The Allocative Effects of Banks' Funding Costs*

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Abstract

In this paper, we document when and how banks adjust their credit supply in response to variations in their funding costs. Using administrative credit-registry and regulatory bank data, we find that higher funding costs lead banks to contract their lending, but they can absorb an increase of up to 21 basis points before doing so. For identification, we exploit the existence of regulated-deposit accounts in France whose interest rates are set by the government. To counterbalance adverse effects on their profits, banks shift their portfolios toward higher-yielding loans when their funding costs increase. Banks' portfolio rebalancing toward smaller, and potentially riskier, firms has repercussions for the economy by altering credit allocation at the more aggregate city level and affecting firms' investment behavior therein.

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1 Introduction

How banks' funding costs affect their behavior and are transmitted to the real economy is at the core of policy debates on the financial system, ranging from the anticipated effects of monetary policy to microprudential and macroprudential regulations of financial intermediaries.[1] While of central importance, providing a clean and reliable estimate of the elasticity between banks' funding costs and their credit supply and loan-portfolio composition remains a major challenge, for at least two reasons. First, banks' actual cost of funding is hard to observe due to a lack of disaggregate data.[2] Second, banks jointly optimize their liabilities and assets, so identifying an exogenous change in funding costs that does not directly affect banks' net worth, the level of their liabilities, or the profitability of their potential investments is difficult.

This paper quantifies the pass-through of banks' funding costs to the quantity and composition of bank credit supply. To do so, we use rich administrative data that cover the near universe of bank loans, information on banks' funding structure and a detailed breakdown of sources of deposits, and their borrowers' balance sheets over the period 2010–2015 in France.

For identification, we exploit the existence of regulated-deposit accounts offered to households in France. Unlike regular savings accounts, the rate on regulated deposits is neither determined by the banks themselves nor directly dependent on the monetary-policy rate but is, instead, set by the government up to twice per year and is mostly driven by political considerations rather than macroeconomic forces. These politically rooted shifts in the cost of regulated deposits provide us with a source of plausibly exogenous variation in banks' funding costs. As we observe the rate on regulated deposits, we can determine the difference in funding costs for regulated-deposit dependent banks as compared to otherwise-funded banks. We then trace out the effects of these exogenous shifts in bank funding costs at dif-

[1] For instance, the transmission of monetary policy to the real sector and its effectiveness depend on the pass-through to banks' funding costs (Gertler and Kiyotaki, 2010). More generally, banks' cost of capital can affect the quantity and quality of credit supply in response to both microprudential (Repullo and Suarez, 2013; Begenau, 2020) and macroprudential regulations (Jiménez, Ongena, Peydró, and Saurina, 2017).

[2] A notable exception is Cassola, Hortaçsu, and Kastl (2013), based on banks' bidding behavior in the European Central Bank's weekly refinancing operations during the 2007 crisis.

ferent levels of aggregation: at the bank-firm level, at the firm level, and at the local lending market level.

Our measure of exposure to an exogenous shift in funding costs exploits differences in the *composition* of bank liabilities, i.e., the extent to which banks rely on regulated deposits, as opposed to regular deposits or the interbank market, for their funding. This enables us to control for confounding effects that may be due to differences in the *level* of bank liabilities and net worth, which ensures that we estimate the direct effect of a change in the cost of funding, net of any change in total liabilities (e.g., change in deposits as in Drechsler, Savov, and Schnabl, 2017) that would directly affect bank lending.

Our first set of results studies how banks' credit supply responds to variations in funding costs. Using granular data at the bank-firm-time level allows us to implement a standard within-firm estimator (Khwaja and Mian, 2008) to net out any changes in firms' credit demand that might be correlated with changes in banks' funding costs. We find that banks contract their lending by 17% when they incur a one-percentage-point increase in their cost of funding, which implies an elasticity of -0.25. However, this average estimate masks large nonlinearities. We exploit the large fluctuations in the difference in funding costs during our sample period to estimate the curvature of banks' credit supply nonparametrically. We find that the relationship between banks' credit supply and their funding costs is highly nonlinear: banks can sustain up to 21 basis points higher funding costs until they start contracting their lending.

While we control for many time-varying elements of banks' balance sheets, we cannot, by definition, account for time-varying *unobserved* heterogeneity across banks. We address the possibility that unobserved bank-level characteristics may be correlated with changes in the cost of regulated-deposit funding in several ways. First, we exploit the fact that variation across banks in their reliance on regulated deposits is driven by differences in regulatory obligations rather than their endogenous decisions on their liability structure. Second, we include a battery of additional high-dimensional fixed effects such as banks' county by time and banking group (BHC) by time fixed effects, and find quantitatively similar results. County by time fixed effects ensure that we only exploit variation across banks bank *branches*in the same county, so that lending decisions cannot be affected by differences in local market power or business cycles. The inclusion of BHC by time fixed effects, in turn, implies that we use variation across banks belonging to the same group, thereby netting out any differences in top-management styles and ability, or broader funding shocks such as a run on the wholesale funding market. Third, our results are invariant to comparing regulated-deposit dependent banks with banks funded by regular deposits or interbank loans.

Having shown that funding costs matter for the supply of credit, we then turn to exploring how this elasticity varies across banks. We find that higher funding costs depress bank lending by more for weakly capitalized banks. This points to an amplification of the sensitivity of banks' credit supply to their funding costs stemming from their net worth, in line with a nonlinear relationship between banks' credit supply and their funding costs. Furthermore, banks with a larger share of non-performing loans extend their credit supply in response to higher funding costs, potentially reflecting gambling for resurrection.

Our second set of results examines whether banks rebalance their loan portfolios across borrowers and loan characteristics in an effort to shield their profits from funding-cost fluctuations. When facing higher cost of funding, exposed banks engage in greater risk taking and shift their portfolios toward higher-yielding loans by increasing the average maturity of their loans and their exposure to riskier firms, such as smaller firms or firms operating in industries with higher bankruptcy risk.

Our credit results rely on within-borrower, between-bank comparisons. While enabling us to cleanly identify credit-supply shocks by holding constant credit demand, this does not allow us to assess the potential importance of these credit fluctuations for the economy at large, as borrowers could redirect their credit demand towards unaffected banks (e.g., Greenstone, Max, and Nguyen, 2020) or seek other sources of financing (e.g., Crouzet and Mehrotra, 2020).

We address the first issue by implementing a "local lending market" approach, where we aggregate total credit provided at the city level. We find that even at this broader level of aggregation, cities with a higher fraction of firms in relationships with banks dependent on regulated deposits experience changes in total credit supply and in credit composition following variations in funding costs that are similar in magnitude as our results at the bank-firm level. This implies that unaffected banks are not able to pick up the unserved credit demand when banks reliant on regulated deposits experience higher funding costs. To address the second issue, we aggregate credit-supply shocks at the firm level, and estimate their real effects. We find that firms more exposed to regulated-deposit dependent banks become smaller in terms of their tangible assets and stock of total capital assets when the relative cost of regulated deposits increases.

Our institutional setting provides us with a clean measure of the funding costs of regulated-deposit dependent banks to estimate how exogenous variations in the cost of funding affect both the quantity and the quality of credit. We view our setting as appealing for multiple reasons. First, our source of variation in banks' funding costs stems from the composition, rather than level, of (deposit) liabilities. This enables us to study banks' reactions to exogenous variations in their funding costs, holding constant their net worth and level of liabilities. Second, the use of credit-registry data enables us to hold constant banks' investment opportunities, so we can identify banks' credit supply. Third, we observe virtually all banks and firms in the economy, with sizable treatment and control groups. In this manner, we can elucidate how banks- and firm-level heterogeneity shape the magnitude of the funding-cost pass-through to the real economy, and to quantify the importance of a potential "reallocation channel." Finally, while the literature typically has to rely on one-time shocks—e.g., the liquidity drought in the interbank market in 2007/8 (e.g., Iyer, Peydró, da Rocha-Lopes, and Schoar, 2013; Cingano, Manaresi, and Sette, 2016)—we have both large and frequent variations in banks' cost of funding, allowing us to estimate nonlinear effects and banks' credit-supply curve.

Our paper estimates the elasticity of banks' credit supply with respect to their funding costs. As such, it contributes to a large literature that pins down banks' credit supply (e.g., Khwaja and Mian, 2008; Paravisini, 2008; Becker and Ivashina, 2014; Darmouni, 2020), and that examines the real economic consequences of banks' credit allocation (e.g., Chodorow-Reich, 2014; Cingano, Manaresi, and Sette, 2016; Neuhann and Saidi, 2018).

As we use the pass-through of the monetary-policy rate to approximate the cost of funding of banks that do not rely on regulated deposits, our analysis is linked to the rich literature on the transmission of monetary policy through banks' balance sheets. Theoretically, almost all models in this literature consider that monetary policy affects bank behavior through its effect on bank profits and ultimately net worth, which determines banks' overall cost of funding due to the existence of asymmetric information that creates collateral constraints (e.g., Gertler and Kiyotaki, 2010; Martinez-Miera and Repullo, 2017; Zentefis, 2020). These models have been tested empirically, in papers showing that the cross-section of banks' balance sheets or their net worth matters for the quantity of bank lending (Kashyap and Stein, 2000; Kishan and Opiela, 2000; Jiménez, Ongena, Peydró, and Saurina, 2012) and its quality in terms of risk taking (Jiménez, Ongena, Peydró, and Saurina, 2014; Ioannidou, Ongena, and Peydró, 2015; Dell'Ariccia, Laeven, and Suarez, 2017; Paligorova and Santos, 2017) or overall portfolio yields (Hanson and Stein, 2015).

We contribute to this literature by showing that in contrast to the class of models with bank net worth as the prime determinant of the transmission of monetary policy, changes in banks' funding costs can have a *direct* effect on credit supply, irrespective of their ultimate effect on bank net worth. Note that while we hold constant bank net worth by exploiting the composition, rather than the level, of liabilities, this does *not* imply that net worth does not matter. On the contrary, the fact that we find a nonlinear effect of banks' funding costs on their credit supply is consistent with an additional feedback effect stemming from depressed bank net worth as a result of higher funding costs. The existence of these direct and indirect effects implies that the cross-section of banks is important for estimating the average pass-through of a change in funding costs on the economy.

This also helps clarify our contribution relative to Drechsler, Savov, and Schnabl (2017), where banks increase the spreads they charge on deposits in concentrated markets if the monetary-policy rate increases. This, in turn, leads to a credit contraction as deposits flow out of the system.[3] By comparing the supply of credit by banks with a different composition of liabilities, holding constant their total liabilities and investment opportunities on the asset side (through the inclusion of firm-time fixed effects), we can cleanly measure the pass-through of the *price* of deposit funding and disentangle it from a change in its *quantity*.

Our source of variation in banks' funding costs stems from differential pass-through of monetary-policy to regulated-deposit rates vs. rates on all other deposits and market-based funding. As such, our paper naturally relates to studies that document if and how monetary policy is transmitted to deposit rates (Hannan and Berger, 1991; Driscoll and Judson, 2013), which has been at the center of theories of monetary-policy transmission.[4] A growing body of work argues that if monetary policy affects the supply of deposits or the cost thereof, cross-sectional heterogeneity in banks' funding structure matters for the transmission of monetary policy. This has been shown to be the case when there is imperfect pass-through of monetary policy to deposit rates, either as a result of imperfect competition for deposits (Drechsler, Savov, and Schnabl, 2017; Balloch and Koby, 2020) or due to a zero lower bound on deposit rates in spite of negative monetary-policy rates (Heider, Saidi, and Schepens, 2019; Bubeck, Maddaloni, and Peydró, 2020; Eggertsson, Juelsrud, Summers, and Wold, 2020).

In a similar vein, Wang, Whited, Wu, and Xiao (2021) present a structural model to quantify the importance of bank market power for the pass-through of monetary policy to borrowers. In this manner, they uncover an interaction between banks' market power and their capitalization, which can lead to a contraction in bank lending when monetary-policy rates are low and drop further. Furthermore, Gomez, Landier, Sraer, and Thesmar (2021) show that when the interest rate sensitivity of a bank's asset side surpasses that of its liabilities side, contractionary monetary policy does not depress bank lending as much due

[3] On the other hand, Li, Loutskina, and Strahan (2019) show that when banks raise deposits in concentrated markets, this reduces the funding risk of originating long-term illiquid loans, leading to an increase in the average maturity of newly granted loans.

[4] Seminal models such as Bernanke and Blinder (1988), Kashyap and Stein (1994), or Bernanke and Gertler (1995) consider that monetary policy affects the real economy by changing banks' cost of deposits, which has since then been contested by New Keynesian models arguing that the vast financial deregulation and innovation of the 1980s and 1990s as well as the emergence of a "market-based financial system" made this old channel irrelevant (e.g., Woodford, 2010).

to an offsetting effect owing to higher earnings on the asset side. However, deposit rates are ultimately set by banks themselves. Our paper identifies instances of sticky deposit rates that are not due to banks' price-setting behavior, so we can use them as a plausibly exogenous source of variation in banks' funding costs to explain their lending behavior.

By the same token, our paper also sheds light on the potential mechanism through which capital requirements affect bank lending and risk taking. As argued by, among others, Bahaj and Malherbe (2020), in the face of higher capital requirements, banks substitute subsidized deposits with capital. This, in turn, increases banks' cost of capital (Kisin and Manela, 2016), which should lead to less lending. On the other hand, better capitalization induces banks to internalize more of the potential social costs of credit defaults (i.e., they have more "skin in the game"), which should mitigate bank risk taking. We show in general terms that higher cost of funding, without altering the ratio of equity to assets, leads to less lending and more risk taking.

Finally, we assemble data to cover a wide range of asset-side (lending) activities of French banks so as to match the source heterogeneity of bank funding. This enables us to assess the effects on banks' credit supply to large and small firms alike, and self-employed individuals. We do not only characterize the effect of funding-cost shocks on bank lending, but we can also characterize any allocative effects stemming from these bank lending decisions. This opens up the possibility that variations in banks' funding costs can affect the economy above and beyond any effects stemming from funding cost-driven changes in credit supply. Indeed, even in the best case where banks are perfectly able to insulate their profits from changes in the cost of funding by rebalancing their portfolios, this asset-side response can in and of itself affect the aggregate economy if the reallocation of capital, holding constant its total volume, matters for aggregate output (e.g., Baqaee, Farhi, and Sangani, 2021). As such, our paper contributes to a growing literature that analyzes the heterogenous effects of financial shocks, typically confined to monetary policy, on firms (Ottonello and Winberry, 2020) and households (McKay, Nakamura, and Steinsson, 2016; Kaplan, Moll, and Violante, 2018; Auclert, 2019; Gornemann, Kuester, and Nakajima, 2019; Wong, 2019).

2 Background and Empirical Strategy

2.1 Deposit Accounts in France

French households channel €950bn into short-term savings accounts. Three-quarters are stored in regulated-deposit accounts. As they are risk-free, tax-free, highly liquid, and have a very low entry threshold (minimum deposits of €15), these accounts are the most popular savings scheme for medium- and low-income households subject to income tax. Most importantly, regulated deposits pay interest at a rate set by the government that banks cannot adjust.

2.1.1 Livret A and Regulated Deposits

The most common regulated-deposit account is called "livret A," a fully liquid, guaranteed, tax-free savings instrument that can be opened by any individual or non-profit organization. It was established in 1818 to pay back the debts incurred during the Napoleonic wars, and was originally marketed by three "incumbent" banks (Banque Postale, Caisses d'Epargne et de Prévoyance, and Crédit Mutuel). The Law of Modernization of the Economy of 2008 extended the right to offer livret-A accounts to all French credit institutions (including "new banks"), starting January 1, 2009. In spite of the rates being set by the government, French banks widely offer such accounts because French depositors tend to max out on regulated deposits before demanding any regular savings products and possibly other products, such as mortgages.

Given the popularity of livret-A accounts, the government has imposed a cap, often binding for middle-income households, on how much money can be saved in this form. Individuals can only hold a single livret A, and deposits cannot exceed €22,950 for individuals (not including the capitalization of interests) or €76,500 for non-profit legal entities.[5] Regulated

[5] After the financial crisis and the European sovereign debt crisis, this product was so popular that the government increased the maximum amount by 50%, in two stages, from €15,300 to €19,125 and €22,950 euros in October 2012 and January 2013, respectively.

deposits include livret A, which represent one-third of such deposits, as well as other types of savings accounts for which the rates are pegged to the livret-A rate. The rate is the same as, or above, the livret-A rate for most of these deposits (LDD, Livret Jeunes, LEP, PEL), and is equal to two-thirds of the livret-A rate for one type of deposit account (CEL). As the proportion of CEL accounts is only 5%, it is safe to assume that the overall rate paid out on regulated deposits exceeds the livret-A rate.

The livret-A rate is set by the government. It is calculated by the French Central Bank twice a year, on January 15 and July 15, and becomes effective on February 1 and August 1, respectively.[6] The government can deviate from this revision procedure, and has the discretion to decide a new rate. This has been very common in practice.[7]

Thus, unlike rates on ordinary savings accounts or interbank funding, the rate on regulated deposits does not track the monetary-policy rate and fluctuates for reasons independent of it. In Figure 1, we plot the time-series variation in the difference between the livret-A rate and the European Central Bank's main policy rate, the deposit facility rate. For instance, from 2010 to 2013, the ECB's monetary policy is both contractionary and expansionary, whereas the difference between the livret-A and the deposit facility rate tends to increase over the same time period. The correlation between said difference and the actual monetary policy (measured at the quarterly level, as in our regressions) during this period is -0.22.

[6] Over our sample period from 2010 to 2015, the formula for the rate of the livret A corresponds to whichever is the higher of: (a) the sum of the monthly average three-month Euribor rate and the monthly average euro overnight index average (Eonia) rate divided by four, plus the French inflation rate, as measured by the percentage change over the latest available 12 months of the consumer price index, divided by two; or (b) the French inflation rate, as measured by the percentage change over the latest available 12 months of the consumer price index, plus 0.25%.

[7] For instance, on February 1, 2012, the government under François Fillon decided to maintain the rate at 2.25%, although the inflation rate would have prompted an increase in the livret-A rate to 2.75%. On February 1, 2013, the Minister of the Economy at the time, Pierre Moscovici, lowered the livret-A rate only to 1.75% when the strict application of the formula would have implied a greater drop, to 1.5%. Similarly, on August 1, 2013, the livret-A rate was reduced to 1.25% instead of 1%. And on February 1, 2014, although the Governor of the French Central Bank recommended lowering the rate to 1%, and the formula actually implied lowering it further to 0.75%, the Minister decided to keep the livret-A rate at 1.25%.

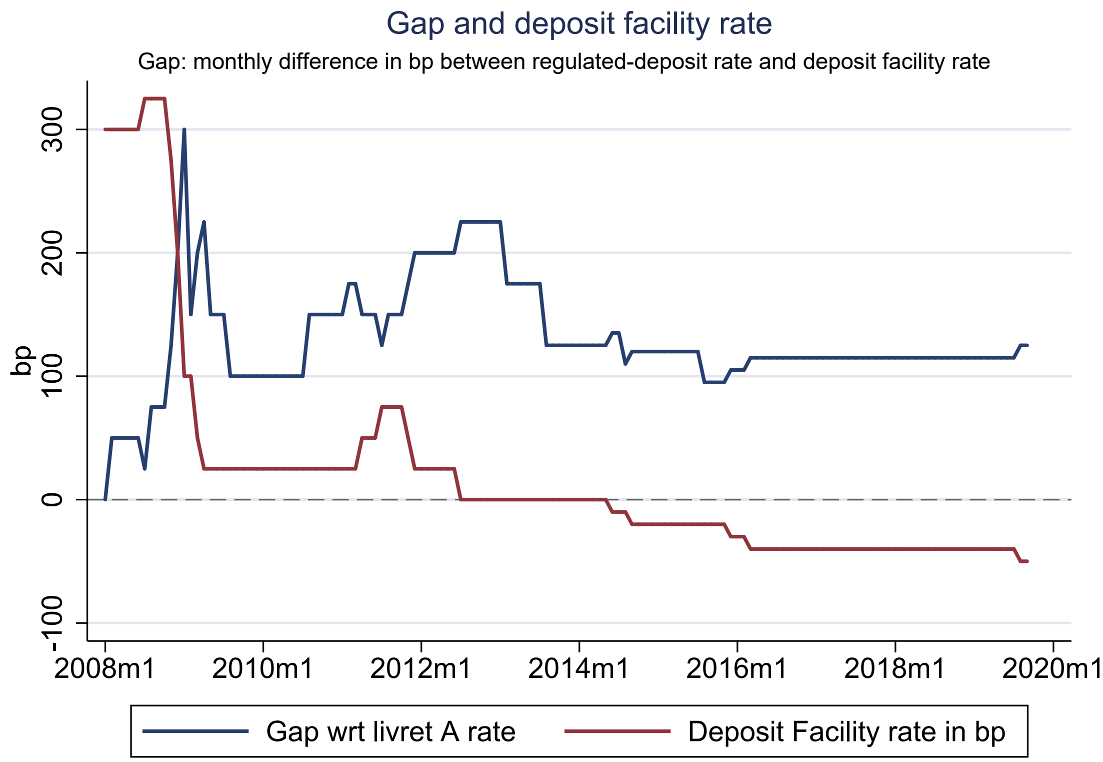


Figure 1: **Changes in Funding-cost Gap.** This figure shows the evolution of the ECB's deposit facility rate and the gap between the livret-A rate and the latter from 2008 to 2019.

2.1.2 Implications for Banks' Funding Cost

As changes in the rate on regulated deposits are best thought of as politically determined, they constitute plausibly exogenous shocks to the cost of funding for banks that rely on them. To measure variation in banks' funding costs, we decompose banks' liabilities into regulated deposits and all other sources of funding, such as regular deposits (from both households and non-financial corporations) or interbank funding. The difference in funding costs for a bank dependent on regulated deposits relative to otherwise-funded banks is a function of the rate paid, which varies due to politically-driven motives that are exogenous to bank behavior and macroeconomic fluctuations, multiplied by the amount of regulated deposits in the bank's liabilities.

The amount of regulated deposits can be considered as mostly exogenous as well. Banks do not bear the full cost of paying interest on regulated deposits as they only keep a fraction of those on their balance sheets. Indeed, approximately 60% of the collected savings are rechanneled to a special fund operated by a state-owned financial institution, the Caisse des Dépôts et Consignations (CDC). The primary use of these funds is the financing of social housing (since 1945). Only a subset of regulated deposits is rechanneled to the CDC. We refer to them as eligible deposits, of which livret A account for 85% (the remaining accounts are LDD and LEP). Banks keep 100% of all other types of regulated deposits.[8]

The share of eligible funds that have to be transferred to the CDC is set by law, and varies across banks and over time. This share used to be substantially higher initially for the three historical (incumbent) banks, and is enforced to converge to a single rate of 60% for all banks by 2022.[9] Table 1 summarizes the evolution of the percentages of deposits rechanneled to the CDC over time. In our empirical strategy, we use the net amount of all regulated deposits, after transfers, to measure the actual amount of deposits banks have to remunerate. We stop the sample period before 2016 as after July 2016, banks were offered the possibility to channel all their regulated deposits to the CDC.[10]

This regulation provides us with plausibly exogenous variation in banks' de-facto reliance on regulated deposits. This implies that banks can adjust neither the price nor the quantity of regulated deposits on their balance sheets. Besides regulated deposits, banks fund themselves by issuing other deposits or through the interbank market. Compared to the livret-A rate, the rates on these alternative funding sources are significantly more aligned with the monetary-policy rate: retail deposit rates exhibit primarily upward, but not downward, stickiness (Hannan and Berger, 1991), and interbank rates still track the monetary-policy rate in the euro area relatively well despite higher post-crisis liquidity and counterparty risk (e.g., Illes and Lombardi, 2013; Heider, Saidi, and Schepens, 2019).

As France is part of the euro area, monetary-policy rates are set by the European Central Bank (ECB), an independent central bank which attempts to maximize outcomes across

[8] There are also some limitations on how livret-A deposits can be used. Banks have the legal obligation to devote at least 80% of the deposits to SME lending. In practice, this obligation has never been binding as the ratio of outstanding amounts of credit to SMEs to livret-A deposits has been fluctuating between 210% and 250% over the period 2010–2015.

[9] The initial target T_{bt} was 65%, and it has been revised to 60% in 2013. In exchange for collecting livret-A funds, the CDC pays banks an intermediary commission, which is proportional to the total amount of deposits collected.

[10] This has been revoked in early 2018, and the rate of 60% has been reinforced since then.

multiple countries facing different macroeconomic situations. As such, movements in the ECB's main policy rate are arguably more exogenous to the French macroeconomic condition.[11] The typically strong pass-through of the monetary-policy rate to regular deposit and interbank rates allows us to approximate the costs for the portion of banks' funding that does not come from regulated deposits. As our sample ends in 2015, this precludes any confounding effects with other measures undertaken by the ECB in more recent years, such as their asset-purchase programs.

Rates on regulated-deposit accounts cannot be adjusted by banks. Therefore, the gap between the monetary-policy rate and the livret-A rate determines whether regulated deposits are a cheap or an expensive source of funding. When the monetary-policy rate is lower than the rate on the livret A, banks have to pay more for regulated deposits than what they can recoup on their asset side. Therefore, banks that rely on regulated deposits incur higher cost of funding than banks whose cost of funding is more aligned with the monetary-policy rate, e.g., interbank-funded banks.

2.2 Data Description

The sample we use results from merging the French national credit register (CCR) with two banking databases on deposits, the Surfi database from the French prudential authority (ACPR) and the Cefit database from Banque de France (BdF). From the near universe of all French firms, we drop those belonging to the financial sector and to public administrations, and only keep firms with standard legal forms (i.e., we drop unions, parishes, cooperatives, etc.).

Credit register. Our main data source is the French national Central Credit Register administered by the Banque de France. The dataset contains monthly information on outstanding amount of credit at the firm-branch level, granted by all credit institutions to all non-financial firms based in France, provided the total exposure (i.e., the sum of all credit

[11] The fact that rates on regulated deposits and monetary-policy rates are not set by the same institution therefore alleviates the classic concern of reverse causality between macroeconomically driven outcomes in the credit market and changes in monetary policy (see, for instance, Maddaloni and Peydró, 2011).

of any kind) of a bank to a firm exceeds €25,000. Credit is broken down by initial maturity (above and below one year).

We use data from January 2010 to December 2015 for our analysis. Our sample comprises 220 distinct banks, each of which has on average 651 branches (which can be located in the same city), whereas the median bank has only 267 branches. For each firm, we aggregate credit across all of a given bank's branches in a given county to the bank-county level.[12] We aggregate the monthly dataset at the quarterly level to merge it with deposit data available at that frequency. The level of observation in our final dataset is the firm-bank-county-quarter level $fbct$, summarizing information on the lending relationship between firm f and bank b's branch(es) in county c ("département") in quarter t.

Deposit data. Deposit data come from two different sources that provide complementary information at different levels of aggregation. The most important source of deposit data is regulatory data (Surfi), maintained by the French prudential authority (ACPR). The data are available at the quarterly level for all banks operating in France. The dataset includes deposit amounts, aggregated at the bank level b, and broken down by types of deposits (regulated vs. others) and depositors (firms, households, non-profit organizations, insurance companies and pension funds, administrations).

We adjust our deposit ratios so as to take into account the net amount of eligible deposits, i.e., after rechanneling to the CDC, in the following way. Let T_{bt} be the percentage of deposits bank b has to rechannel to the CDC in year t, then: $\textit{Net eligible deposits}_{bt} = \textit{Eligible regulated deposits}_{bt} \times (1 - T_{bt})$. T_{bt} varies over time and across banks, based on whether banks used to be distributing livret-A accounts prior to the reform of 2008 (incumbent banks) or whether they were authorized to offer livret-A accounts after 2008 only (new banks). T_{bt} is set by law so as to converge to 60% for banks in both groups by 2022.

We use the average observed percentage of funds being transferred by banks in both

[12] We use the definition of a French "département," which partitions the country into 100 counties. As fewer than 1% of the firms in our sample are banking with multiple branches within the same bank-county cluster, the firm-bank-county level is effectively the same as the firm-bank-branch level.

groups at the end of a calendar year t to define T_{bt}, i.e., we use one percentage for new banks and another one for all incumbent banks but one.[13] Finally, we define the regulated-deposit ratio of bank b in quarter t as follows:

$\textit{Deposit ratio}_{bt} = (\textit{Non-eligible deposits}_{bt} + \textit{Net eligible deposits}_{bt})/\textit{Total liabilities}_{bt}$. The data are available from Q4 2010 to Q4 2015.

Firm balance-sheet data and credit ratings. Firm accounting data come from the FIBEN dataset of the Banque de France, and consist of firm balance sheets compiled from tax returns. The dataset includes all French firms with sales of 750,000 €or more.[14]

We add firm credit-rating information for FIBEN firms using the credit ratings produced by the Banque de France. The latter assigns credit ratings to all French non-financial companies with at least three subsequent years of accounting data. The main use of the ratings is to determine the eligibility of bank loans to rated firms as collateral for Eurosystem funding (see Cahn, Duquerroy, and Mullins (2019) for more details). The rating is an assessment of firms' ability to meet their financial commitments over a three-year horizon. The rating scale contains twelve ordered notches, a lower rating being synonymous with a lower probability of default and a higher rating with a higher probability of default.

Summary statistics. We present summary statistics for all relevant samples and variables in Table 2. In Panel A, we zoom in on our main sources of variation, namely bank-level variables, such as banks' regulated-deposit ratios, as well as the gap between the rate on regulated deposits (livret A) and the ECB's deposit facility rate. Regulated deposits account for a good third of total deposits and, thus, constitute an important source of retail funding. Gap_t ranges from approximately one to two percentage points, with a standard deviation of 0.4 percentage points, and we use its level at the end of each quarter in our analysis.

In Panel B, we move to the firm-bank-county-quarter level, the level of observation for

[13] The exception is La Banque Postale (LBP). Given that LBP was not active in corporate lending at the beginning of the period, and could not fulfill its obligations with respect to SME lending, it was authorized to transfer all of its livret-A deposits to the CDC. We thus discard LBP from our estimations by applying a 100% transfer rate. Including it without adjusting the rate of deposits for the rechanneling scheme or including it while applying the same transfer rate as other incumbent banks does not change the results.

[14] We drop firms with negative debt, negative or zero total assets. All ratios are winsorized at the 1st and 99th percentiles.

all credit-registry-based regressions. On this basis, we aggregate data up to the ZIP-code-quarter level in Panel D. The aggregation at the bank-county-quarter level in Panel C is based on the Cefit dataset,[15] which comprises information on all outstanding amounts of credit and deposits, including loans to households and self-employed individuals that are not covered by the credit registry. Finally, in Panel E, we include summary statistics for all outcome variables at the firm-year level for firms with balance-sheet data.

We also present summary statistics separately for banks with regulated-deposit ratios in the top and bottom half of the distribution in Table 3. Banks with higher regulated-deposit ratios are smaller in terms of assets, generally more dependent on deposits, and source their deposits primarily from households rather than corporations, whereas the exact opposite holds for banks with lower regulated-deposit ratios. In line with this, highly regulated-deposit dependent banks lend more to households and self-employed individuals, rather than firms, as compared to banks with regulated-deposit ratios in the bottom quartile.

As a consequence, regulated-deposit dependent banks also have a larger fraction of medium- to long-term loans (0.90 vs. 0.63). While this is substantially driven by the greater portion of mortgage lending in regulated-deposit dependent banks' loan portfolios, the fraction of medium- to long-term loans among their corporate loans is also higher (0.57 vs. 0.51), with a smaller standard deviation (0.11 vs. 0.28). Due to the stickiness of rates on regulated deposits, the respective banks obtain a low sensitivity by design, and seem to match it on their asset side by granting long-term loans. This is consistent with the observation in Drechsler, Savov, and Schnabl (2021) that U.S. banks match their interest rate sensitivities in spite of a large maturity mismatch between their asset and liabilities side.

[15] In Panel C, firms' average ratings, which are used to identify risky firms, are calculated from rating data merged with the credit registry.

2.3 Identification

We use the following specification to estimate how banks' funding costs affect their lending:

$$\begin{aligned}\ln(Credit)_{fbct} &= \beta_1 \textit{Deposit ratio}_{bt-1} \times Gap_t + \beta_2 \textit{Deposit ratio}_{bt-1} \\ &\quad + \mu_{fbc} + \theta_{ft} + \psi_{ct} + \epsilon_{fbct}, \end{aligned} \tag{1}$$

where $Credit_{fbct}$ measures the euro amount of debt outstanding between firm f and bank b's branch(es) in county c in quarter t, $\textit{Deposit ratio}_{bt-1}$ is the ratio of regulated deposits over total liabilities of bank b in quarter $t-1$, which is assigned to all branches of bank b, Gap_t is the difference between the rate on regulated deposits (livret A) and the ECB's deposit facility rate (in %) at the end of quarter t; and μ_{fbc}, θ_{ft}, and ψ_{ct} denote firm-bank-county, firm-quarter, and bank b's county-quarter fixed effects, respectively. We cluster standard errors at the bank level, which corresponds to the level of our identifying variation.

Our coefficient of interest is β_1 which captures the extent to which banks that rely more on regulated deposits, rather than other types of debt, such as standard deposits and interbank funding, alter their lending when the gap between the rate on regulated deposits and the monetary-policy rate changes. The interaction term can be interpreted as the difference in funding costs for a bank with non-zero regulated deposits and a bank that relies exclusively on other sources of funding. To see this, and to simplify matters, assume that there were only two sources of funding: regulated deposits and interbank funding. Then, a given bank b's funding cost at time t is equal to:[16]

$$\textit{Deposit ratio}_{bt-1} \times LivretA_t + (1 - \textit{Deposit ratio}_{bt-1}) \times DF_t = \textit{Deposit ratio}_{bt-1} \times Gap_t + DF_t.$$

Under the assumption that banks relying on interbank funding experience perfect pass-through of the ECB's deposit facility (DF) rate to interbank-lending rates, $\textit{Deposit ratio}_{bt-1}$ $\times$ Gap_t captures the difference in funding costs incurred by banks that rely more on regulated

[16] In a robustness check, we verify that our results are virtually invariant to the timing of the measurement of regulated-deposit ratios.

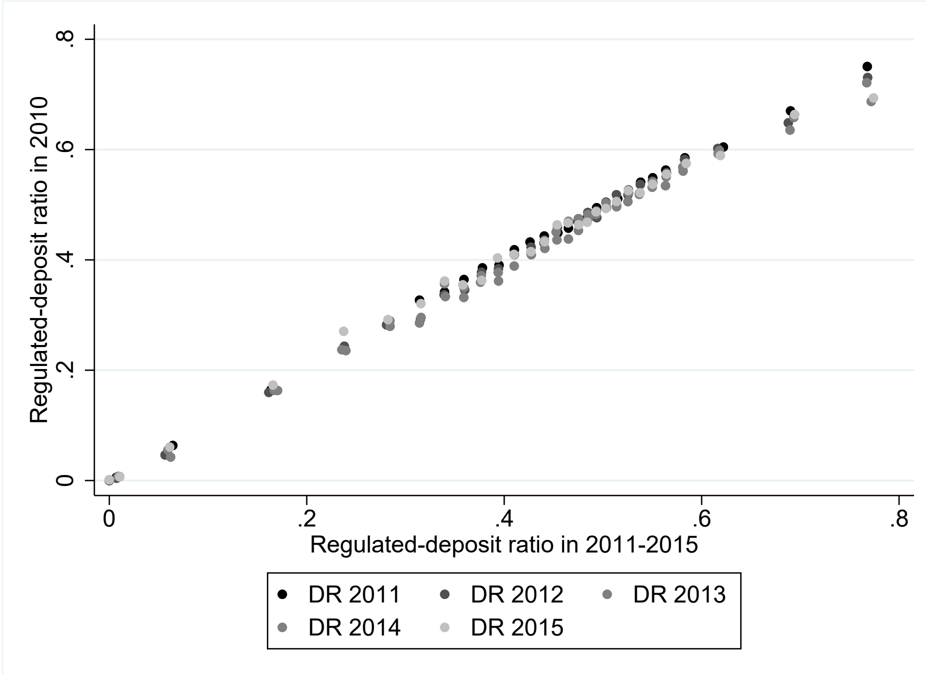
deposits vs. banks whose cost of funding is equal to the ECB's DF rate. In a robustness check, we show that our estimates hold up to explicitly differentiating between interbank-funded banks and those funded only by non-regulated deposits, even when the pass-through of the monetary-policy rate to interbank rates is typically thought to be (even) stronger.

β_1 reflects the elasticity of banks' credit supply with respect to their funding costs, measured in our setting by the relative cost of regulated deposits vis-à-vis other sources of funding. This relative cost varies with the relative cost per euro of regulated deposits (Gap_t) and the share of regulated deposits out of total bank liabilities ($Deposit\ ratio_{bt-1}$). We ensure that β_1 is identified purely by the change in the price of regulated deposits, by controlling separately for $Deposit\ ratio_{bt-1}$ in the regression. This implies that we can cleanly identify how banks adjust their lending in reaction to changes in the *price* of funding, holding constant any changes stemming from *quantities*.[17]

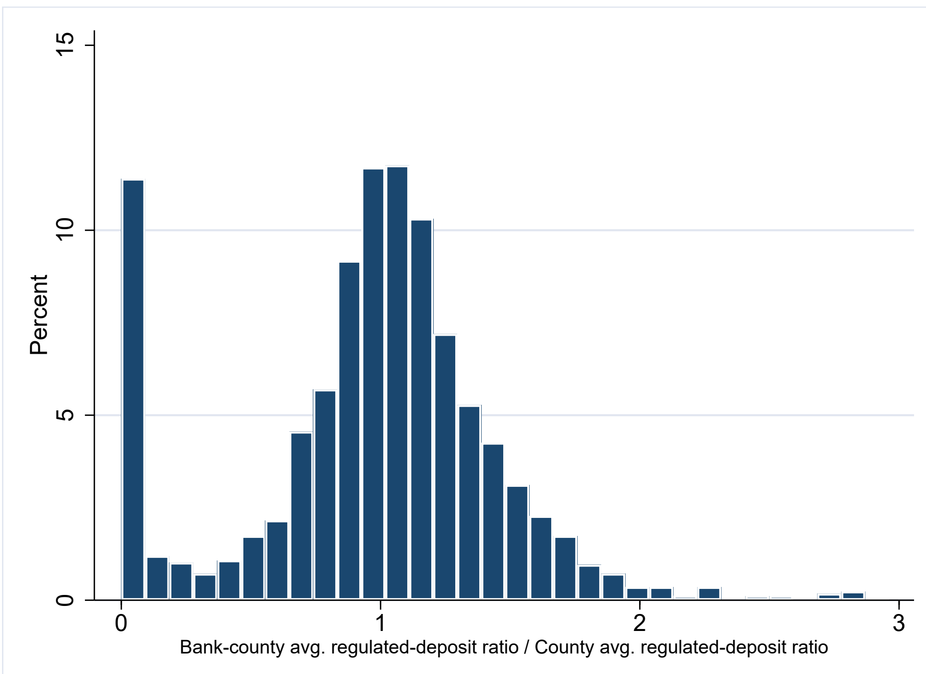
Figure 2.3 provides visual evidence for the sources of variation that we exploit. In the top panel, we plot the persistence in the share of regulated deposits over different horizons (from 2010 to 2011 up to 2015). The correlation almost perfectly aligns with the 45-degree line, consistent with our argument that banks cannot adjust their exposure to regulated deposits even in the medium run. In the bottom panel, we show that there is rich variation across bank branches within counties, which explains why we can control for time-varying unobserved local differences across counties.

We address several issues of endogeneity that could arise when estimating specification (1). The granularity of our data allows us to saturate the specification with multiple sets of fixed effects. μ_{fbc} are borrower-by-bank county (i.e., comprising all branches of a given bank in a given county) fixed effects, and remove time-invariant unobserved heterogeneity across borrower-lender pairs. In particular, this allows us to account for potential differences in sorting motives between borrowers and lenders. This also implies that our treatment effect is estimated only for the intensive margin, within an existing borrower-lender pair, and does not capture the creation or destruction of a new bank-firm relationship.

[17] This would be the case if, for instance, banks more dependent on regulated deposits experienced large inflows and outflows of deposits in general, as in Drechsler, Savov, and Schnabl (2017).



(a) Variation of Regulated-deposit Ratios within Banks over Time



(b) Variation of Regulated-deposit Ratios across Bank Branches within Counties

Figure 2: The top panel is a binscatter plot of the average regulated-deposit ratio, *Deposit ratio*$_{bt}$, for bank b's branch(es) in county c in 2010 (y-axis) vs. $2011 - 2015$ (x-axis). The bottom panel is a relative-frequency histogram of the ratio of the average regulated-deposit ratio (over the entire sample period) for bank b's branch(es) in county c to the average regulated-deposit ratio (over the entire sample period) for all banks in county c.

We control for time-varying unobserved heterogeneity across firms that might affect their credit *demand* by using the common strategy of including borrower-by-quarter fixed effects θ_{ft}. The cost of doing so is that our coefficient of interest is only identified for firms borrowing from multiple lenders, as otherwise, the time-varying bank-level shock would be perfectly collinear with the firm-by-quarter fixed effects.

Because borrowers are not necessarily located in the same county as the bank branches from which they obtain loans, we can also include bank county-by-quarter fixed effects ψ_{ct}.[18] This set of fixed effects controls for time-varying unobserved shocks in the county from where a given bank sources its deposits, which may affect the ability of bank branches to lend. In this manner, our coefficient of interest is estimated by comparing two branches in the same county and the same quarter, and it does not exploit any between-county variation.

After including all of the above-mentioned fixed effects, β_1 is estimated by comparing different bank branches in the same county lending to the same firm over time. In addition, we also estimate specification (1) with banking group (BHC) by quarter fixed effects to control for developments at the more aggregate banking-group level that may also govern local lending decisions.[19]

3 Results

3.1 Average Effect on Credit Supply

In the first column of Table 4, we estimate specification (1), using as $Deposit\ ratio_{bt-1}$ the ratio of regulated deposits over total liabilities in quarter $t-1$. We find that regulated-deposit dependent banks reduce their lending when they incur higher funding costs. This estimate becomes even larger after the inclusion of BHC-quarter fixed effects in column 2, which is our preferred specification, suggesting imperfect internal capital markets within

[18] Within the subset of firms borrowing from multiple banks, 38% borrow from at least one bank located in a different county.

[19] We have 69 banking groups in our sample.

banking groups.[20]

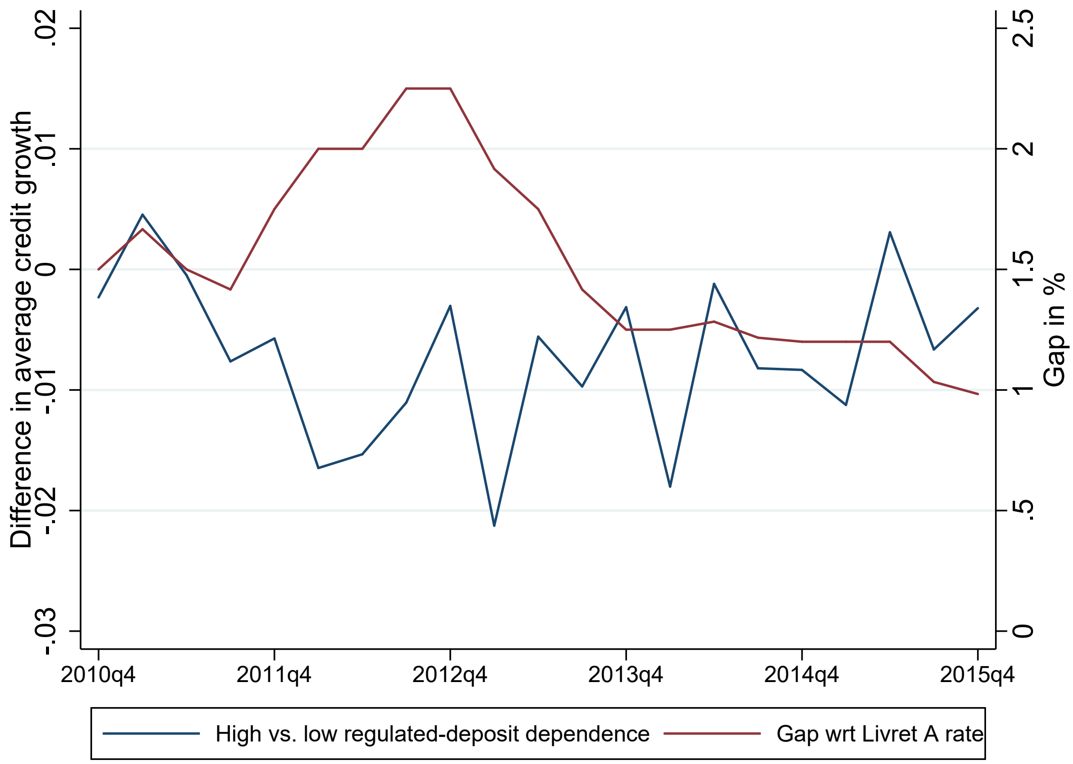


Figure 3: **Funding-cost Gap and Lending by Regulated-deposit Dependent Banks.** This figure plots the difference in the average loan-growth rate (average at the bank level), weighted by banks' total loan volume, for all banks in the top vs. bottom quartile of the ratio of regulated deposits over total liabilities (lagged by one quarter), alongside the evolution of the gap between the livret-A rate and the ECB's deposit facility rate from Q4 2010 to Q4 2015.

As $Deposit\ ratio_{bt-1} \times Gap_t$ captures the difference in funding costs incurred by any bank with non-zero regulated deposits vs. banks whose cost of funding is aligned with the monetary-policy rate, our estimate in column 2 implies that banks contract their lending by 16.8% if they incur 1 percentage point higher funding costs. To estimate the elasticities of different outcomes with respect to cost of funding, we can apply the standard elasticity formula:

$$elasticity^{Y}_{Cost_{funding}} = \Delta \ln(Y) / \left[(Cost^{new}_{funding} - Cost^{old}_{funding}) / (Cost^{old}_{funding}) \right].$$

[20] If banking groups were able to reallocate well deposits across their different banks, we should find a smaller, rather than larger, point estimate, as the reallocation would allow banks belonging to the same group to immunize themselves against any effects arising from deposits they collected in their own county.

Since the average value for Gap_t is 147 basis points, we can set the old cost of funding $Cost^{old}_{funding}$ equal to 1.47 and we can compute $\Delta\ln(Y)$ from our reduced-form regressions. $\Delta\ln(Y)$ is estimated when we increase the cost of funding by 100 basis points, which implies an elasticity of $-0.168/(1/1.47) = -0.25$.

In Figure 3, we present graphical evidence of the same finding, and plot the difference between the livret-A and the deposit facility rate, Gap_t alongside the difference in the weighted average loan-growth rate for all banks in the top vs. bottom quartile of the ratio of regulated deposits over total liabilities (lagged by one quarter). The negative relationship between the differential credit growth and Gap_t suggests that, in line with our conjecture, higher funding costs for regulated-deposit dependent banks induce them to lend less.

So far, our coefficient of interest is estimated by comparing banks more dependent on regulated deposits with all other types of banks, i.e., those funded by other types of deposits or through the interbank market. By effectively pooling together these groups of banks, we implicitly assume that their funding costs are aligned with the monetary-policy rate. In column 3, we split up this group of banks into deposit-funded and interbank-funded banks by defining only the latter as the omitted category. For this purpose, we include as a control variable $\textit{Total deposit ratio}_{bt-1}$, the ratio of all deposits, including regulated deposits, over total liabilities of bank b in quarter $t-1$, interacted with Gap_t. The effect of $\textit{Deposit ratio}_{bt-1} \times Gap_t$ is quantitatively unchanged, while the point estimate for $\textit{Total deposit ratio}_{bt-1} \times Gap_t$ is close to zero (and statistically insignificant). This implies that our estimated effect of funding costs on bank lending is virtually invariant to choosing either type of banks as a comparison group for regulated-deposit dependent banks. This also rules out that deposit-funded banks generally react more strongly to changes in funding costs, which would bias the coefficient on $\textit{Deposit ratio}_{bt-1} \times Gap_t$, since regulated-deposit dependent banks are more likely to rely on deposit funding in general (see Table 3).

In columns 4 to 6, we address the related concern that regulated-deposit dependent banks may have other balance-sheet characteristics that affect the sensitivity of their credit supply to funding costs. Banks' net worth plays a prominent role for the transmission of monetary policy to their funding costs, so we borrow two proxies from the literature (e.g., Kashyap and Stein, 2000; Jiménez, Ongena, Peydró, and Saurina, 2012) to control for it. In columns 4 and 5, we add banks' equity ratio and size, respectively, and their interactions with Gap_t, and control for both simultaneously in column 6. In all three cases, our coefficient of interest on $Deposit\ ratio_{bt-1} \times Gap_t$ remains quantitatively unchanged compared to our baseline estimate in column 2. Hence, banks' funding costs have a direct effect on credit supply even when holding constant their net worth.

In column 7, we replace the interaction effect of our treatment-intensity variable, $Deposit\ ratio_{bt-1}$, with Gap_t by two separate interaction effects with indicators for whether Gap_t ranges in the top or middle tercile of its distribution. The top tercile comprises all observations with a value of Gap_t of at least 150 basis points, and the middle tercile comprises all observations with a value of Gap_t of at least 120 (but fewer than 150) basis points. Therefore, the coefficient on $Deposit\ ratio_{bt-1}$ now captures the effect for regulated-deposit dependent banks when Gap_t is less than 120 basis points.

We find that the effect of funding costs on credit supply becomes negative and significant (at the 1% level) only for values of Gap_t in the top tercile, while there is no discernible difference in credit supply between regulated-deposit dependent banks relative to all other banks when Gap_t is below 150 basis points. As the average bank holds 14% of its liabilities in regulated deposits (see top panel of Table 2), this implies that banks can sustain up to $(0.14 \times 150 =)$ 21 basis points higher funding costs until they contract their lending.

To put this estimate in perspective, using data on bids for short-term loans granted by the ECB during the 2007 crisis, Cassola, Hortaçsu, and Kastl (2013) estimate that for over one-third of the (small sample of) bidding banks, funding costs increased by at least 20 and up to more than 60 basis points, with significant repercussions for these banks' profitability by the end of the same year. Therefore, our elasticity helps to understand why during such crises the typical funding-cost shock experienced by banks is associated with episodes of credit contraction.

We present a battery of robustness checks in the Appendix. In Table A.1, our results are robust to controlling for *Deposit ratio transferred to* CDC_{bt-1}, which is the fraction T_{bt} of regulated deposits (no longer on bank b's balance sheet) transferred to the CDC over total liabilities of bank b in quarter $t-1$. In this manner, we account for intermediary commissions, which tend to be time-invariant and as such are unlikely to covary with Gap_t, received by bank b in exchange for deposits transferred to the CDC for the purpose of financing social housing (cf. Section 2.1.2).

In Table A.2, we show that our estimates are robust to different definitions of *Deposit* $ratio_{bt}$. Using the Banque de France's Cefit database, we can construct deposit ratios at the more granular bank-county level. The data are broken down by the same types of depositors as in the regulatory data, but cannot perfectly isolate regulated deposits. As such, we can only observe "special deposits," defined as regulated deposits plus ordinary savings.[21] In the first two columns, we re-run the same specifications as in columns 1 and 2 of Table 4, using as our exposure variable the special-deposit ratio at the bank-county level. The results are qualitatively similar, but the estimates are somewhat weaker. Any differences between the estimates in the first two columns and those in Table 4 do not stem from the definition of the deposit ratio employed in the latter table, however. To verify this, we re-run the same two regressions, and modify the bank-level deposit ratio according to the definition in the first two columns. The estimated coefficients on the relevant interaction term in Table A.2 are similar to those in Table 4.

Finally, we revisit the timing of our treatment-exposure variable, *Deposit* $ratio_{bt-1}$. We use lagged regulated-deposit ratios to safeguard that our identifying variation does not stem from changes in the amount of regulated deposits but, rather, in the difference between the livret-A rate and the monetary-policy rate. In this manner, we disentangle the price, rather than the quantity, effect of banks' regulated deposits on credit supply. We confirm this by lagging *Deposit* $ratio_{bt-2}$ by another quarter and re-running all regressions from Table 4.

[21] In addition, bank liabilities are not fully observable in this more granular dataset. Thus, we use total deposits plus commercial paper as a proxy for total liabilities. We adjust deposit amounts for the percentage of deposits transferred to the CDC by using the same percentages as for the regulatory data. Let S_{bt} be the share of eligible deposits of bank b in quarter t, then: $\textit{Deposit ratio}_{bct} = (S_{bt} \times (1 - T_{bt}) \times \textit{Special deposits}_{bct} + (1 - S_{bt}) \times \textit{Special deposits}_{bct}) / \textit{Total liabilities}_{bct}$. The data are available from Q1 2010 to Q4 2015.

The results in Table A.4 are virtually unaltered, implying that changes in the quantity of regulated deposits cannot explain our findings. To this end, we verify that (post-transfer) regulated deposits are barely sensitive to variation in the difference between the livret-A and the deposit facility rate. As can be seen in Figure B.1, the growth rate of banks' regulated deposits comoves weakly with the contemporaneous Gap_t. If anything, the somewhat positive comovement should work against us finding a negative credit-supply response.

In Table 5, we explore heterogeneity in the effect of funding costs on credit supply across banks. For this purpose, we modify the regression specification from column 2 of Table 4 to include interactions with different bank characteristics. We first consider banks' capitalization, as reflected by their (time-invariant) equity-to-assets ratio at the beginning of our sample period. In column 1, higher funding costs depress bank lending less for strongly capitalized banks. In column 2, we show that there is a distinct negative effect on credit supply by low-equity banks, which we characterize as banks with equity-to-assets ratios in the bottom quintile of the distribution. This evidence is consistent with the idea that sufficiently high funding costs can adversely affect banks' overall intermediation costs by depressing their net worth (analogously to Di Tella and Kurlat, 2021), which generates a feedback effect as reflected in the above-mentioned nonlinearity of banks' credit-supply response.

In column 3, we show a similar effect for low-liquidity banks, i.e., banks with a relatively low ratio of cash and central-bank reserves to total assets (measured again at the beginning of the sample period). This implies that banks with less liquid assets are more likely to reduce their lending in response to higher funding costs, which partly reflects that they have greater scope for doing so as they have granted more (illiquid) loans to start with. In column 4, where we use a discrete variable based on the distribution of liquidity ratios, we see that the effect is driven primarily—if not nonlinearly—by high-liquidity banks lending disproportionately more.

In columns 5 and 6, we consider banks' share of non-performing loans (NPLs) out of total loans in the previous quarter. For both the continuous and the discrete version of the variable, with the latter capturing banks in the top tercile of the distribution, we find that high-NPL banks' lending response is positively related to their funding costs—a potential reflection of gambling for resurrection.

Finally, we also consider the effects of variations in funding costs on banks' balance sheets. For this purpose, in Table 6, we use bank balance-sheet data in a bank-quarter (bt) level panel. We find no effect on banks' total assets (column 1) or their capitalization (column 2). The latter speaks against regulatory-capital constraints governing banks' lending response. We find no discernible effect on liquid-asset holdings (column 3) or interbank assets (loans and other banks' securities) either (column 4). In summary, affected banks do not see their balance sheets shrink despite the fact that we have shown them to contract their corporate lending. This gives rise to the possibility that banks facing higher funding costs do not contract their lending to all types of borrowers, but only to some (primarily corporations). Furthermore, our evidence that high-NPL banks actually increase their lending in the face of higher funding costs suggests that affected banks increase their risk taking, or in the case of a high share of NPLs, gamble for resurrection. In what follows, we investigate whether affected banks' loan-portfolio rebalancing reflects such risk taking.

3.2 Reallocation of Credit

To test whether affected banks rebalance their portfolios towards higher-yielding loans so as to preserve their profits, we complement the credit registry with a bank-county-level dataset (Cefit) that provides more detailed information on the recipients of credit, and additionally has credit information for non-corporate debtors, especially self-employed individuals (which are not covered in the credit registry).

In Table 7, the level of observation is a bank-county-quarter bct, summarizing information on all branches of a given bank b in county c. In columns 1 to 5, we estimate the adjustment of banks' loan portfolio across borrower types, and use as dependent variables the ratios of loans accruing to different borrower types over bank b's total loan portfolio. In column 1, we find that following an increase in funding costs, affected banks reduce their loan exposure to large firms (with sales in excess of 1m €) in the credit registry. In column 2, this effect survives when we compare banks' loan exposure to large firms to their total loan portfolios (comprising not only corporate lending, as captured by the credit registry, but loans to all kinds of borrowers). Affected banks compensate by reallocating loans to small firms (with sales up to 1m €) for the most part (column 3) and to self-employed individuals (column 4).[22]

The decomposition of the loan-portfolio reallocation across borrower types suggests a form of bank risk taking in search of higher yields. When facing higher funding costs, affected banks increase their loan-portfolio exposure to smaller and potentially riskier borrowers, and reduce their exposure to larger firms. We provide further evidence for banks' risk taking in two ways. First, in column 5, we show that banks facing higher funding costs increase their exposure to firms with a higher risk of bankruptcies. For this purpose, we compute the ex-post bankruptcy probability at the industry level,[23] and use as our dependent variable the ratio of loans to firms in industries with above-median occurrences of bankruptcies over total loans.

Second, we exploit the credit ratings assigned by the Banque de France. To compute the proportion of loans accruing to risky firms, we label a firm as "risky" if it receives a rating worse than 4, which used to be the minimum rating required for a firm's loans to be eligible as collateral for the ECB (Cahn, Duquerroy, and Mullins, 2019). One drawback of this measure is that the Banque de France provides credit ratings only for firms with balance-sheet information.[24] Column 6 reports the result, and shows that regulated-deposit dependent banks increase their loan exposure to risky firms when their funding costs increase. The increases in risky lending by far surpass all other estimates of loan-portfolio rebalancing in Table 7.

[22] Note that this does not necessarily imply an increase in credit supply to small firms and self-employed individuals; instead, their relative importance in affected banks' loan portfolio increases.

[23] Based on additional data from the Banque de France (SCR) on bankruptcies and payment delinquencies, we use for each (three-digit) industry the total number of such events and scale it by the number of firms (available in these data) in the respective industry.

[24] As such, we need to limit the denominator of the dependent variable to firms with sales of 750,000 €or more).

Our final test to study if banks reach for yield is to explore whether higher funding costs also induce banks to extend loans with a longer maturity. For this purpose, we compute the fraction of medium- to long-term loans in banks' loan portfolios and use it as dependent variable in column 7. The positive and significant coefficient on the interaction term *Deposit* $ratio_{bt-1} \times Gap_t$ confirms that when their funding costs increase, affected banks increase the average maturity of their loan portfolios.

3.3 Aggregate Effects

So far, our results might overestimate the true effect of changes in credit supply if, for instance, a reduction in the supply of credit by regulated-deposit dependent banks during periods in which they incur higher funding costs is actually fully compensated for by an increase in the supply of credit by otherwise-funded banks. This could happen if borrowers can easily substitute credit across lenders.[25] In that case, our point estimate could be unbiased, but the conclusion in terms of economic consequences would be quite different. The reverse might also be true. We could underestimate the total effect on credit if changes in credit supply from exposed banks has local spillover effects.

We address this question by adopting a "local lending market" approach and aggregate all our variables at the city (ZIP code) level by computing a weighted average of bank dependence on regulated deposits, providing us with a city-level credit shock, and treat all cities as small independent economies facing an "aggregate shock." While still relatively uncommon in the banking literature, this type of geographical approach is becoming increasingly popular as a way to capture "semi-aggregate" effects (e.g., Greenstone, Max, and Nguyen, 2020).

To construct the city-wide shock, we use a shift-share approach by considering the funding structure of all banks lending to firms in a given ZIP code. Namely, for each bank b lending

[25] There are multiple reasons that can affect switching costs: the existence of a "stigma" when switching (e.g., Darmouni, 2020) or the lack of geographic diversification across banks (e.g., Célérier and Matray, 2019). For a debate on the importance for the banking literature to compare firm-level and more aggregate estimates, see, for instance, the discussion between Greenstone, Max, and Nguyen (2020) and Chodorow-Reich (2014).

to firms f in ZIP code k,[26] we weight the bank-level deposit ratio by the respective bank b's lagged share of all loans in ZIP code k:

$$Deposit\ ratio_{kt} = \sum_{f \in k} \frac{Credit_{fbt-1}}{\sum_{f \in k} Credit_{fbt-1}} Deposit\ ratio_{bt} \tag{2}$$

where $Credit_{fbt-1}$ measures the euro amount of debt outstanding between firm f and (all branches of) bank b in quarter $t-1$, and $Deposit\ ratio_{bt}$ is the ratio of regulated deposits over total liabilities of bank b in quarter t.

We then estimate the following specification at the ZIP-code-quarter level kt:

$$y_{kt} = \beta_1 Deposit\ ratio_{kt-1} \times Gap_t + \beta_2 Deposit\ ratio_{kt-1} + \psi_{ct} + \delta_k + \epsilon_{kt} \tag{3}$$

where y_{kt} is a variable based on the cross-section of loans granted to firms in ZIP code k in quarter t, and ψ_{ct} and δ_k denote county-quarter and ZIP-code fixed effects, respectively. Standard errors are clustered at the ZIP-code level.

This type of "local lending market" approach involves a trade-off with the more classic within-firm estimator. While a higher level of aggregation allows us to understand better the economic consequences of bank-specific credit-supply shocks, it prevents us, by construction, from controlling for time-varying unobserved heterogeneity at the firm level. In order to ensure that cities are still as comparable as possible, we control for county-by-time fixed effects in order to at least compare only cities within the same county, without using any variation across counties. Such a strategy removes time-varying unobserved heterogeneity across counties, such as differences in credit demand, in business cycles and dynamism, or in industrial composition that may influence our estimate.

Due to the need for data on loan recipients' cities, all dependent variables are based on corporate-lending data from the credit registry. In column 1 of Table 8, we estimate equation (3) and use the natural logarithm of total (corporate) credit as dependent variable. We find a large, negative coefficient, significant at the 1% level, implying that non-affected banks

[26] There are around 33,000 distinct cities in France, each belonging to only one county.

cannot perfectly compensate for the change in credit supply from affected banks.

$Deposit\ ratio_{kt-1} \times Gap_t$ captures the difference in the city-level weighted average funding costs of regulated-deposit dependent banks in relationships with firms in the respective cities vs. cities that are home to firms only in relationships with otherwise-funded banks. As such, our estimate in column 1 implies that cities see their credit drop by 14.3% if they face funding costs that are 1 percentage point higher. Alternatively, when the difference between the livret-A and the deposit facility rate equals 1 percentage point, cities at the 75$^{\text{th}}$ percentile of the regulated-deposit ratio ($Deposit\ ratio_{kt}$) distribution see their credit drop by $(0.25 - 0.18) \times 0.143 = 1.0\%$ (see Panel D of Table 2) relative to cities at the 25$^{\text{th}}$ percentile, which is economically significant, albeit somewhat smaller than the corresponding effect at the micro level (see column 2 of Table 4). This suggests that borrowers have very limited means of switching banks so as to smooth over credit-supply shocks, possibly due to sticky lending relationships.

In column 2 of Table 8, we use as dependent variable the fraction of loans to large vs. all firms. Consistent with an important reallocation in the loan portfolios for affected banks (Table 7), we find again a large negative and highly significant effect. Therefore, at the city level, credit contraction following adverse shocks to banks' funding costs affects primarily large rather than small firms, significantly shifting the ratio of loans accruing to these two groups in favor of small firms.

In columns 3 and 4, we consider two additional dimensions of cross-sectional heterogeneity implied by Table 7, the respective dependent variables of which we can compute at the aggregate city level based on the credit-registry data. In column 3, we show that affected banks' risk taking in terms of lending to firms in risky industries (cf. column 6 of Table 7) also holds at the more aggregate level. Put differently, relatively safe firms—in industries with below-median occurrences of bankruptcies—cannot readily substitute their relative loss of credit access with other sources of bank credit. Similarly, in column 4, we find that affected banks' extension of longer-term loans (cf. column 8 of Table 7) is also reflected in our more aggregate estimates. All of these estimates are robust to, and at times become even larger after, removing ZIP codes with at most five firms (with records in the credit registry) in the last four columns of Table 8.

3.4 Firm-level Real Effects

Given the magnitude of the change in credit supply and the difficulty for firms facing a credit contraction to arbitrage across lenders (Table 8), variations in banks' funding costs are likely to have real effects. This is exacerbated by the fact that the firms in our sample cannot compensate a change in bank credit (at least in the short run) with other types of financing, as 99% of them do not have any capital-market financing.

First, we verify that our effects on bank lending in Table 4 also pertain to the subsample of firms with balance-sheet data available. In Table A.3, we re-run the same specifications as in Table 4 on this sample, and find that all credit-based results continue to hold and are even stronger than in the overall sample.

To estimate the real effects of banks' credit-supply response to variations in their funding costs, we estimate regressions at the firm-year level for the subsample of said firms with balance-sheet data in France. We use a shift-share approach similar to equation (2). To compute firm-level exposure to credit-supply shocks, $Deposit\ ratio_{ft}$, we use for each lender to firm f their bank-level deposit ratio, and weight the latter by the lagged share of all loans granted to firm f by bank b's branch(es) in county c.

We then estimate the following regression specification at the firm-year level ft:

$$y_{ft} = \beta_1 Deposit\ ratio_{ft-1} \times Gap_t + \beta_2 Deposit\ ratio_{ft-1} + \psi_{cit} + \delta_f + \epsilon_{ft}, \qquad (4)$$

where y_{ft} is an outcome of firm f in year t, and ψ_{cit} and δ_f denote firm f's county-industry-year and firm fixed effects, respectively. Standard errors are clustered at the firm level.

In Table 9, we estimate (4) and use multiple firm-level outcomes. We find that more exposed firms see a drop in their capital assets, both in general (column 1) and more specifically in terms of their property, plant, and equipment (column 2). In terms of economic significance, $Deposit\ ratio_{ft-1} \times Gap_t$ captures the difference in the weighted average funding costs of regulated-deposit dependent banks that a firm is in a relationship with, as opposed to firms that are only in relationships with otherwise-funded banks. Therefore, our estimate in column 1 implies that firms see a drop in their stock of total capital by 3.6% if their relationship banks incur funding costs that are 1 percentage point higher. Alternatively, when the difference between the livret-A and the deposit facility rate equals 1 percentage point, firms at the 75$^{\text{th}}$ percentile of the regulated-deposit ratio distribution experience a drop in assets by $(0.21 - 0.03) \times 0.036 = 0.6\%$ (see Panel E of Table 2) relative to firms at the 25$^{\text{th}}$ percentile.

In column 3, we see that more exposed firms become smaller in terms of their stock of total capital assets because they also invest less, as reflected by a drop in their capital expenditure out of total capital assets. Similarly, we can infer from column 4 that affected firms' property, plant, and equipment decreases because they invest less in tangible assets. Finally, we also estimate a negative, albeit insignificant, effect on employment in column 5.

4 Conclusion

In uncertain economic times, governments may opt to induce saving by offering sticky rates on savings products. Using stickiness in the rates paid on regulated-deposit accounts in France, we show that when banks incur relatively higher cost of funding, they contract their lending. Consistent with risk shifting, affected banks rebalance their portfolios toward riskier firms and extend more long-term loans. We carve out the allocative effects of this shock to banks' funding cost not only by examining credit supply to different borrowers, but also by implementing a "local lending market" approach to yield aggregate effects. We show that cities that are home to firms in relationships with regulated-deposit dependent banks experience a drop in total credit and a relative increase in credit available to small, as opposed to large, firms.

Besides pointing to distributional consequences of variations in credit supply, our results also speak to the potential spillover effects of assets with stable returns. By attracting savings, subsidized funds such as regulated deposits could affect the distribution of liquidity and, thus, aggregate stability of the banking system (Hakenes and Schliephake, 2017).

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Tables

Table 1: Evolution of Percentage of Eligible Regulated Deposits Transferred to the CDC

	2010	2011	2012	2013	2014	2015
Incumbent banks (prior to the reform in 2008)	80%	76%	70%	64%	62%	61%
New banks	24%	34%	40%	37%	40%	40%

Source: Observatoire de l'épargne réglementée.

Table 2: Summary Statistics

Panel A: Main sources of variation & bank-level variables	Mean	p5	p25	Median	p75	p95	Std. dev.	N
Deposit ratio$_{bt}$ (Q4 2010 − Q4 2015)	0.14	0.00	0.00	0.15	0.25	0.34	0.12	3,673
Total deposit ratio$_{bt}$	0.51	0.06	0.37	0.51	0.68	0.92	0.24	3,673
Assets$_{bt}$ in billion €	32.39	0.19	1.41	8.25	16.44	116.81	122.31	3,673
Equity ratio$_{bt}$	0.04	0.00	0.01	0.02	0.04	0.12	0.07	3,673
Liquidity ratio$_{bt}$	0.01	0.00	0.00	0.01	0.01	0.04	0.05	3,673
Interbank/Assets$_{bt}$	0.11	0.00	0.00	0.04	0.18	0.42	0.17	3,673
Gap$_t$ in % (Jan 2010 − Dec 2015)	1.47	0.95	1.20	1.35	1.75	2.25	0.40	72
Panel B: Firm-bank-county-quarter level								
Credit in thousand €	397.87	28.00	54.00	119.00	287.00	1166.00	3,044.31	4,134,974
Panel C: Bank-county-quarter level								
$\frac{\text{Large firms}}{\text{Total loans}}$	0.07	0.00	0.02	0.04	0.08	0.25	0.10	28,063
$\frac{\text{Small firms}}{\text{Total loans}}$	0.09	0.00	0.04	0.07	0.11	0.23	0.08	28,063
$\frac{\text{Loans to self-employed}}{\text{Total loans}}$	0.08	0.00	0.02	0.06	0.13	0.20	0.07	28,063
$\frac{\text{High-bankruptcy industries}}{\text{Total loans}}$	0.29	0.03	0.18	0.26	0.36	0.62	0.17	27,139
$\frac{\text{Risky firms}}{\text{Rated firms}}$	0.60	0.21	0.49	0.61	0.74	0.97	0.21	26,336
$\frac{\text{MLT loans}}{\text{Total loans}}$	0.87	0.68	0.86	0.90	0.92	0.96	0.12	28,063
Panel D: ZIP-code-quarter level								
Deposit ratio$_{kt}$	0.21	0.11	0.18	0.22	0.25	0.29	0.06	664,654
Total credit in thousand €	5,353.22	61.00	294.00	834.00	2,496.00	15,827.00	59,609.23	664,654
Panel E: Firm-year level								
Deposit ratio$_{ft}$	0.12	0.00	0.03	0.13	0.21	0.29	0.10	380,657
Capital assets in million €	2.74	0.10	0.38	0.84	1.94	7.78	16.07	380,657
PP&E in million €	2.36	0.07	0.27	0.63	1.55	6.72	15.69	380,657
$\frac{\text{CapEx}}{\text{Capital assets}}$	0.23	0.00	0.03	0.09	0.24	0.87	0.46	380,657
$\frac{\text{Tangible investment}}{\text{PP\&E}}$	0.14	0.00	0.02	0.05	0.14	0.51	0.28	380,657
Employment	28.53	5.00	12.00	18.00	34.00	86.00	32.91	380,657

In Panel A, *Deposit ratio*$_{bt}$ is the ratio of regulated deposits over total liabilities of bank b in quarter t; *Total deposit ratio*$_{bt}$ is the ratio of all deposits over total liabilities of bank b in quarter t; *Assets*$_{bt}$, *Equity ratio*$_{bt}$, *Liquidity ratio*$_{bt}$, and *Interbank/Assets*$_{bt}$ are defined as in Table 6; and *Gap*$_t$ is the difference between the rate on regulated deposits (livret A) and the ECB's deposit facility rate in month t. The summary statistics in Panels B, C, D, and E correspond to Tables 4, 7, 8, and 9, respectively, and the sample period is Q4 2010 to Q4 2015 (Tables 4, 7, and 8) and 2010 to 2015 (annual data, Table 9).

Table 3: High- vs. Low-regulated-deposit Banks

Banks with regulated-deposit ratios in the top half	Mean	p5	p25	Median	p75	p95	Std. dev.	N
Total deposit ratio$_{bt}$	0.58	0.36	0.45	0.57	0.69	0.93	0.17	1,836
$\frac{\text{Household deposits}}{\text{Total deposits}}$	0.56	0.34	0.42	0.52	0.72	0.85	0.17	1,836
$\frac{\text{Corporate deposits}}{\text{Total deposits}}$	0.34	0.10	0.22	0.38	0.44	0.50	0.13	1,836
Total loans in billion €	10.88	0.34	5.40	8.17	12.00	26.22	14.30	1,836
Corporate loans in billion €	2.65	0.10	1.23	2.05	3.07	6.31	3.34	1,836
Mortgages in billion €	5.58	0.16	2.37	3.78	5.52	14.19	8.86	1,836
Loans to self-employed in billion €	1.03	0.02	0.34	0.75	1.37	2.28	1.42	1,836
$\frac{\text{MLT loans}}{\text{Total loan portfolio}}$	0.90	0.84	0.89	0.91	0.92	0.94	0.04	1,836
$\frac{\text{MLT corporate loans}}{\text{Corporate loan portfolio}}$	0.57	0.40	0.52	0.58	0.65	0.71	0.11	1,836
Equity ratio$_{bt}$	0.02	0.00	0.01	0.02	0.03	0.07	0.02	1,836
Assets$_{bt}$ in billion €	18.25	0.65	7.97	12.50	18.62	53.96	28.40	1,836
Banks with regulated-deposit ratios in the bottom half								
Total deposit ratio$_{bt}$	0.44	0.01	0.20	0.44	0.66	0.92	0.28	1,837
$\frac{\text{Household deposits}}{\text{Total deposits}}$	0.32	0.00	0.02	0.35	0.52	0.83	0.27	1,819
$\frac{\text{Corporate deposits}}{\text{Total deposits}}$	0.58	0.11	0.36	0.55	0.89	1.00	0.29	1,819
Total loans in billion €	7.94	0.07	0.40	1.29	4.39	29.66	24.52	1,819
Corporate loans in billion €	3.11	0.02	0.11	0.54	1.66	13.13	8.71	1,819
Mortgages in billion €	2.27	0.00	0.00	0.02	0.95	8.76	8.10	1,819
Loans to self-employed in billion €	0.39	0.00	0.00	0.00	0.08	2.25	1.33	1,819
$\frac{\text{MLT loans}}{\text{Total loan portfolio}}$	0.63	0.03	0.40	0.76	0.89	0.97	0.31	1,819
$\frac{\text{MLT corporate loans}}{\text{Corporate loan portfolio}}$	0.51	0.00	0.36	0.50	0.66	1.00	0.28	1,837
Equity ratio$_{bt}$	0.06	0.00	0.01	0.03	0.07	0.19	0.09	1,837
Assets$_{bt}$ in billion €	46.52	0.14	0.72	2.42	9.64	303.15	169.45	1,837

All variables are measured at the bank-quarter level bt. Summary statistics in the top (bottom) panel are for banks with ratios of regulated deposits over total liabilities in the top (bottom) half of the distribution. *Total deposit ratio*$_{bt}$ is the ratio of all deposits over total liabilities of bank b in quarter t. Summary statistics on banks' lending activity correspond to the respective descriptions in Table 7, with the exception of $\frac{MLT\ corporate\ loans_{bt}}{Corporate\ loan\ portfolio_{bt}}$, which is the ratio of bank b's corporate loans with a maturity of more than one year over its total corporate loan exposure (based on the data in Table 4). *Equity ratio*$_{bt}$ and *Assets*$_{bt}$ are, respectively, the ratio of equity over total assets and total assets of bank b in quarter t.

Table 4: Average Effect of Funding Costs on Credit Supply

Variable	ln(Credit) (1)	ln(Credit) (2)	ln(Credit) (3)	ln(Credit) (4)	ln(Credit) (5)	ln(Credit) (6)	ln(Credit) (7)
Deposit ratio × Gap	-0.103***	-0.168***	-0.156***	-0.170***	-0.168***	-0.169***	
	(0.029)	(0.050)	(0.055)	(0.048)	(0.051)	(0.049)	
Deposit ratio	0.151	0.140	0.262*	0.120	0.134	0.122	-0.021
	(0.096)	(0.122)	(0.153)	(0.114)	(0.095)	(0.096)	(0.116)
Total deposit ratio × Gap			0.016				
			(0.024)				
Total deposit ratio			-0.164**				
			(0.082)				
Equity ratio × Gap				0.258		0.263	
				(0.225)		(0.220)	
Equity ratio				0.042		0.025	
				(0.578)		(0.559)	
Bank size × Gap					0.001	0.001	
					(0.002)	(0.002)	
Bank size					-0.008	-0.003	
					(0.036)	(0.035)	
Deposit ratio × Gap in top tercile							-0.148***
							(0.051)
Deposit ratio × Gap in 2^{nd} tercile							-0.038
							(0.033)
Firm-bank-county FE	Y	Y	Y	Y	Y	Y	Y
Firm-quarter FE	Y	Y	Y	Y	Y	Y	Y
County-quarter FE	Y	Y	Y	Y	Y	Y	Y
BHC-quarter FE	N	Y	Y	Y	Y	Y	Y
N bank clusters	196	196	196	196	196	196	196
N	4,134,974	4,134,974	4,134,974	4,134,974	4,134,974	4,134,974	4,134,974
R^2	0.94	0.94	0.94	0.94	0.94	0.94	0.94

The level of observation is credit to firm f by bank b's branch(es) in county c in quarter t. The sample period is Q4 2010 to Q4 2015. The dependent variable is the natural logarithm of the euro amount of debt outstanding between firm f and bank b's branch(es) in county c in quarter t. *Deposit ratio*$_{bt-1}$ is the ratio of regulated deposits over total liabilities of bank b in quarter $t-1$. *Total deposit ratio*$_{bt-1}$ is the ratio of all deposits over total liabilities of bank b in quarter $t-1$. *Equity ratio*$_{bt-1}$ is the ratio of equity over total assets of bank b in quarter $t-1$. *Bank size*$_{bt-1}$ is the natural logarithm of total assets of bank b in quarter $t-1$. *Gap*$_t$ is the difference between the rate on regulated deposits (livret A) and the ECB's deposit facility rate (in %) at the end of quarter t. *Gap in top (2^{nd}) tercile*$_t$ is a dummy variable for whether *Gap*$_t$ ranges in the top (middle) tercile of its distribution. Robust standard errors (clustered at the bank level) are in parentheses.

Table 5: The Effect of Funding Costs on Credit Supply across Bank Characteristics

	ln(Credit)	ln(Credit)	ln(Credit)	ln(Credit)	ln(Credit)	ln(Credit)
Bank characteristic	Equity ratio	Low equity	Liquidity ratio	High liquidity	NPL share	High NPL
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Deposit ratio × Gap × Bank characteristic	3.566**	-0.161*	18.722***	0.164*	3.112**	0.240***
	(1.788)	(0.083)	(6.641)	(0.089)	(1.396)	(0.085)
Deposit ratio × Gap	-0.271***	-0.128**	-0.289***	-0.205***	-0.270***	-0.200***
	(0.065)	(0.059)	(0.063)	(0.058)	(0.077)	(0.053)
Deposit ratio × Bank characteristic	-6.387	0.087	-25.829*	-0.358	-11.058***	-0.546***
	(4.719)	(0.188)	(13.197)	(0.249)	(3.068)	(0.150)
Deposit ratio	0.322**	0.151	0.315*	0.248	0.486***	0.200*
	(0.149)	(0.161)	(0.190)	(0.152)	(0.174)	(0.118)
Bank characteristic × Gap	-0.228	0.010	-2.062**	-0.023	-0.339	-0.033**
	(0.242)	(0.018)	(0.894)	(0.015)	(0.244)	(0.014)
Bank characteristic					1.648***	0.077***
					(0.621)	(0.026)
Firm-bank-county FE	Y	Y	Y	Y	Y	Y
Firm-quarter FE	Y	Y	Y	Y	Y	Y
County-quarter FE	Y	Y	Y	Y	Y	Y
BHC-quarter FE	Y	Y	Y	Y	Y	Y
N bank clusters	196	196	196	196	196	196
N	4,134,974	4,134,974	4,134,974	4,134,974	4,134,974	4,134,974
R^2	0.94	0.94	0.94	0.94	0.94	0.94

The level of observation is credit to firm f by bank b's branch(es) in county c in quarter t. The sample period is Q4 2010 to Q4 2015. The dependent variable is the natural logarithm of the euro amount of debt outstanding between firm f and bank b's branch(es) in county c in quarter t. *Deposit ratio*$_{bt-1}$ is the ratio of regulated deposits over total liabilities of bank b in quarter $t-1$. *Gap*$_t$ is the difference between the rate on regulated deposits (livret A) and the ECB's deposit facility rate (in %) at the end of quarter t. In the first four columns, *Bank characteristic*$_b$ is a time-invariant bank-level characteristic, namely bank b's continuous ratio of equity over total assets (column 1), an indicator for whether its equity-to-assets ratio is in the bottom tercile of the bank-level distribution (column 2), the continuous ratio of bank b's cash and central-bank reserves (i.e., liquid assets) over total assets (column 3), and an indicator for whether its ratio of cash and central-bank reserves over total assets is the top tercile of the bank-level distribution (column 4), all measured at the beginning of the sample period (Q3 2010). In columns 5 and 6, *Bank characteristic*$_{bt-1}$ is based on the share of non-performing loans (NPLs) out of total loans, and the respective variable in column 6 is an indicator for whether bank b's share of NPLs out of total loans is in the top tercile of the bank-level distribution, in quarter $t-1$. Robust standard errors (clustered at the bank level) are in parentheses.

Table 6: The Effect of Funding Costs on Banks' Balance Sheets

Variable	ln(Total assets) (1)	Equity ratio (2)	Liquidity ratio (3)	Interbank/Assets (4)
Deposit ratio × Gap	0.036	0.004	-0.023	-0.010
	(0.145)	(0.015)	(0.032)	(0.056)
Deposit ratio	-0.983**	0.033	0.001	-0.018
	(0.471)	(0.031)	(0.042)	(0.151)
Bank FE	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y
N bank clusters	196	196	196	196
N	3,673	3,673	3,673	3,673
R^2	0.99	0.95	0.63	0.74

The level of observation is the bank-quarter level bt. The sample period is Q4 2010 to Q4 2015. The dependent variable in column 1 is the natural logarithm of total assets of bank b in quarter t. The dependent variable in column 2 is the ratio of equity over total assets of bank b in quarter t. The dependent variable in column 3 is the ratio of cash and central-bank reserves (i.e., liquid assets) over total assets of bank b in quarter t. The dependent variable in column 4 is the ratio of interbank loans and other banks' securities over total assets of bank b in quarter t. $\textit{Deposit ratio}_{bt-1}$ is the ratio of regulated deposits over total liabilities of bank b in quarter $t-1$. $\textit{Gap}_t$ is the difference between the rate on regulated deposits (livret A) and the ECB's deposit facility rate (in %) at the end of quarter t. Robust standard errors (clustered at the bank level) are in parentheses.

Table 7: Reallocation of Credit: Bank-county-level Data

Variable	Large firms / Corporate loans (1)	Large firms / Total loans (2)	Small firms / Total loans (3)	Loans to self-employed / Total loans (4)	High-bankruptcy industries / Total loans (5)	Risky firms / Rated firms (6)	MLT loans / Total loans (7)
Deposit ratio × Gap	-0.122***	-0.034**	0.064***	0.026***	0.146**	0.133**	0.039*
	(0.045)	(0.016)	(0.023)	(0.007)	(0.063)	(0.060)	(0.023)
Deposit ratio	0.425***	0.109**	-0.176***	-0.058**	-0.041	-0.310*	-0.046
	(0.154)	(0.046)	(0.062)	(0.023)	(0.187)	(0.170)	(0.061)
Bank-county FE	Y	Y	Y	Y	Y	Y	Y
County-quarter FE	Y	Y	Y	Y	Y	Y	Y
BHC-quarter FE	Y	Y	Y	Y	Y	Y	Y
N county clusters	148	148	148	148	146	138	148
N	28,063	28,063	28,063	28,063	27,139	26,336	28,063
R^2	0.69	0.71	0.74	0.96	0.78	0.71	0.88

The level of observation is all credit granted by bank b's branch(es) in county c in quarter t. The sample period is Q4 2010 to Q4 2015. The dependent variable in column 1 is the ratio of loans to large firms (with sales in excess of 1m €) over corporate loans of bank b's branch(es) in county c in quarter t. The dependent variable in column 2 is the ratio of loans to large firms over total loans of bank b's branch(es) in county c in quarter t. The dependent variable in column 3 is the ratio of loans to small firms (with sales up to 1m €) over total loans of bank b's branch(es) in county c in quarter t. The dependent variable in column 4 is the ratio of loans to self-employed individuals over total loans of bank b's branch(es) in county c in quarter t. The dependent variable in column 5 is the ratio of loans to firms in (three-digit) industries with above-median occurrences of bankruptcies over total loans of bank b's branch(es) in county c in quarter t. The dependent variable in column 6 is the ratio of loans to firms with a credit rating above 4 on the Banque de France's credit-rating scale (higher rating = closer to default) over all loans to rated firms (with balance-sheet data) granted by bank b's branch(es) in county c in quarter t. The dependent variable in column 7 is the ratio of medium- to long-term loans over total loans of bank b's branch(es) in county c in quarter t. $\textit{Deposit ratio}_{bt-1}$ is the ratio of regulated deposits over total liabilities of bank b in quarter $t-1$. $\textit{Gap}_t$ is the difference between the rate on regulated deposits (livret A) and the ECB's deposit facility rate (in %) at the end of quarter t. Robust standard errors (clustered at the bank level) are in parentheses.

Table 8: Aggregate Credit Effects of Funding-cost Shocks

	ln(Total credit)	$\frac{\text{Large firms}}{\text{Total credit}}$	$\frac{\text{High-bankruptcy ind.}}{\text{Total credit}}$	$\frac{\text{MLT credit}}{\text{Total credit}}$	ln(Total credit)	$\frac{\text{Large firms}}{\text{Total credit}}$	$\frac{\text{High-bankruptcy ind.}}{\text{Total credit}}$	$\frac{\text{MLT credit}}{\text{Total credit}}$
Sample	All	All	All	All	> 5 firms	> 5 firms	> 5 firms	> 5 firms
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Deposit ratio × Gap	-0.143***	-0.080***	0.062***	0.064***	-0.362***	-0.126***	0.124***	0.045***
	(0.055)	(0.014)	(0.020)	(0.017)	(0.059)	(0.025)	(0.025)	(0.016)
Deposit ratio	0.027	-0.012	-0.260***	0.173***	-0.906***	-0.125**	-0.213***	-0.002
	(0.109)	(0.027)	(0.040)	(0.033)	(0.140)	(0.053)	(0.054)	(0.031)
ZIP-code FE	Y	Y	Y	Y	Y	Y	Y	Y
County-quarter FE	Y	Y	Y	Y	Y	Y	Y	Y
N ZIP-code clusters	33,046	33,046	33,035	33,046	19,142	19,142	19,140	19,142
N	664,654	664,654	663,190	664,654	353,722	353,722	353,655	353,722
R^2	0.96	0.87	0.80	0.68	0.97	0.87	0.80	0.76

The level of observation is the ZIP-code-quarter level kt. The sample period is Q4 2010 to Q4 2015. In the last four columns, the sample is limited to ZIP codes with more than five firms (with records in the credit registry). The dependent variable in columns 1 and 5 is the natural logarithm of the total euro amount of debt outstanding of all firms in ZIP code k in quarter t. The dependent variable in columns 2 and 6 is the ratio of all loans accruing to large firms (with sales in excess of 1m €) over the total euro amount of debt outstanding of all firms in ZIP code k in quarter t. The dependent variable in columns 3 and 7 is the ratio of all loans accruing to firms in (three-digit) industries with above-median occurrences of bankruptcies over the total euro amount of debt outstanding of all firms in ZIP code k in quarter t. The dependent variable in columns 4 and 8 is the ratio of all medium- to long-term loans over the total euro amount of debt outstanding of all firms in ZIP code k in quarter t. $\textit{Deposit ratio}_{kt-1}$ is the loan-exposure-weighted average $\textit{Deposit ratio}_{bt-1}$ of all firms in ZIP code k in quarter $t-1$ (see (2)), where $\textit{Deposit ratio}_{bt-1}$ is the ratio of regulated deposits over total liabilities of bank b in quarter $t-1$. $\textit{Gap}_t$ is the difference between the rate on regulated deposits (livret A) and the ECB's deposit facility rate (in %) at the end of quarter t. Robust standard errors (clustered at the ZIP-code level) are in parentheses.

Table 9: Firm-level Real Effects of Funding-cost Shocks

Variable	ln(Capital assets) (1)	ln(PP&E) (2)	$\frac{\text{CapEx}}{\text{Capital assets}}$ (3)	$\frac{\text{Tangible investment}}{\text{PP\&E}}$ (4)	ln(Employment) (5)
Deposit ratio × Gap	-0.036**	-0.054***	-0.064***	-0.040***	-0.014
	(0.016)	(0.017)	(0.025)	(0.015)	(0.011)
Deposit ratio	0.165***	0.206***	0.055	0.040	0.028
	(0.032)	(0.033)	(0.044)	(0.027)	(0.022)
Firm FE	Y	Y	Y	Y	Y
County-ind.-yr. FE	Y	Y	Y	Y	Y
N firm clusters	84,015	84,015	84,015	84,015	84,015
N	380,657	380,657	380,657	380,657	380,657
R^2	0.97	0.97	0.43	0.42	0.97

The level of observation is the firm-year level ft. Furthermore, the sample is limited to rated firms (with available balance-sheet data). The sample period is 2010 to 2015. All dependent variables are measured at the firm-year level ft. $CapEx_{ft}$ is computed as the sum of firm f's tangible and intangible investment in year t. $Deposit\ ratio_{ft-1}$ is the loan-exposure-weighted average $Deposit\ ratio_{bt-1}$ of all bank branches lending to firm f in quarter $t-1$, where $Deposit\ ratio_{bt-1}$ is the ratio of regulated deposits over total liabilities of bank b in quarter $t-1$. Gap_t is the difference between the rate on regulated deposits (livret A) and the ECB's deposit facility rate (in %) at the end of quarter t. Industry fixed effects are measured at the "Naf" three-digit level. Robust standard errors (clustered at the firm level) are in parentheses.

ONLINE APPENDIX

A Supplementary Tables

Table A.1: Effect of Funding Cost on Lending by Deposit-funded Banks: Control for Income from CDC Transfer

Variable	ln(Credit) (1)	ln(Credit) (2)	ln(Credit) (3)	ln(Credit) (4)	ln(Credit) (5)	ln(Credit) (6)	ln(Credit) (7)
Deposit ratio × Gap	-0.085***	-0.138***	-0.123**	-0.140***	-0.137***	-0.138***	
	(0.030)	(0.049)	(0.055)	(0.047)	(0.050)	(0.048)	
Deposit ratio	0.325***	0.280**	0.375**	0.257*	0.274**	0.261**	0.149
	(0.114)	(0.140)	(0.159)	(0.136)	(0.122)	(0.125)	(0.141)
Deposit ratio transferred to CDC	-0.370***	-0.289***	-0.228*	-0.291***	-0.298***	-0.299***	-0.303***
	(0.103)	(0.110)	(0.116)	(0.110)	(0.110)	(0.110)	(0.109)
Total deposit ratio × Gap			0.008				
			(0.022)				
Total deposit ratio			-0.157*				
			(0.089)				
Equity ratio × Gap				0.237		0.244	
				(0.222)		(0.214)	
Equity ratio				0.147		0.112	
				(0.566)		(0.541)	
Bank size × Gap					0.002	0.002	
					(0.002)	(0.002)	
Bank size					-0.012	-0.006	
					(0.036)	(0.036)	
Deposit ratio × Gap in top tercile							-0.116**
							(0.050)
Deposit ratio × Gap in 2nd tercile							-0.023
							(0.032)
Firm-bank-county FE	Y	Y	Y	Y	Y	Y	Y
Firm-quarter FE	Y	Y	Y	Y	Y	Y	Y
County-quarter FE	Y	Y	Y	Y	Y	Y	Y
BHC-quarter FE	N	Y	Y	Y	Y	Y	Y
N bank clusters	196	196	196	196	196	196	196
N	4,134,974	4,134,974	4,134,974	4,134,974	4,134,974	4,134,974	4,134,974
R^2	0.94	0.94	0.94	0.94	0.94	0.94	0.94

The level of observation is credit to firm f by bank b's branch(es) in county c in quarter t. The sample period is Q4 2010 to Q4 2015. The dependent variable is the natural logarithm of the euro amount of debt outstanding between firm f and bank b's branch(es) in county c in quarter t. *Deposit ratio*$_{bt-1}$ is the ratio of regulated deposits over total liabilities of bank b in quarter $t-1$. *Deposit ratio transferred to CDC*$_{bt-1}$ is the fraction of regulated deposits (no longer on bank b's balance sheet) transferred to the CDC over total liabilities of bank b in quarter $t-1$. *Total deposit ratio*$_{bt-1}$ is the ratio of all deposits over total liabilities of bank b in quarter $t-1$. *Equity ratio*$_{bt-1}$ is the ratio of equity over total assets of bank b in quarter $t-1$. *Bank size*$_{bt-1}$ is the natural logarithm of total assets of bank b in quarter $t-1$. *Gap*$_t$ is the difference between the rate on regulated deposits (livret A) and the ECB's deposit facility rate (in %) at the end of quarter t. *Gap in top* (2^{nd}) *tercile*$_t$ is a dummy variable for whether *Gap*$_t$ ranges in the top (middle) tercile of its distribution. Robust standard errors (clustered at the bank level) are in parentheses.

Table A.2: Effect of Funding Cost on Lending by Deposit-funded Banks: Robustness

	ln(Credit)	ln(Credit)	ln(Credit)	ln(Credit)
Deposits	Regulated deposits + ordinary savings (branch level)		Regulated deposits + ordinary savings (bank level)	
Variable	(1)	(2)	(3)	(4)
Deposit ratio × Gap	-0.038**	-0.054**	-0.085***	-0.133***
	(0.018)	(0.021)	(0.025)	(0.038)
Deposit ratio	0.059	0.086*	0.133*	0.135
	(0.045)	(0.046)	(0.074)	(0.084)
Firm-bank-county FE	Y	Y	Y	Y
Firm-quarter FE	Y	Y	Y	Y
County-quarter FE	Y	Y	Y	Y
BHC-quarter FE	N	Y	N	Y
N bank clusters	204	204	196	196
N	5,267,366	5,267,366	4,134,974	4,134,974
R^2	0.94	0.94	0.94	0.94

The level of observation is credit to firm f by bank b's branch(es) in county c in quarter t. The sample period is Q1 2010 to Q4 2015 in the first two columns, and Q4 2010 to Q4 2015 in the last two columns. The dependent variable is the natural logarithm of the euro amount of debt outstanding between firm f and bank b's branch(es) in county c in quarter t. In the first two columns, $\textit{Deposit ratio}_{bct-1}$ is the ratio of regulated deposits plus ordinary savings accounts all over total deposits and commercial paper of bank b's branch(es) in county c in quarter $t-1$. In the last two columns, $\textit{Deposit ratio}_{bt-1}$ is the ratio of regulated deposits plus ordinary savings accounts all over total liabilities of bank b in quarter $t-1$. $\textit{Gap}_t$ is the difference between the rate on regulated deposits (livret A) and the ECB's deposit facility rate (in %) at the end of quarter t. Robust standard errors (clustered at the bank level) are in parentheses.

Table A.3: Effect of Funding Cost on Lending by Deposit-funded Banks: Firms with Balance-sheet Data

Variable	ln(Credit) (1)	ln(Credit) (2)	ln(Credit) (3)	ln(Credit) (4)	ln(Credit) (5)	ln(Credit) (6)	ln(Credit) (7)
Deposit ratio × Gap	-0.116***	-0.228***	-0.205***	-0.223***	-0.226***	-0.219***	
	(0.037)	(0.069)	(0.078)	(0.067)	(0.070)	(0.067)	
Deposit ratio	0.207	0.249	0.341	0.207	0.209	0.181	0.090
	(0.153)	(0.188)	(0.223)	(0.172)	(0.156)	(0.152)	(0.186)
Total deposit ratio × Gap			-0.003				
			(0.034)				
Total deposit ratio			-0.135				
			(0.115)				
Equity ratio × Gap				0.366		0.412	
				(0.337)		(0.317)	
Equity ratio				-0.046		-0.237	
				(0.721)		(0.670)	
Bank size × Gap					0.003	0.004	
					(0.003)	(0.003)	
Bank size					-0.028	-0.024	
					(0.053)	(0.052)	
Deposit ratio × Gap in top tercile							-0.187***
							(0.073)
Deposit ratio × Gap in 2^{nd} tercile							-0.084
							(0.054)
Firm-bank-county FE	Y	Y	Y	Y	Y	Y	Y
Firm-quarter FE	Y	Y	Y	Y	Y	Y	Y
County-quarter FE	Y	Y	Y	Y	Y	Y	Y
BHC-quarter FE	N	Y	Y	Y	Y	Y	Y
N bank clusters	158	158	158	158	158	158	158
N	1,625,830	1,625,830	1,625,830	1,625,830	1,625,830	1,625,830	1,625,830
R^2	0.92	0.92	0.92	0.92	0.92	0.92	0.92

The level of observation is credit to firm f by bank b's branch(es) in county c in quarter t. Furthermore, the sample is limited to firms with available balance-sheet data. The sample period is Q4 2010 to Q4 2015. The dependent variable is the natural logarithm of the euro amount of debt outstanding between firm f and bank b's branch(es) in county c in quarter t. $\textit{Deposit ratio}_{bt-1}$ is the ratio of regulated deposits over total liabilities of bank b in quarter $t-1$. $\textit{Total deposit ratio}_{bt-1}$ is the ratio of all deposits over total liabilities of bank b in quarter $t-1$. $\textit{Equity ratio}_{bt-1}$ is the ratio of equity over total assets of bank b in quarter $t-1$. $\textit{Bank size}_{bt-1}$ is the natural logarithm of total assets of bank b in quarter $t-1$. $\textit{Gap}_t$ is the difference between the rate on regulated deposits (livret A) and the ECB's deposit facility rate (in %) at the end of quarter t. $\textit{Gap in top } (2^{nd}) \textit{ tercile}_t$ is a dummy variable for whether $\textit{Gap}_t$ ranges in the top (middle) tercile of its distribution. Robust standard errors (clustered at the bank level) are in parentheses.

Table A.4: Effect of Funding Cost on Lending by Deposit-funded Banks: Robustness to Timing

Variable	ln(Credit) (1)	ln(Credit) (2)	ln(Credit) (3)	ln(Credit) (4)	ln(Credit) (5)	ln(Credit) (6)	ln(Credit) (7)
Deposit ratio$_{t-2}$ × Gap	-0.108***	-0.169***	-0.141**	-0.168***	-0.168***	-0.166***	
	(0.029)	(0.050)	(0.057)	(0.047)	(0.049)	(0.047)	
Deposit ratio$_{t-2}$	0.190**	0.194*	0.340**	0.181*	0.198**	0.192**	0.054
	(0.090)	(0.114)	(0.145)	(0.105)	(0.096)	(0.094)	(0.106)
Total deposit ratio$_{t-2}$ × Gap			0.019				
			(0.023)				
Total deposit ratio$_{t-2}$			-0.193**				
			(0.079)				
Equity ratio × Gap				0.253		0.259	
				(0.226)		(0.222)	
Equity ratio				0.254		0.329	
				(0.640)		(0.574)	
Bank size × Gap					0.001	0.001	
					(0.002)	(0.002)	
Bank size					-0.002	0.008	
					(0.034)	(0.032)	
Deposit ratio$_{t-2}$ × Gap in top tercile							-0.133***
							(0.048)
Deposit ratio$_{t-2}$ × Gap in 2^{nd} tercile							-0.048
							(0.033)
Firm-bank-county FE	Y	Y	Y	Y	Y	Y	Y
Firm-quarter FE	Y	Y	Y	Y	Y	Y	Y
County-quarter FE	Y	Y	Y	Y	Y	Y	Y
BHC-quarter FE	N	Y	Y	Y	Y	Y	Y
N bank clusters	196	196	196	196	196	196	196
N	3,962,890	3,962,886	3,962,886	3,962,886	3,962,886	3,962,886	3,962,886
R^2	0.94	0.94	0.94	0.94	0.94	0.94	0.94

The level of observation is credit to firm f by bank b's branch(es) in county c in quarter t. The sample period is Q1 2011 to Q4 2015. The dependent variable is the natural logarithm of the euro amount of debt outstanding between firm f and bank b's branch(es) in county c in quarter t. *Deposit ratio*$_{bt-2}$ is the ratio of regulated deposits over total liabilities of bank b in quarter $t-2$. *Total deposit ratio*$_{bt-2}$ is the ratio of all deposits over total liabilities of bank b in quarter $t-2$. *Equity ratio*$_{bt-1}$ is the ratio of equity over total assets of bank b in quarter $t-1$. *Bank size*$_{bt-1}$ is the natural logarithm of total assets of bank b in quarter $t-1$. *Gap*$_t$ is the difference between the rate on regulated deposits (livret A) and the ECB's deposit facility rate (in %) at the end of quarter t. *Gap in top* (2^{nd}) *tercile*$_t$ is a dummy variable for whether *Gap*$_t$ ranges in the top (middle) tercile of its distribution. Robust standard errors (clustered at the bank level) are in parentheses.

B Supplementary Figures

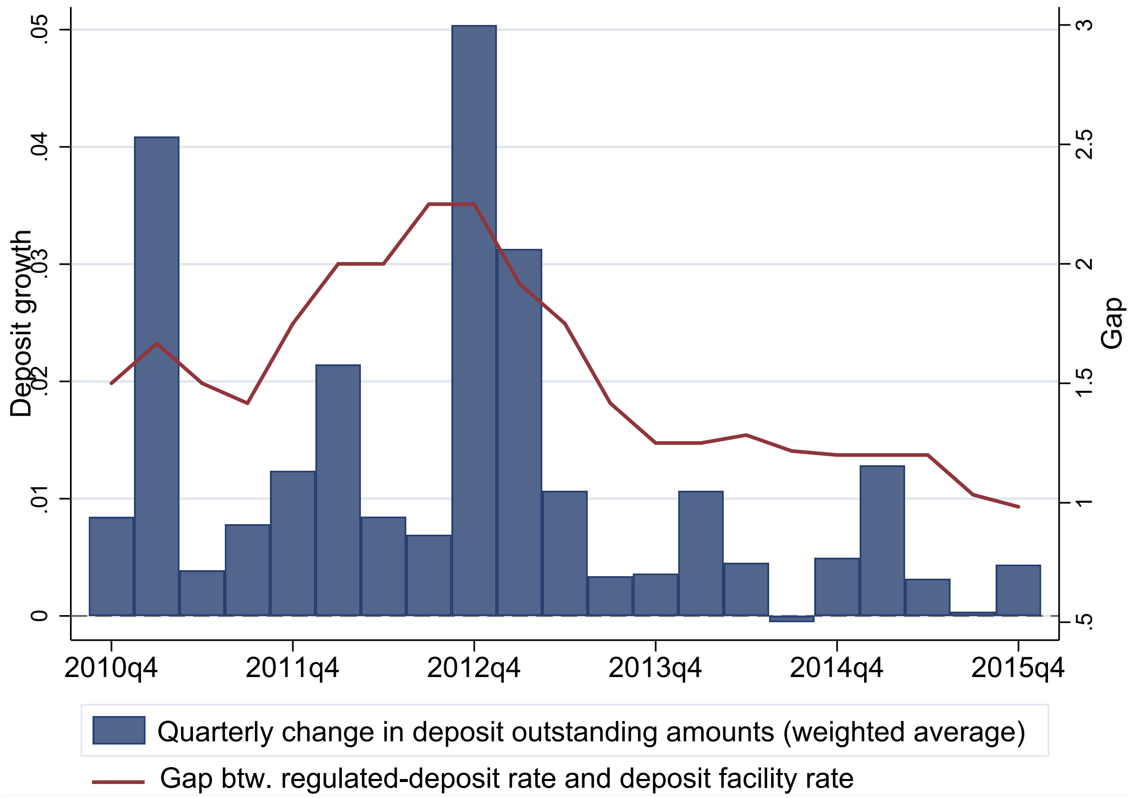

Figure B.1: **Sensitivity of Regulated Deposits to Funding-cost Gap.** This figure shows the quarterly growth rate in the weighted average of post-transfer regulated deposits at the bank level (accounting for entry and exit, as in Davis and Haltiwanger, 1992), $\frac{Deposits_{bdt} - Deposits_{bdt-1}}{0.5(Deposits_{bdt} + Deposits_{bdt-1})}$, alongside the evolution of the gap between the livret-A rate and the ECB's deposit facility rate from Q4 2010 to Q4 2015.