Sticky Deposit Rates and Allocative Effects of Monetary Policy

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ABSTRACT

This paper documents that monetary policy affects credit supply through banks' cost of funding. Using administrative credit-registry and regulatory bank data, we find that banks can incur an increase in their funding costs of at least 30 basis points before they adjust their lending. For identification, we exploit the existence of regulated-deposit accounts in France whose interest rates are set by the government and are, thus, not directly affected by the monetary-policy rate. When banks' funding cost increases and they contract their lending, we observe portfolio reallocations consistent with risk shifting: banks that depend on regulated deposits lend less to large firms, and relatively more to small firms and entrepreneurs.[4]

Keywords: Monetary-policy transmission; deposits; credit supply; SMEs; savings.

JEL classification: E23, E32, E44, G20, G21, L14

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Non-Technical Summary

By exploiting instances in which banks cannot adjust deposit rates in response to monetary policy, we show that monetary policy impacts banks' funding cost, causing them to adjust their supply of credit to the real economy.

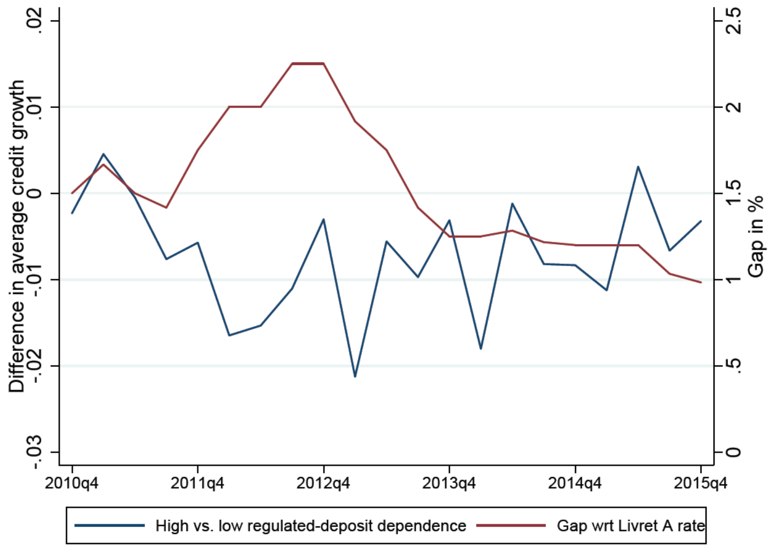
Our experiment is based on the existence of regulated-deposit accounts offered to households in France. Unlike regular savings accounts, the rate on regulated deposits is not determined by the banks themselves. It does not depend directly on the monetary-policy rate either but is, instead, set by the government up to twice per year.

Figure 1 below provides simple graphical evidence for how the stickiness of regulated-deposit rates differentially affects the lending behavior of banks reliant on them as opposed to other sources of financing. The negative relationship between the differential credit growth and the funding-cost gap suggests that higher average cost of funding for regulated-deposit dependent banks induces them to lend less. This result is confirmed in our econometric analysis. We estimate that banks can sustain at least 30 basis points higher funding cost until monetary policy actually has contractionary effects. This results in a sizable aggregate effect for the real economy including a drop in investment, as we show that borrowers can neither substitute credit across lenders nor switch to other sources of funding.

As the cost of funding changes, banks also have incentives for risk taking and rebalancing their loan portfolios, leading not only to a shift in the overall amount of credit supplied, but also to a reallocation across different borrowers and types of loans. They primarily contract lending for their large borrowers, leading to an increase in the exposition of their loan portfolio to smaller, younger, and riskier firms. They also reduce their proportion of loans to household mortgages, which are relatively safe in France.

Besides pointing to an important role of credit supply for the distributional consequences of monetary policy, our results also speak to the potential spillover effects of assets with stable returns for the distribution of liquidity and thus the aggregate stability of the banking system.

Funding-cost Gap and Lending by Regulated-deposit Dependent Banks.



Note: 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 Q42015.

Rigidité des taux de dépôts et effets réallocatifs de la politique monétaire

RÉSUMÉ

Cet article montre que la politique monétaire affecte l'offre de crédit par le biais du coût de financement des banques. En utilisant des données individuelles issues du registre du crédit de la Banque de France et des données réglementaires bancaires, nous constatons que les banques peuvent subir une augmentation de leurs coûts de financement d'au moins 30 points de base avant d'ajuster leur offre de crédit. Notre stratégie d'identification exploite l'existence de comptes de dépôt à taux réglementé en France, dont les taux d'intérêt sont fixés par le gouvernement et ne sont donc pas directement affectés par le taux de la politique monétaire. Lorsque le coût de financement des banques augmente et qu'elles resserrent leur octroi de crédit, nous observons également une réallocation des portefeuilles de prêt signe de la recherche d'une prise de risque accrue: les banques qui dépendent des dépôts réglementés prêtent moins aux grandes entreprises et relativement plus aux petites entreprises et aux entrepreneurs.

Mots-clés : transmission de la politique monétaire ; dépôts ; octroi de crédit ; PME ; épargne.

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1 Introduction

Do bank liabilities matter for the transmission of monetary policy to the production side, and if so, how the heterogeneity of banks and firm characteristics conditions the magnitude of the transmission?

A growing body of work argues that the potency of monetary policy depends on banks' balance sheets and, in particular, their deposit-taking function. If monetary policy affects the supply of deposits or the cost thereof, then 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)) or due to a zero lower bound on deposit rates in spite of negative monetary-policy rates (Heider, Saidi, and Schepens (2019)). However, deposit rates are ultimately set by banks themselves whose lending responses, thus, cannot be reliably related to the role of deposit funding for the transmission of monetary policy.

In this paper, we argue that banks' funding cost is relevant for the effectiveness of monetary policy in stimulating bank lending. By exploiting instances in which deposit rates cannot be adjusted by banks in response to monetary policy, we show that monetary policy impacts banks' funding cost, causing them to adjust their supply of credit. This results in a sizable aggregate effect for the real economy. As the cost of funding changes, banks also have incentives for risk taking and rebalancing their loan portfolios, leading not only to a shift in the overall amount of credit supplied, but also to a reallocation across different borrowers, types of loans, and locations.

We conduct our analysis by assembling multiple administrative datasets from the Banque de France over the period 2010–2015 to obtain information on bank lending across France, borrower types (firms and households), loan characteristics (maturity, size, and risk), banks' funding structure and a detailed breakdown of sources of deposits, and their borrowers' balance sheets.

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 not determined by the banks themselves. It does not depend directly on the monetary-policy rate either but is, instead, guaranteed and set by the government up to twice per year so as to preserve households' purchasing power. This institutionalized stickiness in deposit rates implies that fluctuations in the monetary-policy rate will affect banks' funding cost, depending on the extent to which they rely on regulated deposits for funding purposes.

As France is part of the euro area, monetary-policy rates are set by the European Central Bank (ECB), an independent central bank which tries to maximize outcomes across 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. This is important because despite the institutionalized stickiness in deposit rates, variations in banks' funding cost could still be correlated with macroeconomic variables driving credit demand if the monetary-policy rate was set by the French central bank. 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, e.g., Maddaloni and Peydró (2011)).

In addition, we measure banks' cost of funding as a function of the difference between the rate on regulated deposits and the eurozone-wide policy rate. In doing so, we exploit a unique feature of regulated deposits, namely that the rates on these accounts, and the subsequent cost of funding for banks relying on them, are not set by the banks themselves. This gives rise to differences in funding costs incurred by banks that rely more on regulated deposits vs. banks whose cost of funding is aligned with the ECB's monetary-policy rate. The sign of this funding-cost gap is not necessarily related to whether the ECB's monetary policy is contractionary or expansionary, so that our results are purely driven by cross-sectional differences in banks' funding costs due to differential pass-through of monetary-policy rates. Finally, our sample ends in 2015 so as to preclude any confounding effects with other measures undertaken by the ECB in more recent years, such as their asset-purchase programs.

Using data at the bank-firm-time level, we find that when the gap between the rate on regulated deposits and the monetary-policy rate changes, treated banks reliant on regulated deposits, as opposed to a control group of banks that may rely on other deposit accounts or the interbank market, alter their lending. In particular, when the funding-cost gap widens by 1 percentage point, banks at the 75^{th} percentile of the regulated-deposit ratio distribution contract their lending by 4.3% relative to banks at the 25^{th} percentile. By exploiting time-varying differences in banks' funding cost that arise independently from the actual monetary policy, we can assess at what point imperfect pass-through of monetary-policy rates giving rise to higher funding cost induces banks to reduce their lending. We estimate that banks can sustain at least 30 basis points higher funding cost until monetary policy actually has contractionary effects.

Changes in banks' net-interest margin driven by monetary-policy fluctuations affect not only the total amount of credit supplied but also the composition of loan portfolios of exposed banks, leading to important reallocation of loans across borrowers and loan characteristics. Across borrowers, we find that when facing higher cost of funding, exposed banks engage in "search for yield" behavior. They primarily contract lending for their large borrowers, leading to an increase in the exposition of their loan portfolio to smaller, younger, and riskier firms. They also reduce their proportion of loans to household mortgages, which are relatively safe in France.

Across loan types, we find that when banks funded by regulated deposits face relatively higher funding cost, they extend more long-term loans. By increasing the average maturity of their loans and thereby matching the impairment in the pass-through of monetary-policy rates on their liabilities side with that on their asset side, treated banks attempt to counteract the adverse effect on their net-interest margin when monetary policy is expansionary.

These results rely on within-borrower and 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. Lacking aggregate effects despite large relative within-borrower effects are possible for two reasons. First, if exposed borrowers can easily switch from affected to non-affected banks, our earlier specifications might simply document a pure swap in lender identity, with no real effect for the overall amount of bank credit distributed in the economy (e.g., Greenstone, Max, and Nguyen (2020)). Second, even if bank credit declines, borrowers might be able to switch to other sources of funding to maintain their investment and other activities.

We address the first issue by implementing a "local lending market" approach, where we aggregate all the credit provided at the city level. We find that even at this broader level of aggregation, cities with a higher fraction of loans supplied by banks dependent on regulated deposits experience a sizable drop in credit following variations in banks' cost of funding stemming from regulated deposits. Importantly, this city-level effect exhibits a similar economic magnitude as the micro effect at the bank-firm level. This suggests that unaffected banks are not able to pick up the unserved credit demand when banks reliant on regulated deposits experience higher funding cost.

To address the second issue, we trace credit-supply shocks to firms' balance sheets, and estimate their real effects. We find that firms more exposed to regulated-deposit dependent banks cut their investment in terms of capital expenditure, tangible fixed assets, and total assets when the funding-cost gap widens.

As banks are differentially affected, we also investigate whether variations in banks' cost of funding have repercussions for the market structure of banks, and indeed find this to be the case. In periods of higher cost of funding stemming from regulated deposits, affected banks rebalance their loan portfolios, and local credit markets subsequently become more concentrated.

While our credit results are obtained using standard "within-firm estimators" (Khwaja and Mian (2008)) that absorb credit demand, we cannot, by definition, control for time-varying unobserved heterogeneity across banks. Therefore, a lingering concern regarding our identification lies in the correlation of banks' funding structure with other bank characteristics that may drive their bank lending decisions. We tackle this possibility of omitted variables in several ways. First, we exploit the fact that variations across banks in their reliance on regulated deposits are also driven by differences in regulatory obligations. Indeed, banks have to transfer some of their regulated deposits to a special fund operated by a state-owned financial institution that uses those funds to finance social housing. Importantly for our identification, the proportion of transferable funds varies not only across (types of) banks but also over time, providing us with regulatory-driven differences in reliance on regulated deposits, instead of variations derived from banks' endogenous decisions on their liability structure.

Second, we show that our results hold up to including banks' county-by-time fixed effects, thereby removing local geographical shocks that may differentially affect banks' other sources of funding or their lending decisions. We also make use of the fact that banks in France to a large degree belong to a few large banking groups, and include banking group-by-time fixed effects, thereby using only variation across banks belonging to the same group. To the extent that the largest additional funding shocks (such as a run on the wholesale funding market, as in Pérignon, Thesmar, and Vuillemey (2018)) occur at the group level, these shocks will be differenced out. Third, we show that our results are robust to refining our control group by separating deposit-funded from interbank-funded banks. In this manner, we can compare regulated-deposit dependent banks with banks funded by any other kind of deposits, and continue to find the same treatment effect.

Our paper contributes to the literature that relates the transmission of monetary policy (e.g., Gertler and Kiyotaki (2010)) to banks' balance sheets, affecting 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)). In contrast, we point out the role of banks' deposit funding for monetary-policy transmission. As such, our paper naturally relates to studies that document if and how monetary policy is transmitted to deposit rates. In this regard, deposit rates are typically thought to be upward sticky but downward flexible (Hannan and Berger (1991), Driscoll and Judson (2013)). Our paper contributes to this literature by identifying 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 cost to explain bank lending behavior.

Importantly, our identification strategy enables us to estimate the causal effect of banks' funding cost for the transmission of monetary policy to credit supply. We hold constant a host of other bank-level variables that may affect banks' funding costs and, as such, monetary-policy transmission. In particular, our bank-level cross-sectional heterogeneity in funding costs is independent of bank capital, which reduces the cost of funding according to Kashyap and Stein (2000) and Gambacorta and Shin (2018), because we exploit banks' composition, rather than level, of (deposit) liabilities.

More generally, our paper is related to a nascent literature that identifies imperfect pass-through of monetary-policy rates to banks' asset side (lending rates) or liabilities side (cost of funding, e.g., deposits). In Drechsler, Savov, and Schnabl (2017), the pass-through of monetary-policy rates to deposit rates is impaired in the absence of perfect competition for deposits. That is, if the monetary-policy rate increases, banks increase the spreads they charge on deposits in concentrated markets. This, in turn, leads to a credit contraction as deposits flow out of the system.[1]

In a similar vein, Wang, Whited, Wu, and Xiao (2019) 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 (2020) 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 to an offsetting effect owing to higher earnings on the asset side.

Heider, Saidi, and Schepens (2019) present an example of imperfect pass-through of monetary policy in interaction with the specificity of the monetary policy under consideration. Namely, they show that when monetary-policy rates drop below zero (as is the case in the euro area since June 2014), banks that are funded primarily by deposits lend less and to riskier firms because deposit-funded banks are constrained in their ability to pass on negative rates to their depositors. As such, high-deposit banks face higher cost of funding. Heider, Saidi, and Schepens (2019) thus point out that the transmission of monetary policy under what was believed to be the zero lower bound is special. Another example of state-contingent monetary-policy transmission is Acharya, Imbierowicz, Steffen, and Teichmann (2019) who show that the transmission can be impaired due to financial stability.

Our paper constitutes a unique example of imperfect pass-through of monetary policy to deposit rates. The rate on regulated-deposit accounts is set by the government, and not by the banks themselves. This gives rise to funding-cost shocks that are orthogonal to all of the forces discussed in the literature to date. We show that imperfect pass-through can arise irrespective of whether monetary policy is expansionary or contractionary, nor does it depend on bank competition.

Finally, we have assembled 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 bank supply to large and small firms alike, entrepreneurs, and households. We do not only characterize the effect of monetary policy and funding-cost shocks on bank lending, but we can also characterize any allocative effects stemming from these bank lending decisions. In this manner, we contribute to a growing literature that analyzes the heterogenous effects of monetary policy, giving rise to inequality (Auclert (2019) and Gornemann, Kuester, and Nakajima (2019)). Our results point to a role of credit supply for the distributional effects of monetary policy.

[1] 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.

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. Regulated deposits are guaranteed by the government, pay interests which are fully or partially tax-exempt, at a rate set by law: banks cannot adjust it following monetary-policy changes.

2.1.1 Livret A and Regulated Deposits

The livret A is 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.

The return on savings deposited in livret A is set and guaranteed by the government according to a rule designed to preserve households' purchasing power. The remuneration rate of the livret A 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.

Over our sample period from 2010 to 2015, the formula for the remuneration 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%.

The French Central Bank may deviate from this revision procedure in the event of steep increases or drops in the inflation rate or in money market rates. In addition, there are instances in which the rate is not adjusted according to the above-mentioned formula, e.g., in situations where the calculation would lead to a rate that would not allow for the preservation of household purchasing power. In such cases, the governor of the French central bank has the right to propose to the government not to apply the new rate. Similarly, the government may decide not to apply the formula.

This veto procedure adds to the stickiness in livret-A rates. Within only two years in our sample period, multiple such instances occurred, implying both upward and downward stickiness. 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%.

This incidence was followed by three cases of downward stickiness. 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%.

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.[2] Regulated-deposit accounts also include other types of savings accounts, with smaller volumes than the livret A, whose rates are pegged to the livret-A rate (LDD, Livret Jeunes, LEP, PEL, and CEL).

2.1.2 Geography of Regulated Deposits and Income

As they are risk-free, tax-free, highly liquid, and have a very low entry threshold (minimum deposits of €15), livret-A accounts are a very popular savings scheme for medium- and low-income households subject to income tax. The distribution of savings under the livret A is very skewed, with 9% of the accounts comprising more than 45% of the deposits in 2016. Thus, the richer areas in France have higher absolute amounts of regulated deposits.

However, in areas with lower income, households have less diversified savings, and banks subsequently have less diversified sources of funding. Thus, banks' ratios of regulated deposits over bank liabilities tend to be higher in relatively poor areas. As a result, the geographic distribution of median income in France is negatively correlated with bank dependence on regulated-deposit funding (see Figures 1 and 2). This feature has been steady over time, at a correlation between county median income and the average county deposit ratio of -0.55 in 2010 and -0.57 in 2015.[3]

2.1.3 Implications for Banks' Funding Cost

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

[2] 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.

[3] The average county deposit ratio is the weighted mean of deposit ratios of all banks operating in a given county at that time based on their market shares in lending.

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.

In Figure 3, 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. Importantly, there is no discernible relationship between the funding-cost gap and the actual monetary-policy stance. For instance, from 2010 to 2013, the ECB's monetary policy is both contractionary and expansionary, whereas the funding-cost gap tends to increase over the same time period.

Notably, these funding-cost gaps are unprecedented in other work that attempts to identify instances of imperfect pass-through of monetary policy to deposit rates at least in the euro area. For instance, in Heider, Saidi, and Schepens (2019), the largest gap between deposit rates, which hit the zero lower bound for retail depositors when the ECB introduced negative interest rates, and the ECB's deposit facility rate by the end of their sample in December 2015 is 30 basis points.

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). Among all regulated deposits, only those collected under the livret A and its equivalents (LDD and LEP) are subject to this transfer obligation ("eligible deposits").[4]

The share of eligible funds that have to be transferred to the CDC is set by law, and can vary 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.[5] 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.[6]

[4] 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.

[5] 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 and averages around 0.4%.

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

Finally, we explore to what extent (post-transfer) regulated deposits are sensitive to variation in the funding-cost gap. As can be seen in Figure 4, the growth rate of banks' regulated deposits comoves positively and contemporaneously with the funding-cost gap. This holds up to formally testing the relationship between regulated-deposit flows and variation in the funding-cost gap using bank-level data for four types of deposits – regulated (household) deposits, other household deposits, non-financial-corporation deposits, and any remaining deposits – at the quarterly frequency.

In Table 4, we document that the funding-cost gap is associated with a significantly higher growth rate for regulated deposits as opposed to all other types of deposits (column 1). In column 2, this estimate is broadly robust to controlling for any increases in the ceiling for regulated deposits, $\textit{Ceiling increase}_{dt-1}$. For instance, while the maximum amount that could be stored in a livret-A account used to be 15,300 €, the ceiling was increased to €19,125 and €22,950 euros in October 2012 and January 2013, respectively. Similarly, the ceiling for LDD was increased from initially €6,000 to €12,000 in September 2012. While these ceiling increases could explain larger inflows of regulated deposits – and the positive coefficient on the respective variable indicates this – they do not explain away regulated-deposit inflows following changes in the funding-cost gap.

This correlation is robust to additionally accounting for time-varying unobserved heterogeneity at the bank level by controlling for bank-time fixed effects in columns 3 and 4. Finally, in columns 5 and 6, instead of using growth rates on the left-hand side, we include bank by deposit type fixed effects, and use as dependent variable the natural logarithm of the total amount of deposits outstanding (for each deposit type). All six estimates are quantitatively similar: an increase in the funding-cost gap by one percentage point is associated with an increase in regulated, as opposed to any other, deposits on banks' balance sheets by 2 to 7%.

These findings suggest, first, that banks' reliance on regulated deposits should be used as a time-varying, rather than a time-invariant, exposure variable. Second, we can infer from these estimates that an increase in the funding-cost gap is associated with an increase in regulated-deposit dependent banks' average cost of funding, as the latter face not only higher regulated-deposit rates but also a larger inflow of regulated, as oppose to other, deposits.

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).

We focus our empirical analysis on French small and medium-sized enterprises (SMEs). We drop firms 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.). We observe close to the universe of such French firms.

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 (with the exception of entrepreneurs) based in France, provided the total exposure (i.e., the sum of all credit of any kind) of a bank to a firm exceeds €25,000. Credit is broken down by type (e.g., credit lines, account-receivables financing, export credit, leasing, etc.) and 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. 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. 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 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 and depositors (firms, individual entrepreneurs, households, non-profit organizations, insurance companies and pension funds, administrations). Using these data, we can disentangle regulated deposits from ordinary savings accounts.

Regulated deposits include livret A, which represent one-third of such deposits, as well as other types of savings accounts the rate on which is 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.

Banks only keep a fraction of some of these deposits on their balance sheets, as they have the legal obligation to rechannel them to a state-owned entity (the CDC). We refer to such deposits as eligible deposits: livret A, LDD, and LEP deposits. Livret A account for 85% of eligible deposits. Banks keep 100% of all other types of regulated deposits (Livret Jeunes, PEL, and CEL).

We adjust our deposit ratios so as to take into account the net amount of eligible deposits, i.e., after rechanneling, 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 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.[7] Finally, we define the regulated-deposit ratio of bank b in quarter t as: $\textit{Deposit ratio}_{bt} = (Non - \textit{eligible deposits}_{bt} + \textit{Net eligible deposits}_{bt})/Total\ \textit{liabilities}_{bt}$. The data are available from Q4 2010 to Q4 2015.

In a robustness check, we use a second source of deposit information from regional data produced by the Banque de France (Cefit database). Credit and deposit data are collected at the level of local bank branches and aggregated, based on the location of the branch, at the bank-county level ("département"). The data are broken down by the same types of depositors as in the regulatory data, but cannot perfectly isolate regulated deposits. We can only observe "special deposits," defined as regulated deposits plus ordinary savings. 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.

Finally, we adjust deposit amounts for the percentage of deposits transferred to the CDC by using the same percentages as for the regulatory data, and by considering the fraction of eligible funds to be the same at the bank and bank-county levels. Let S_{bt} be the share of eligible deposits of bank b in quarter t, then: $\textit{Deposit ratio}_{bct} = (S_{bt} \times (1 - T_{bt}) \times \textit{Special deposits}_{bct} + (1 - S_{bt}) \times \textit{Special deposits}_{bct})/Total\ \textit{liabilities}_{bct}$. The data are available from Q1 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 (SMEs) with sales of €750,000 or more.[8]

Finally, 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

[7] 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.

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

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 deposit ratios at the bank-county-quarter and bank-quarter level, as well as the gap between between the rate on regulated deposits (livret A) and the ECB's deposit facility rate.

$Deposit\ ratio_{bt}$ tends to be smaller than $Deposit\ ratio_{bct}$ because the latter (i) is measured at the level of all branches of a given bank b in county c, (ii) does not consider only regulated deposits in the numerator, and (iii) uses a smaller denominator as a proxy for total liabilities. Having said this, regulated deposits make for a good third of total deposits and, thus, constitute an important source of retail funding. Gap_t, measured at the monthly level but used at the quarterly level in our analysis, ranges from approximately one to two percentage points, with a standard deviation of 0.4 percentage points.

In Panel B, we move to the firm-bank-county-quarter level, the level of observation for 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 – with the exception of firms' average rating, which comes from rating data merged with the credit registry – based on the Cefit dataset. The latter comprises information on all outstanding amounts of credit and deposits, including loans to households and individuals (such as entrepreneurs) 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 large firms with balance-sheet data.

In addition, we 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 focus much more on households and entrepreneurs, rather than firms, in their overall loan portfolio 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 (2020) that U.S. banks match their interest rate sensitivities in spite of a large maturity mismatch between their asset and liabilities side.

2.3 Identification

To identify whether regulated-deposit banks respond differently to a change in the ECB's monetary policy, we estimate the following specification:

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

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 $t-1$, 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. Standard errors are clustered at the bank level.

In estimating (1), we attempt to solve several issues of endogeneity that could arise. First of all, we exploit variation in exposure to regulated deposits, $\textit{Deposit ratio}_{bt}$, stemming from the fact that the share of regulated deposits that have to be transferred to the CDC is set by law, and can vary across banks b and over time t.

Furthermore, the granularity of our data allows us to saturate the specification with a plethora 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.

In such a setting, one faces the empirical challenge of disentangling loan demand from loan supply. Despite accounting for time-invariant heterogeneity in sorting motives, it is still possible that our bank-level shock is correlated with changes in credit demand. This would be the case, for instance, if firms whose investment decision is more sensitive to a change in the ECB's monetary policy are also paired with banks more dependent on regulated deposits. In this case, a positive shock to credit demand would result in higher loan amounts outstanding at regulated-deposit dependent banks.

To address this, we adopt a now common strategy, the inclusion of borrower-by-quarter fixed effects θ_{ft} to control for such time-varying unobserved heterogeneity at the firm level. The cost of this methodology 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. While only 26% of the firms in our sample borrow from multiple banks, these firms account for 61% of total credit.

Because borrowers are not necessarily located in the same county as the bank branches from which they attain loans, we can also include bank county-by-quarter fixed effects ψ_{ct}.[9] This set of fixed effects controls for local time-varying unobserved shocks that may affect the ability of bank branches to lend as it forces our coefficient of interest to be estimated by comparing two branches in the same county and the same quarter, and it does not exploit any between-county variation.

In addition, we also estimate (1) with banking-group-quarter fixed effects to control for developments at the more aggregate banking-group level that may also govern local lending decisions. We have 69 banking groups in our sample, and the three largest ones account, on average, for 69% of total credit over our sample period. Finally, we cluster standard errors at the bank level to account for serial correlation within lenders.

Our coefficient of interest is β_1 which captures to what extent banks that rely more on regulated deposits, rather than other types of short-term 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. Because of the above-described set of fixed effects, this coefficient is estimated by comparing different bank branches in the same county lending to the same firm over time, and, thus, reflects the elasticity of credit supply with respect to a change in the funding gap for banks more dependent on regulated deposits relative to others.

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:

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

Under the assumption that banks that rely on interbank funding experience perfect pass-through of the ECB's deposit facility (DF) rate to interbank-lending rates, β_1 in our regression thus captures the difference in funding costs incurred by banks that rely more on regulated deposits vs. banks whose cost of funding is aligned with the ECB's DF rate.

Despite the inclusion of our set of high-dimensional fixed effects, the main threat to our identification is that the extent to which banks rely on regulated deposits for their funding is to some degree a choice variable for the bank that might be correlated with other bank characteristics affecting how it reacts to a change in the ECB's monetary policy. By exploiting cross-sectional differences in banks' funding cost as a function of their reliance on regulated deposits, we address this concern in the following ways. First, variations in the funding-cost gap are not driven only by the ECB's monetary policy. As seen in Figure 3

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

and discussed above, it is entirely possible for the ECB to engage in expansionary monetary policy, which is arguably intended to increase bank lending, and for the funding-cost gap to increase at the same time, which should induce regulated-deposit dependent banks to contract their lending. Second, a large portion of the variation in regulated deposits that remain on banks' balance sheets is derived from regulation and is, thus, outside of banks' control.

3 Results

3.1 Average Effect on Credit Supply

We start with graphical evidence for how the stickiness of regulated-deposit rates differentially affects the lending behavior of banks reliant on them as opposed to other sources of financing. In Figure 5, we plot the funding-cost gap 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 the funding-cost gap suggests that, in line with our conjecture, higher average cost of funding for regulated-deposit dependent banks induces them to lend less.

To test this more formally, in the first column of Table 5, we estimate (1), using as $Deposit\ ratio_{bt-1}$ the ratio of regulated deposits over total liabilities in quarter $t-1$, and assigning the same value to all branches of bank b. We find that regulated-deposit dependent banks reduce their lending when the gap between the rate on these regulated deposits and the monetary-policy rate becomes larger.

This estimate becomes even larger after the inclusion of banking-group-quarter fixed effects in column 2, which is our preferred specification, suggesting very imperfect banking-group-level internal capital markets.[10] Using the estimate in column 2, when the funding-cost gap widens by 1 percentage point, banks at the 75^{th} percentile of the regulated-deposit ratio distribution contract their lending by $0.25 \times 1 \times 0.168 = 4.2\%$ (see Panel A of Table 2) relative to banks at the 25^{th} percentile.

As we argue in Section 2.1.1, we exploit the fact that rates on regulated deposits exhibit reduced sensitivity to monetary-policy rates due to the formula for livret-A rates. More than that, regulated-deposit rates are sticky because of the option to veto the application of the formula, which has been exercised multiple times during our sample period, by the governor of the Banque de France and the government alike. In fact, livret-A rates are downward sticky for this very reason for one and a half years of our total sample period of five years

[10] 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 be immune to any effects arising from deposits they collected in their own county.

and three months. Following these "surprise" events, Gap_t was 25 basis points higher than expected, implying a sizable reduction in credit supply of $0.25 \times 0.25 \times 0.168 = 1.05\%$ by banks at the 75^{th} percentile of the regulated-deposit ratio distribution relative to banks at the 25^{th} percentile.

So far, our coefficient of interest is estimated by comparing banks more dependent on regulated deposits with all other types of banks. Since regulated-deposit dependent banks are more likely to rely on deposit funding in general (see Table 3), the coefficient on $\textit{Deposit ratio}_{bt-1} \times Gap_t$ might be biased if deposit-funded banks generally react more strongly to the ECB's monetary policy. We address this problem in column 3 by including 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. Reassuringly, we find that 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).

In columns 4 to 6, we address the related concern that regulated-deposit dependent banks may have other bank balance-sheet characteristics that affect the transmission of monetary policy (e.g., Kashyap and Stein (2000)). 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. Not only are the respective coefficients all insignificant, but – most importantly – our coefficient of interest on $\textit{Deposit ratio}_{bt-1} \times Gap_t$ remains quantitatively unchanged compared to our baseline estimate in column 2.

In column 7, we replace the interaction effect of our treatment-intensity variable, $\textit{Deposit ratio}_{bt-1}$, 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 funding-cost gap of at least 150 basis points, and the middle tercile comprises all observations with a funding-cost gap of at least 120 (but fewer than 150) basis points. Therefore, the coefficient on $\textit{Deposit ratio}_{bt-1}$ now captures the differential effect for regulated-deposit dependent banks when the funding-cost gap is less than 120 basis points.

The baseline effect for $\textit{Deposit ratio}_{bt-1}$ and funding-cost gaps in the bottom tercile is insignificant and close to zero, whereas the treatment effect becomes negative only for funding-cost gaps in the top tercile. This difference in treatment effects between funding-cost gaps in the top vs. bottom tercile is significant at the 1% level. This implies that funding-cost gaps affect credit supply by regulated-deposit dependent banks only when they move from the bottom tercile, 95 to 120 basis points, to the top tercile, 150 to 225 basis points (see summary statistics in Table 2).

That is, when the funding-cost gap widens, regulated-deposit dependent banks contract their lending only when the funding-cost gap increases by 30 $(= 150-120)$ to 130 $(= 225-95)$ basis points. Put differently, banks can sustain at least 30 basis points higher funding cost until monetary policy actually has contractionary effects. This characterization matches well what one may label a "relative reversal rate" in the parlance of Brunnermeier and Koby

(2019). The relevance of this estimate stems from the fact that it is not derived from a specific monetary policy, contractionary or expansionary.

For comparison, in Heider, Saidi, and Schepens (2019), the zero lower bound on deposit rates induces a funding-cost gap between deposit-funded and non-deposit-funded banks after the introduction of negative monetary-policy rates. At the end of their sample period, said funding-cost gap amounts also to 30 basis points, implying a potentially similar "relative reversal rate." The estimate is, however, specific to a highly unconventional monetary policy, namely the introduction of negative rates, and equals the minimum of the above-mentioned range (from 30 to 130 basis points).

In light of the positive sensitivity of regulated deposits to the funding-cost gap (see Figure 4 and Table 4), it may be the case that the interaction term $\textit{Deposit ratio}_{bt-1} \times \textit{Gap}_t$ captures credit-supply effects for regulated-deposit dependent banks when the latter receive a larger inflow of such deposits. As such, the coefficient on $\textit{Deposit ratio}_{bt-1} \times \textit{Gap}_t$ would reflect, at least in part, the effect of higher *marginal* cost of funding rather than the effect of higher *average* cost of funding. To test whether the former is the case, we lag $\textit{Deposit ratio}_{bt-2}$ by another quarter so as to reduce the likelihood that the coefficient on the interaction term reflects the potential inflow of regulated deposits, and re-run all regressions from Table 5. The results in Appendix-Table A.1 are virtually unaltered, suggesting that we indeed capture the credit-supply effect of higher average cost of funding.

In Appendix-Table A.2, our results are also robust to controlling for $\textit{Deposit ratio transferred to CDC}_{bt-1}$, 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 $\textit{Gap}_t$, received by bank b in exchange for deposits transferred to the CDC for the purpose of financing social housing (cf. Section 2.1.3).

Finally, in Appendix-Table A.3, we show that our estimates are robust to different definitions of $\textit{Deposit ratio}_{bt}$. In the first two columns, we re-run the same specifications as in columns 1 and 2 of Table 5 using the most granular measure (at the bank-county level), namely special deposits (= regulated deposits + ordinary savings accounts) over total deposits and commercial paper (as a proxy for total liabilities). 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 5 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 Appendix-Table A.3 are similar to those in Table 5.

3.2 Reallocation of Credit

Banks affected by a change in their cost of funding might either alter their credit allocation across the board and maintain the composition of their loan portfolio, or decide to adjust the asset side of their balance sheet along multiple dimensions. In particular, affected banks may adjust their credit supply in terms of recipients' firm size, riskiness, borrower types (households vs. firms), and maturity.

To explore affected banks' loan-portfolio rebalancing, 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, including households and entrepreneurs (which are not covered in the credit registry).

In Table 6, 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 4, we estimate the adjustment of banks' loan portfolio in terms of borrower types, and use as dependent variables the ratios of loans accruing to different borrower types over bank b's total loan portfolio (from the bank-county-level dataset).

We find that following a widening of the funding-cost gap, regulated-deposit dependent banks reduce their loan exposure to large firms in the credit registry (with balance-sheet data, column 1) and mortgages (column 3), with an adjustment that is twice as large for mortgages. These banks compensate by reallocating loans to small firms in the credit registry (for which we do not have any balance-sheet data) for the most part (column 2) and to entrepreneurs (column 4). Note that this does not necessarily, and in fact does not, imply an increase in credit supply to small firms and entrepreneurs; instead, their relative importance in affected banks' loan portfolio increases.

The decomposition of the loan-portfolio reallocation across borrower types suggests a form of bank risk taking. When the gap between the rate of regulated deposits and the ECB's monetary-policy rate widens and the funding cost of regulated-deposit dependent banks subsequently increases, the latter banks increase their loan-portfolio exposure to smaller, more opaque and potentially riskier borrowers, and reduce their exposure to larger, more transparent firms and mortgages, which are relatively safe in France.[11]

We test this hypothesis more formally by computing the proportion of loans accruing to risky firms. To do so, we exploit the credit ratings assigned by the Banque de France, and consider a firm to be "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 large firms with balance-sheet information, so we need to limit the denominator of the dependent variable to said large firms. Column 5 reports the result, and shows that even within the pool of loans to large firms (for which credit supply is reduced, see

[11] Source: Annual report of the French prudential authority on mortgage finance

column 1), affected banks increase their loan exposure to risky firms when the funding-cost gap widens.

Finally, we explore whether banks adjust their maturity on top of the underlying risks of their loan portfolio. If the funding-cost gap increases because of expansionary monetary policy, banks that rely on regulated deposits and, thus, incur higher funding cost will have an incentive to increase the average maturity of their loans in an attempt to reduce the transmission of (lower) monetary-policy rates on their asset. We test this by computing the fraction of medium- to long-term loans in banks' loan portfolio and using it as dependent variable. The positive and significant coefficient on the interaction term $Deposit\ ratio_{bt-1} \times Gap_t$ indicates that when the funding-cost gap increases, treated banks increase the average maturity of their loan portfolio.

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 exposed banks during periods with a higher funding-cost gap is actually fully compensated for by an increase in the supply of credit by non-exposed banks. This could happen if borrowers can easily substitute credit across lenders.[12] In that case, our point estimate could be unbiased, but the conclusion in terms of economic consequences would be quite different. In fact, the reverse might be true, i.e., 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 to firms f in ZIP code k,[13] we weight the bank-level deposit ratio by the respective bank b's

[12] There are multiple reasons that can affect switching costs: the existence of a "stigma" when switching (e.g., Darmouni (2019)) 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)).

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

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 either the natural logarithm of the sum of all firms' loans in ZIP code k in quarter t, or the ratio of all large firms' loans over all remaining firms' loans in ZIP code k in quarter t; 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.

In column 1 of Table 7, we estimate equation (3) and use the natural logarithm of total credit as dependent variable. We find a large, negative coefficient, significant at the 1% level, implying that non-affected banks cannot perfectly compensate for the change in credit supply from affected banks. Indeed, when the funding-cost gap widens by 1 percentage point, cities at the 75^{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^{th} percentile, which is economically significant, albeit somewhat smaller than the corresponding effect at the micro level (see column 2 of Table 5). 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 7, we use as dependent variable the ratio of loans to large vs. small firms. Consistent with an important reallocation in the loan portfolios for affected banks, we find again a large negative and highly significant effect. Therefore, at the city level, credit contraction following a widening of the funding-cost gap affects primarily large firms rather than small firms, significantly shifting the ratio of loans accruing to these two groups in favor of micro firms (without balance-sheet data). These estimates become slightly larger after removing ZIP codes with at most five firms (with records in the credit registry) in the last two columns of Table 7.

The reallocation of credit from large to small firms suggests more equal access to credit for firms. It is less clear how it affects bank concentration in the credit market, with possible repercussions for financial stability (see, among others, Keeley (1990), Petersen and Rajan (1995), and Giannetti and Saidi (2019)).

In Table 8, we test this at the ZIP-code-quarter level (similar to Table 7). To compute meaningful measures of bank concentration based on the credit-registry data (comprising all firms), we limit the sample to cities with more than five firms. In column 1, we use as dependent variable a Herfindahl-Hirschman Index, ranging from 0 to 1, for credit concentration measured by loan amounts outstanding across all banks granting credit in a given year.

The coefficient on the interaction term $\textit{Deposit ratio}_{kt-1} \times \textit{Gap}_t$ is positive and significant. Cities with greater exposure to regulated-deposit dependent banks experience higher bank concentration in the credit market following funding-cost shocks. The economic significance of this effect is, however, modest. Even for a large increase in the regulated-deposit ratio at the city level, from the 5^{th} to the 95^{th} percentile, the subsequent reduction in credit concentration, evaluated at a $\textit{Gap}_t$ of 1 (percentage point), amounts to only $0.18 \times 0.048 = 0.009$, which corresponds to roughly 4% of a standard deviation of the HHI measure.

One potential conjecture would have been that as large firms tend to match with large banks, the reduction in lending to large firms may also lead to losses in market shares in the credit market primarily for large banks, implying a drop in bank concentration. At the same time, affected banks rebalance their loan portfolios in response to funding-cost shocks (see Table 6).

To see whether the overall increase in concentration can be explained by affected banks' loan-portfolio rebalancing, in columns 2 and 3, we calculate the same credit-concentration measure but focus on, respectively, medium- to long-term and short-term loans. Indeed, we find that the increase in credit concentration is particulary pronounced for medium- to long-term loans (column 2). This is in line with our previous finding that treated banks that rely on regulated deposits extend the maturity of their loans (see column 5 of Table 6) so as to reduce the transmission of monetary-policy rates on their asset side when they face higher funding cost.

3.4 Firm-level Real Effects

Given the magnitude of the change in credit supply to large firms (Table A.4) and the difficulty for firms facing a credit contraction to arbitrage across lenders (Table 7), it seems likely that changes in the ECB's monetary policy will have real effects via its impact on the funding-cost gap. 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 5 also pertain to the subsample of relatively large firms with balance-sheet data available, as we can estimate real effects only for these firms, which have sales of at least €750,000. For this purpose, in Appendix-Table A.4, we re-run the same specifications as in Table 5 on said sample of relatively large firms. All credit-based results continue to hold, and are even stronger than in the overall sample.

To estimate the real effects of banks' credit contraction, we run regressions at the firm-year level for the subsample of said large 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, $\textit{Deposit ratio}_{ft}$, 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:

$$y_{ft} = \beta_1 \textit{Deposit ratio}_{ft-1} \times \textit{Gap}_t + \beta_2 \textit{Deposit ratio}_{ft-1} + \psi_{cit} + \delta_f + \epsilon_{ft}, \qquad (4)$$

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 reduce their investment, both in general (column 1) and more specifically in terms of tangibles (column 2). In column 3, we also see that more exposed firms become smaller in terms of assets because of it: firms at the 75$^{\text{th}}$ percentile of the regulated-deposit ratio ($\textit{Deposit ratio}_{ft}$) distribution experience a drop in assets by $(0.21 - 0.03) \times 0.033 = 0.6\%$ (see Panel E of Table 2) relative to firms at the 25$^{\text{th}}$ percentile when the funding-cost gap widens by 1 percentage point. We also estimate a negative, albeit insignificant, effect on employment in column 4.

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 document that while such accounts are successful at attracting savings, they also entail significant costs. In particular, we show that when regulated-deposit dependent banks incur relatively higher cost of funding in comparison to banks whose funding cost is more aligned with the monetary-policy rate, they contract their lending. Consistent with risk shifting, affected banks rebalance their loan portfolios away from large firms and safe mortgages toward small firms and entrepreneurs.

We then 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, a relative increase in credit available to small, as opposed to large, firms, and higher concentration in the banking sector.

Besides pointing to an important role of credit supply for the distributional consequences of monetary policy, 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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Figures

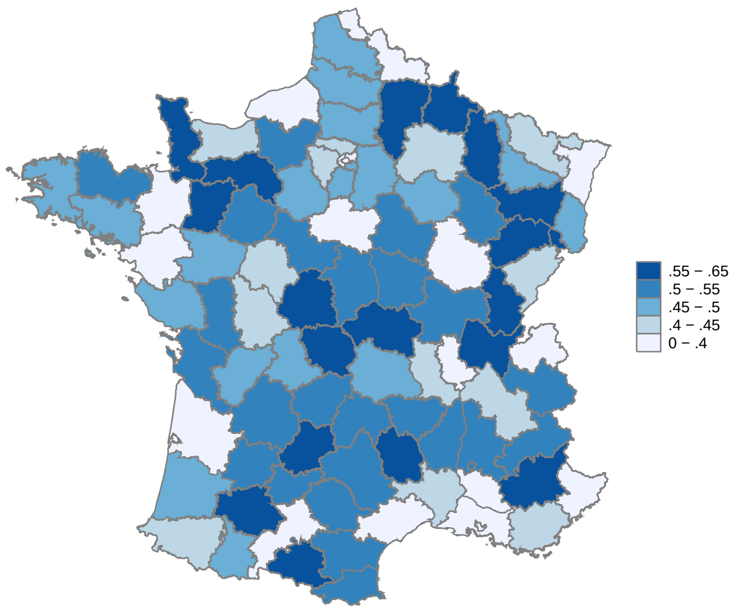

Figure 1: **County-level Regulated-deposit Ratio as of Q4 2015**

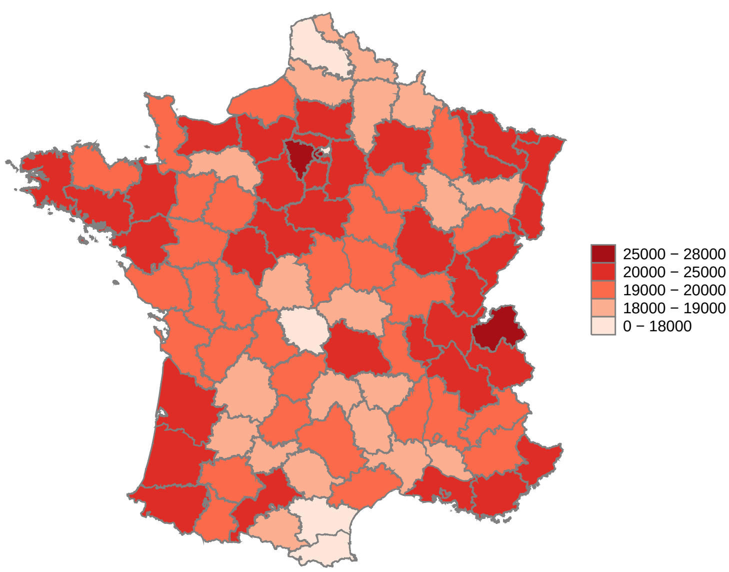

Figure 2: **County-level Median Income as of Q4 2015, in €**

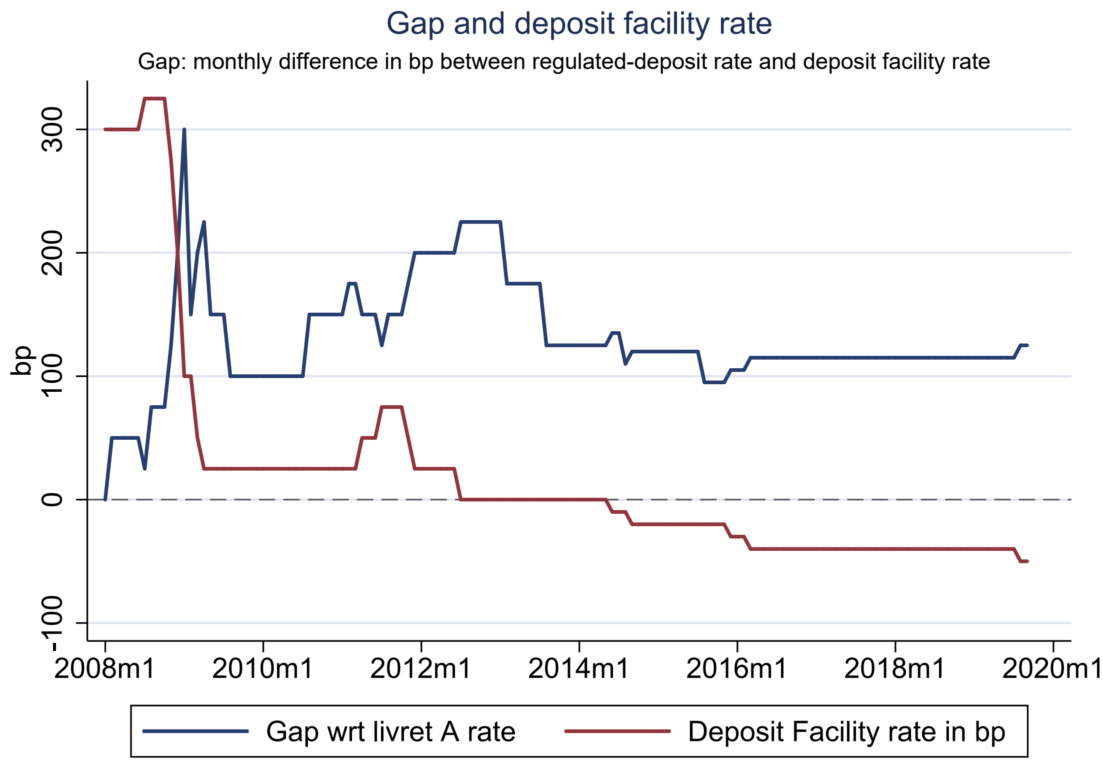

Figure 3: **Changes in Funding-cost Gap.** This figure shows the evolution of the ECB's deposit facility rate and the gap between the livret-A rate and the latter from 2008 to 2019.

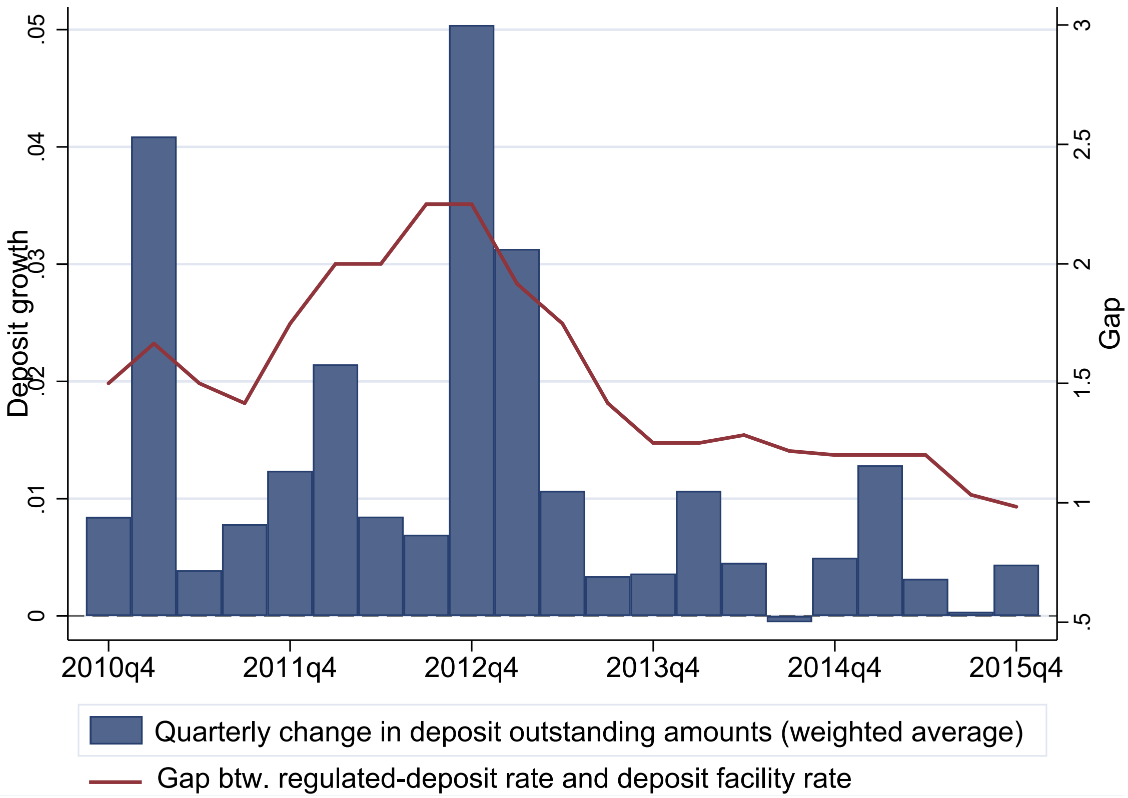

Figure 4: **Sensitivity of Regulated Deposits to Funding-cost Gap.** This figure shows the quarterly growth rate in the weighted average of post-transfer regulated deposits at the bank level (accounting for entry and exit, as in Davis and Haltiwanger (1992)), $\frac{Deposits_{bdt} - Deposits_{bdt-1}}{0.5(Deposits_{bdt} + Deposits_{bdt-1})}$, alongside the evolution of the gap between the livret-A rate and the ECB's deposit facility rate from Q4 2010 to Q4 2015.

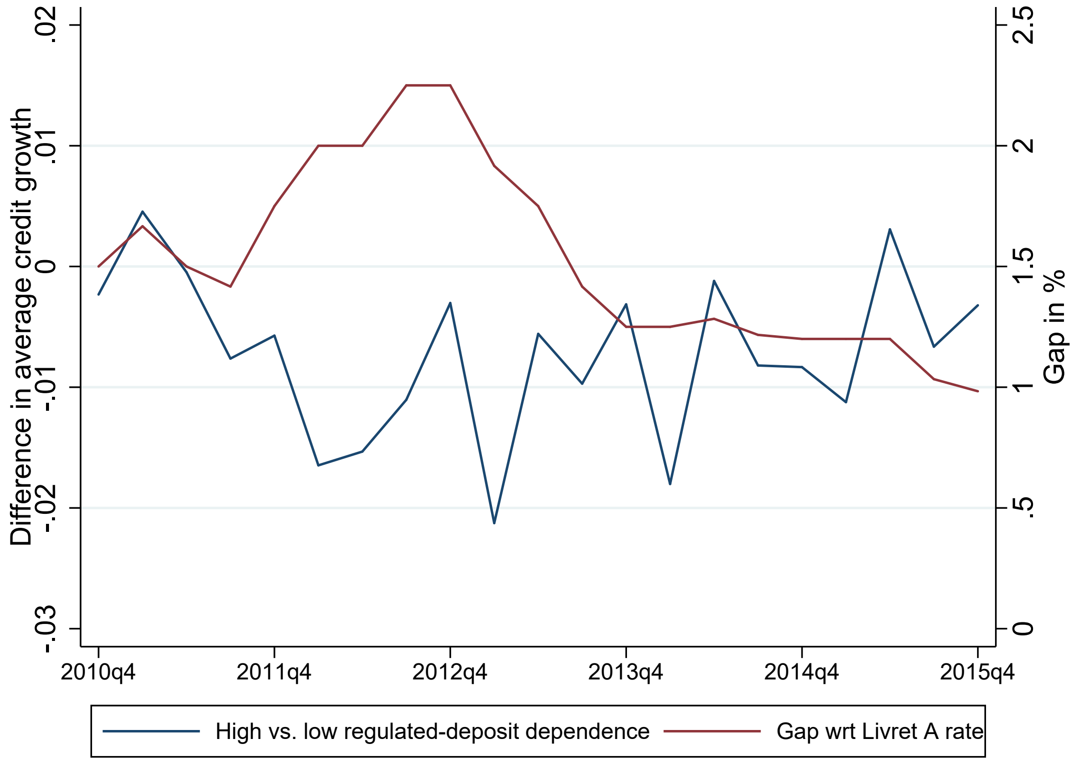

Figure 5: **Funding-cost Gap and Lending by Regulated-deposit Dependent Banks.** This figure plots the difference in the average loan-growth rate (average at the bank level), weighted by banks' total loan volume, for all banks in the top vs. bottom quartile of the ratio of regulated deposits over total 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.

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	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
Equity ratio$_{bt}$	0.04	0.00	0.01	0.02	0.04	0.12	0.07	3,673
Assets$_{bt}$ in billion €	32.39	0.19	1.41	8.25	16.44	116.81	122.31	3,673
Deposit ratio$_{bct}$ (Q1 2010 − Q4 2015)	0.40	0.00	0.32	0.44	0.53	0.69	0.19	32,460
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								
$\frac{\text{Loans to large firms}}{\text{Total loan portfolio}}$	0.07	0.00	0.02	0.05	0.09	0.24	0.09	28,063
$\frac{\text{Loans to small firms}}{\text{Total loan portfolio}}$	0.09	0.00	0.04	0.08	0.12	0.22	0.08	28,063
$\frac{\text{Mortgages}}{\text{Total loan portfolio}}$	0.44	0.00	0.33	0.46	0.58	0.83	0.23	28,063
$\frac{\text{Loans to entrepreneurs}}{\text{Total loan portfolio}}$	0.08	0.00	0.02	0.06	0.13	0.20	0.07	28,063
$\frac{\text{Loans to risky firms}}{\text{Loans to large firms}}$	0.62	0.29	0.50	0.62	0.74	0.97	0.19	25,729
$\frac{\text{MLT loans}}{\text{Total loan portfolio}}$	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
$\frac{\text{Credit large firms}}{\text{Credit small firms}}$	1.38	0.00	0.00	0.16	1.38	6.21	3.22	643,334
Bank-level credit HHI	0.41	0.14	0.25	0.37	0.53	0.86	0.22	317,477
Bank-level MLT-credit HHI	0.44	0.16	0.27	0.39	0.56	0.89	0.22	317,477
Bank-level ST-credit HHI	0.52	0.15	0.30	0.48	0.71	1.00	0.28	317,477
Panel E: Firm-year level								
Deposit ratio$_{ft}$	0.12	0.00	0.03	0.13	0.21	0.29	0.10	380,657
$\frac{\text{CapEx}}{\text{Assets}}$	0.09	0.00	0.01	0.04	0.11	0.37	0.15	380,657
$\frac{\text{Tangible investment}}{\text{Assets}}$	0.04	0.00	0.01	0.02	0.05	0.17	0.07	380,657
Assets in million €	4.91	0.40	0.94	1.82	3.88	14.45	55.52	380,657
No. of employees	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, *Equity ratio*$_{bt}$ and *Assets*$_{bt}$ are, respectively, the ratio of equity over total assets and total assets of bank b in quarter t, *Deposit ratio*$_{bct}$ 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, 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, and E correspond to Tables 5, 6, and 9, respectively, and the sample period is Q4 2010 to Q4 2015 (Tables 5 and 6) and 2010 to 2015 (annual data, Table 9). The summary statistics in Panel D correspond to Tables 7 and 8, and the sample period is Q4 2010 to Q4 2015.

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 entrepreneurs 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 entrepreneurs 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 6, 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 5). *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: Sensitivity of Deposit Flows to Regulated-deposit Rates

Variable	Deposit growth rate (1)	Deposit growth rate (2)	Deposit growth rate (3)	Deposit growth rate (4)	ln(Total amount) (5)	(6)
Regulated deposits × Gap	0.043***	0.038***	0.032***	0.018**	0.065**	0.059*
	(0.011)	(0.011)	(0.009)	(0.009)	(0.030)	(0.034)
Ceiling increase		0.014		0.043**		0.020
		(0.019)		(0.018)		(0.019)
Bank FE	Y	Y	N	N	N	N
Deposit-type FE	Y	Y	Y	Y	N	N
Bank-deposit-type FE	N	N	N	N	Y	Y
Quarter FE	Y	Y	N	N	N	N
Bank-quarter FE	N	N	Y	Y	Y	Y
N bank clusters	194	194	189	189	189	189
N	14,292	14,292	14,211	14,211	14,176	14,176
R^2	0.03	0.03	0.38	0.38	0.98	0.98

The level of observation is the bank-deposit-type-quarter level bdt, where for each bank-quarter bt we record one observation for each deposit type d (four observations in total), referring to either regulated (household) deposits, other household deposits, non-financial-corporation deposits, or any remaining deposits. The sample period is Q4 2010 to Q4 2015. In the first four columns, the dependent variable is the quarterly growth rate, accommodating for entry and exit (as in Davis and Haltiwanger (1992)), for deposit type d at bank b in quarter t, i.e., $\frac{Deposits_{bdt}-Deposits_{bdt-1}}{0.5(Deposits_{bdt}+Deposits_{bdt-1})}$. In the last two columns, the dependent variable is the natural logarithm of the total euro amount of deposit type d at bank b in quarter t. $Regulated\ deposits_d$ is an indicator variable for whether deposit type d refers to regulated deposits, which we measure as the weighted average amount of outstanding (post-transfer) regulated deposits at the bank level. $Ceiling\ increase_{dt-1}$ is an indicator variable for whether there is an increase in the ceiling for deposit account d 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. Robust standard errors (clustered at the bank level) are in parentheses.

Table 5: Effect of Funding Cost on Lending by Deposit-funded Banks

Variable	ln(Credit) (1)	ln(Credit) (2)	ln(Credit) (3)	ln(Credit) (4)	ln(Credit) (5)	ln(Credit) (6)	ln(Credit) (7)	ln(Credit) (8)
Deposit ratio × Gap	-0.236***	-0.103***	-0.168***	-0.156***	-0.170***	-0.168***	-0.169***	
	(0.045)	(0.029)	(0.050)	(0.055)	(0.048)	(0.051)	(0.049)	
Deposit ratio	-0.211	0.151	0.140	0.262*	0.120	0.134	0.122	-0.021
	(0.154)	(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	Y
Firm-quarter FE	N	Y	Y	Y	Y	Y	Y	Y
County-quarter FE	Y	Y	Y	Y	Y	Y	Y	Y
Banking-group-quarter FE	N	N	Y	Y	Y	Y	Y	Y
N bank clusters	196	196	196	196	196	196	196	
N	13,570,948	4,134,974	4,134,974	4,134,974	4,134,974	4,134,974	4,134,974	4,134,974
R^2	0.89	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. $\textit{Deposit ratio}_{bt-1}$ 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 6: Reallocation of Credit: Bank-county-level Data

Variable	Loans to large firms / Total loan portfolio (1)	Loans to small firms / Total loan portfolio (2)	Mortgages / Total loan portfolio (3)	Loans to entrepreneurs / Total loan portfolio (4)	Loans to risky firms / Loans to large firms (5)	MLT loans / Total loan portfolio (6)
Deposit ratio × Gap	-0.037*	0.060**	-0.069**	0.026***	0.109*	0.039*
	(0.022)	(0.025)	(0.032)	(0.007)	(0.057)	(0.021)
Deposit ratio	0.121**	-0.178**	0.113	-0.058**	-0.376**	-0.046
	(0.049)	(0.076)	(0.092)	(0.023)	(0.170)	(0.058)
Bank-county FE	Y	Y	Y	Y	Y	Y
County-quarter FE	Y	Y	Y	Y	Y	Y
Banking-group-quarter FE	Y	Y	Y	Y	Y	Y
N county clusters	148	148	148	148	134	148
N	28,063	28,063	28,063	28,063	25,729	28,063
R^2	0.90	0.83	0.98	0.96	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 balance-sheet data) over total 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 small firms (without balance-sheet data) 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 mortgage loans to households 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 entrepreneurs 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 with a credit rating above 4 on the Banque de France's credit-rating scale (higher rating = closer to default) over all loans to large firms (with balance-sheet data) granted by bank b's branch(es) in county c in quarter t. The dependent variable in column 6 is the ratio of medium- to long-term loans over total loans of 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. Robust standard errors (clustered at the bank level) are in parentheses.

Table 7: Aggregate Credit Effects of Funding-cost Shocks

	ln(Total credit)	$\frac{\text{Credit large firms}}{\text{Credit small firms}}$	ln(Total credit)	$\frac{\text{Credit large firms}}{\text{Credit small firms}}$
Sample	All	All	> 5 firms	> 5 firms
Variable	(1)	(2)	(3)	(4)
Deposit ratio × Gap	-0.143***	-1.349***	-0.362***	-1.791***
	(0.055)	(0.209)	(0.059)	(0.346)
Deposit ratio	0.027	-0.206	-0.906***	-3.257***
	(0.109)	(0.389)	(0.140)	(0.766)
ZIP-code FE	Y	Y	Y	Y
County-quarter FE	Y	Y	Y	Y
N ZIP-code clusters	33,046	32,322	19,142	19,063
N	664,654	643,334	353,722	352,003
R^2	0.96	0.82	0.97	0.84

The level of observation is the ZIP-code-quarter level kt. The sample period is Q4 2010 to Q4 2015. In the last two 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 3 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 4 is the ratio of loans accruing to large firms (with balance-sheet data) vs. small 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 8: Credit-concentration Effects of Funding-cost Shocks

	Bank-level credit HHI	Bank-level MLT-credit HHI	Bank-level ST-credit HHI
Sample	> 5 firms	> 5 firms	> 5 firms
Variable	(1)	(2)	(3)
Deposit ratio × Gap	0.048**	0.064***	0.025
	(0.018)	(0.022)	(0.031)
Deposit ratio	0.816***	0.705***	0.368***
	(0.040)	(0.045)	(0.058)
ZIP-code FE	Y	Y	Y
County-quarter FE	Y	Y	Y
N ZIP-code clusters	17,059	17,059	17,005
N	317,477	317,475	312,632
R^2	0.91	0.89	0.74

The level of observation is the ZIP-code-quarter level kt. The sample period is Q4 2010 to Q4 2015. The sample is limited to ZIP codes with more than five firms (with records in the credit registry). The dependent variable in column 1 is a measure of credit concentration, between 0 and 1, across all banks granting credit in ZIP code k in quarter t. The dependent variable in column 2 is a measure of credit concentration, between 0 and 1, across all banks granting medium- to long-term credit in ZIP code k in quarter t. The dependent variable in column 3 is a measure of credit concentration, between 0 and 1, across all banks granting short-term credit 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: Large Firms

Variable	$\frac{\text{CapEx}}{\text{Assets}}$ (1)	$\frac{\text{Tangible investment}}{\text{Assets}}$ (2)	ln(Assets) (3)	ln(No. of employees) (4)
Deposit ratio × Gap	-0.015*	-0.008**	-0.033***	-0.009
	(0.008)	(0.004)	(0.012)	(0.010)
Deposit ratio	0.016	0.008	0.103***	0.011
	(0.014)	(0.006)	(0.023)	(0.020)
Firm FE	Y	Y	Y	Y
County-industry-year FE	Y	Y	Y	Y
N firm clusters	84,015	84,015	84,015	82,531
N	380,657	380,657	380,657	375,139
R^2	0.47	0.48	0.98	0.97

The level of observation is the firm-year level ft. Furthermore, the sample is limited to large firms with available balance-sheet data. The sample period is 2010 to 2015. All dependent variables are measured at the firm-year level ft. $CapEx_{ft}$ and $Tangible\ investment_{ft}$ are scaled by $Assets_{ft-1}$. $Deposit\ ratio_{ft-1}$ 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: 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$^{\text{nd}}$ 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
Banking-group-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.

Table A.2: 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 2^{nd} 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
Banking-group-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.3: 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
Banking-group-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 $t-1$. 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.4: Effect of Funding Cost on Lending by Deposit-funded Banks: Large Firms

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 2nd 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
Banking-group-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 large 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. *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.