbb{1}\{\text{New debt} > 0\}$ (1)	Volume (2)	$\mathbb{1}\{\text{New debt} > 0\}$ (3)	Volume (4)
Post $\times$ Treated	-0.016***	-5,771.266***	-0.015***	-6,940.655***
	(0.002)	(1,194.084)	(0.002)	(1,143.706)
Post $\times$ Treated $\times$Nonbank			0.018***	21,669.663***
			(0.004)	(8,273.569)
Post $\times$ Nonbank			0.006***	-9,279.351***
			(0.001)	(2,727.230)
Treated $\times$ Nonbank			-0.082***	-23,975.424***
			(0.005)	(5,996.556)
Observations	1,003,043	1,003,043	1,003,043	1,003,043
R-squared	0.181	0.208	0.486	0.216
Firm FE	Yes	Yes	Yes	Yes
Industry-Location-Time FE	Yes	Yes	Yes	Yes

The table presents OLS estimates of Eq. (1) using the entropy balancing algorithm in Hainmueller (2012), where treated and control groups are re-weighted to achieve a balanced sample in terms of total assets. The dependent variable in columns (1)-(2) is an indicator variable equal to one if firm i receives a new debt contract in a given quarter, while in columns (3)-(4) it is the loan volume or credit limit of new debt received in a given quarter. $Treated$ is a dummy equal to one if firm i had a credit relationship with the exit bank in the one year prior to the exit announcement. $Post$ is a dummy variable taking the value of 1 after 220Q3 and zero prior to this date. Standard errors clustered at the firm level in parenthesis. ***,**,* represent significance at 1, 5 and 10% levels, respectively.

Table 11: Alternative exit definition

Dependent variable:	$\mathbb{1}\{\text{New debt} > 0\}$		New debt volume	
	(1)	(2)	(3)	(4)
Treated $\times$ $Post_2$	-0.035***	-0.028***	-4,312.3***	-3,976.3***
	(0.002)	(0.002)	(852.153)	(1,099.100)
Observations	2,512,577	1,519,893	2,512,577	1,519,893
R-squared	0.094	0.115	0.117	0.132
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes		Yes	
Industry-Location-Time FE		Yes		Yes

The table presents OLS estimates of Eq. (1). The dependent variable in columns (1)-(2) is an indicator variable equal to one if firm i receives a new debt contract in a given quarter, while in columns (3)-(4) it is the loan volume or credit limit of new debt received in a given quarter. $Treated$ is a dummy equal to one if firm i had a credit relationship with the exit bank in the one year prior to the exit announcement. $Post_2$ is a dummy variable taking the value of 1 after January 2021 and zero prior to this date. Standard errors clustered at the firm level in parenthesis. ***,**,* represent significance at 1, 5 and 10% levels, respectively.

Table 12: Heterogeneous Treatment effects

Dependent variable:	(1) Small	(2) Large	(3) High Leverage	(4) Low Leverage	(5) Low Liquidity	(6) High Liquidity
Panel A: Credit supply shock						
Treated × Post	-0.022***	-0.017***	-0.023***	-0.019***	-0.023***	-0.016***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	684,571	648,542	673,861	655,403	661,048	647,232
R-squared	0.094	0.164	0.150	0.161	0.158	0.155
Panel B: Non bank substitution						
Treated × Post × Nonbank	0.031***	0.025***	0.030***	0.023***	0.026***	0.022***
	(0.007)	(0.004)	(0.006)	(0.006)	(0.006)	(0.006)
Treated × Post	-0.021***	-0.019***	-0.021***	-0.019***	-0.022***	-0.015***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)
Post × Nonbank	0.009***	-0.002	0.011***	-0.001	0.011***	-0.001
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Treated × Nonbank	-0.043***	-0.084***	-0.094***	-0.086***	-0.097***	-0.082***
	(0.005)	(0.006)	(0.008)	(0.007)	(0.007)	(0.007)
Observations	684,571	648,542	673,861	655,403	661,048	647,232
R-squared	0.432	0.501	0.481	0.487	0.486	0.482
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Location-Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank type FE	Yes	Yes	Yes	Yes	Yes	Yes

Table presents estimates of Eq. (1) (Panel A) and Eq. (2) (Panel B) . The dependent variable is a dummy equal to 1 if firm i receives a new debt contract in a given quarter. $Treated$ is a dummy equal to one if firm i had a credit relationship with the exit bank in the one year prior to the exit announcement. $Post$ is a dummy variable taking the value of 1 after 2020Q3 and zero prior to this date. Standard errors clustered at the firm level in parentheses. ***,**,* represent significance at 1, 5 and 10% level, respectively.

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