Banks as patient lenders: Evidence from a tax reform*

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ABSTRACT

We provide new evidence on how deposit funding affects bank lending. For identification, we exploit the 2011 reform of the investment income tax in Italy that induced households to substitute bank bonds with deposits. We find that banks with larger increases in deposits expand the supply of credit lines and long-term credit to low-risk firms. Additional evidence indicates that these results are consistent with theories emphasizing the demandable nature of the deposit contract rather than theories stressing the stability of deposit funding due to government guarantees. In this regard, we show that banks under stress face large runs on retail deposits, but not on retail bonds.

Keywords: Banks, Deposits, Maturity, Risk-taking, Government guarantee

JEL classification: G21, G28

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1. Introduction

This paper provides new evidence on how a greater reliance on deposit funding affects bank lending policies. The traditional business model of commercial banks combines short-term deposit funding with long-term lending, often together with lending commitments in the form of credit lines. Building on the seminal papers of Diamond (1984) and Diamond and Dybvig (1983), many studies in the financial intermediation literature attempt to explain banks' peculiar business model. The common assumption in these studies is that deposits are a defining characteristic of banks due to their distinctive contractual features.

According to influential theories of financial intermediation, the demandable nature of the deposit contract is key not only for providing liquidity on demand on the asset side through credit lines (Kashyap, Rajan, and Stein, 2002), but also for maturity transformation. Under this view, the inherent fragility in their funding structure, through the threat of runs, is precisely what enables banks to fund opaque and illiquid long-term loans with debt. Calomiris and Kahn (1991) and Flannery (1994) argue that demandability serves as an incentive scheme to discipline bank risk-taking, while in Diamond and Rajan (2001) demandability works as a commitment device allowing banks to increase their borrowing capacity against long-term illiquid loans. Crucial in both cases is debtholders' ability to withdraw their funds in response to the arrival of negative news on bank fundamentals (Jacklin and Bhattacharya, 1988; Goldstein and Pauzner, 2005).

The empirical relevance of these theories is unclear. Other studies view deposits as a stable source of funding due to the presence of strong government guarantees on deposits (Hanson et al., 2015) or bank market power on retail depositors (Drechsler, Savov, and Schnabl, 2021; Li, Loutskina, and Strahan, 2019). It follows that the stability of deposits—rather than their demandability—constitutes banks' comparative advantage in the provision of long-term credit, which may however come at the cost of excessive risk-taking, especially if it draws on government guarantees (Merton, 1977).

Estimating the causal impact of deposits on bank lending policies and assessing the empirical relevance of these groups of theories poses significant identification challenges. Bank funding structure is endogenous to both their lending policies and the overall economic environment, making it very hard to obtain causal estimates. In addition, investors behind different funding sources are also typically different. It is thus very difficult to distinguish whether any differences in lending outcomes are due to the intrinsic characteristics of the different funding sources or investor differences (e.g., retail vs. institutional investors).

To obtain exogenous variation in bank deposit funding within the same class of investors, we take advantage of the 2011 reform of the investment income tax ("Riforma della

tassazione sulle rendite finanziarie") enacted in Italy in September 2011. The reform eliminated a tax disadvantage in the treatment of interest income from deposits over other privately issued securities held by households, inducing a shock in household demand for bank bonds and deposits. Within two years of the reform, households substituted €75 billion of their holdings of bank bonds with deposits, causing a significant change in banks' retail funding: bonds decreased from 21% to 17% of total assets, while deposits increased from 38% to 42% of total assets, leaving their total funding unchanged.[1]

This substitution within the same class of investors presents a unique opportunity to evaluate how the distinctive characteristics of the deposit contract may affect bank lending. Deposits are a demandable, first-come first-served contract that exposes banks to the threat of runs, especially in crisis periods, such as the one we analyze, when bank fundamentals are weak. In contrast, bank funding from bonds is secured from issuance until maturity with limited second market liquidity (see, e.g., Bessembinder, Spatt, and Venkataraman, 2020). Relative to bonds, deposits enjoy stronger government guarantees. Deposits are explicitly insured up to €100,000 and are typically senior to bonds, thus also enjoying stronger implicit guarantees.

Because of the longer maturity and the limited secondary market liquidity, retail bank bonds represent a more stable source of funding compared to retail deposits, which can be withdrawn on demand. The ensuing difference in the probability of a run between the two sources of funding is crucial to understanding our results. In this regard, we show that a selected group of Italian banks that went under stress between 2015 and 2017 faced massive runs on retail deposits but not on retail bonds, although both types of liabilities are held by the same class of investors. The evidence on the stability of retail bonds versus the run-like behavior of deposits reinforces our key result that it is the demandability of the deposit contract that drives banks "special" ability to lend in the form of credit commitments or long-term loans.

We employ three micro-level data sets: data on deposit volumes at the bank-province level from the supervisory reports, information on bank bonds held by households at the security-level from the Securities Holding Statistics and the Centralized Securities Database, and information on bank-firm credit from the Italian Credit Register. All three datasets are held at the Bank of Italy.

We proceed in two steps. We first show that the tax reform induced households to substitute bank bonds with deposits, and then analyze how this change in bank funding affected

[1] This reshuffling is consistent with a price elasticity of retail bonds and deposits of about 0.29, which is in line with estimates of household deposit rate elasticity to interest rates found in Egan, Hortaçsu, and Matvos (2017).

lending. To identify the substitution from bonds to deposits, we use a differences-in-differences specification exploiting within *bank-time* variation arising from pre-existing geographical heterogeneity in bank presence and household portfolios. That is, we compare changes in deposits of the same bank over a short event window around the reform across different provinces. We hypothesize that, all else equal, banks with branches in provinces where households held larger volumes of bank bonds prior to the reform experience larger increases in household deposits.

We find that banks in provinces with one standard deviation higher volume of bank bonds prior to the reform experienced a 27% larger increase in total deposits and a corresponding reduction in bonds. Bank total funding from household deposits and bonds did not change, indicating an average pass through of around one (€1 of bonds was converted into €1 of deposits). We also find that this substitution began at the time of the law approval in September 2011 with no prior significant treatment effects. To lend further support to the internal validity of our identification strategy, we conduct placebo tests on firms whose tax treatment was not changed by the reform and find no significant treatment effects.

The substitution occurred predominantly from bonds to term deposits, which carry interest rates closer to those of bank bonds. In provinces with a one standard deviation higher volume of bonds prior to the reform, banks experienced 67% larger increases in term deposits. Exploiting variation in the time to maturity of household bond holdings, we find that only the share of bonds maturing in the post-event window has significant explanatory power, indicating that households substituted their bonds with deposits as their bonds began maturing, consistent with the fact that 91% of these bonds are not publicly traded (Grasso et al., 2010). Importantly, term deposits have a fixed contractual maturity, but contrary to bonds, are a demandable contract: account holders can withdraw their funds prior to the contractual maturity by forgoing interest payments.[2] The tax reform thus led to a significant increase in the share of bank demandable liabilities, potentially affecting their lending policies.

To exclude plausible alternative explanations for households' behavior, we provide evidence that the substitution from bonds to deposits was not due to a "flight to quality", although it occurred during a time of crisis. First, we show that households reshuffled their senior and junior bonds to a similar degree, and that riskier banks (with lower capital and worse loan portfolios) increased their term deposits more than safer ones. A flight to quality

[2] Artavanis et al. (2019) find that early withdrawals on time deposits are common and households exhibit a high willingness to pay for early withdrawals when concerned about the safety of their funds.

explanation would predict the opposite. Second, term deposits increased only after the approval of the reform in September 2011, despite the increase in bank and sovereign risk after the first Greek bailout in May 2010. Finally, no increases in term deposits occurred in other European countries that were similarly affected by the sovereign debt crisis.

In the second part of the analysis, we study how the increase in banks' reliance on deposit funding affects their lending policies. To absorb possible confounding changes in firms' demand for credit and other firm unobservable characteristics, we exploit within-firm variation as in Khwaja and Mian (2008). To obtain exogenous variation in deposit funding, we build an instrument for changes in bank deposit funding based on the predetermined cross-sectional variation studied in the first part of the analysis. The instrument aggregates household bond holdings across provinces at the bank level. This helps to further reduce concerns that increases in household deposits may correlate with contemporaneous increases in firms' demand for credit as banks use internal capital markets to move funds from one region to another (Gilje, Loutskina, and Strahan, 2016; Drechsler, Savov, and Schnabl, 2017).[3]

We find that the change in bank funding following the reform did not change the overall credit supply, consistent with total funding not expanding. It led, however, to important compositional changes: the greater reliance on deposits led to an increase in both credit lines and long-term loans (with maturities longer than five years). The latter result is only evident in the two-stage least squares (2SLS) estimates, underscoring the importance of taking into account the endogeneity of bank funding to not underestimate the causal effect of deposits on long-term credit.

Further analysis on the mechanisms behind our baseline findings reveals that increases in credit lines are consistent with Kashyap et al. (2002), who argue that the provision of liquidity on demand to depositors creates synergies for the provision of liquidity on demand to borrowers. We find that banks increase their liquidity holdings when their reliance on deposits increases, and that better capitalized banks, with arguably better capital market access and thus smaller synergies, show smaller increases in credit lines. Overall, these findings indicate that a banking system funded with more deposits is better able to provide liquidity insurance to firms, reinforcing and complementing key insights from Gatev and Strahan (2006).[4]

[3] To further strengthen the exclusion restrictions in robustness tests we also exclude banks with branches in a single province (or a group of adjacent provinces).

[4] Ippolito et al. (2016) analyze a distinct mechanism through which the provision of credit lines may be affected by banks' funding structure. They show that banks more reliant on wholesale interbank deposits, rather than retail demandable deposits, experience an increase in credit line drawdowns around the 2007 shock to interbank market, as firms tried to pre-empt banks from reducing the amount of credit lines.

We also find that the increases in credit lines and longer maturity loans are concentrated in low-risk firms. Term credit to risky firms is instead found to decrease, particularly from banks with worse fundamentals that are naturally more exposed to runs. These results are consistent with theories emphasizing the disciplinary role of demandable debt through the credible threat of runs (Calomiris and Kahn, 1991; Flannery, 1994; Diamond and Rajan, 2001) and are not supportive of the guarantee channel (Hanson et al., 2015). The threat of runs is credible in our setting because our sample overlaps with a crisis period and the increase in deposits comes from large depositors (with more than €250,000) who, all else equal, are more responsive to bank fundamentals. Retail bonds instead are more stable as we find for stressed banks. Overall, these novel findings indicate that demandable debt can limit credit to riskier firms and enhance the provision of long-term credit to the real economy.[5]

Our findings complement and expand several strands of the extant literature. In our paper, we exploit a shock leading to a substitution from bonds to deposits within the same class of investors to test seminal theories on the effects of banks' capital structure for lending. In this sense, our paper differs from prior studies analyzing the transmission of deposits shocks across regions (e.g., Gilje et al., 2016; Bustos, Garber, and Ponticelli, 2020) in that the shock we analyze does not involve the influx of new funds into banks, but rather the substitution of one funding source with another within the same class of investors.

The tax reform we exploit takes place during the European sovereign debt crisis. In this context, our paper relates to studies analyzing deposit withdrawals during stress periods due to either panic or deterioration of bank fundamentals. Recent contributions include Iyer and Puri (2012), Iyer, Puri, and Ryan (2016), Martin, Puri, and Ufier (2018), and Artavanis et al. (2019). Our study builds on these studies to investigate the asset side implications of depositors' behavior in crisis periods.

Our paper also relates to an emerging literature on how tax shocks impact bank capital structure and lending. Schepens (2016) shows that the reduction of the tax advantage of debt over equity in Belgium increased bank equity and decreased loan portfolio risk. Célérier, Kick, and Ongena (2017) use changes in the taxation of banks' profits in several European countries to analyze the effects of an increase in capital ratios on credit supply.[6] Our paper differs from

[5] In additional tests, we also analyze whether market power on retail depositors could also explain the increase in long-term credit, in line with recent work by Drechsler et al. (2021) and Li et al. (2019). We find that market power has an additional independent effect on banks' ability to provide long-term credit to the real economy but does not affect our baseline results (see Table A1 in the Appendix).

[6] Bond et al. (2016) and Gambacorta et al. (2017) examine a similar question on bank capital structure using cross-sectional variation in corporate taxes across Italian provinces.

these in that the tax reform we analyze induces a change in the composition of bank liabilities, not in capital ratios. An important common takeaway is that changes in taxation can prompt substantial changes in bank funding structures and lending policies.

Finally, recent studies examine the role of deposits for the transmission of monetary policy (Drechsler et al., 2017; Hoffmann et al., 2019; Heider, Saidi, and Schepens, 2019). An important insight from these studies is that deposits resemble fixed rate liabilities facilitating bank maturity transformation, consistent with our findings that a greater reliance on deposits leads to more long-term loans.

The remainder of the paper is organized as follows. In Section 2, we offer an overview of the tax reform and its aggregate effects on the Italian banking system. In Section 3, we describe the data. In Section 4, we report our key findings on bank deposit and bond funding. In Section 5, we explore bank credit policies. Concluding remarks are in Section 6.

2. The tax reform

As the European sovereign debt crisis intensified in the summer of 2011 and yields on Italian sovereign bonds surged, the Italian government passed an emergency budget law to increase government revenues and reduce its deficit. One of the provisions of this budget law eliminated the asymmetry in the tax treatment of income from deposits over income from other securities. Until this reform, income from deposits was taxed at 27%, while income from all other securities was taxed at 12.5%.[7] The 2011 reform harmonized the tax treatment of deposits and all private sector securities at 20%. Sovereign bonds, both domestic and foreign, maintained their lower 12.5% tax rate. The new tax rates went into effect in January 2012 but were first announced in August 2011 and approved in September 2011. Importantly, these changes applied only to households and not to firms, since the withholding tax is only on individuals, not firms.

The reform shocked bank funding sources by inducing a positive supply shock to bank deposits and a negative supply shock to bond financing. All else equal, the changes in the tax code made bank deposits (all private sector securities) more (less) attractive to households and created incentives for households to reshuffle their portfolios away from private sector securities towards bank deposits. Aggregate banking sector statistics, visualized in Panel A of Fig. 1, show that between the end of 2011 and 2013, bank deposits and bonds in Italy moved in opposite

[7] This asymmetry was introduced in 1996 when the Italian government increased the tax rate on bank deposits to 27%, while leaving the tax rate on all other securities at 12.5%. Since then, Italian banks have been selling significant amounts of bank bonds to households (Ricotti and Sanelli, 2008).

directions by roughly the same amount: deposits increased by about €100 billion and bonds decreased by about €94 billion. Distinguished by the size of the deposit account, Panel B of Fig. 1 shows that the inflow of deposits into the banking sector shifted the distribution of deposits toward larger accounts. Between the end of 2011 and 2013, accounts with more than €250,000 increased substantially from €288 billion to almost €400 billion. In sharp contrast, deposits from smaller accounts with at most €50,000 remained fairly constant. The increase in the share of large accounts is consistent with the idea that households holding bank bonds are fairly wealthy (by way of comparison, Italy's GDP per capita in 2012 was €27,000).

(Insert Figure 1 here)

Fig. 2 reveals that the increase in deposits was mainly driven by an increase in household deposits, which increased by about €75 billion from €560 to €635 billion, and in particular by term deposits. Demand deposits, instead, remained roughly constant, suggesting that households may view term deposits as a closer substitute to bank bonds than demand deposits. Term deposits and bank bonds, for example, carried more comparable interest rates. In particular, in the year prior to the reform, the average annual interest rate on household demand deposits was 0.36%. Household term deposits instead paid on average 2.27% per annum, closer to the 3.81% average yield on bank bonds held by households. The higher interest rate on bank bonds reflects their longer maturities and higher risk. Bank bonds have an average maturity of four years and are uninsured, while more than 90% of term deposits have a contractual maturity of one year or less and part of them is explicitly insured.

(Insert Figure 2 here)

The increase in term deposits in Fig. 2 appears very large. This is due to the very small initial levels of term deposits and the large initial volume of bank bonds held by households. The reshuffled volume from bank bonds to term deposits is in fact consistent with what one would expect, given the change in after-tax net returns of bonds over deposits and prior studies on households' demand elasticity to interest rates. In particular, in the year prior to the reform, the average interest rate spread between the bank bonds and term deposits was 154 bps (3.81% - 2.27%).[8] Because of their differential tax treatment, the net spread was even larger at 168 bps; after the tax reform, this difference dropped by 66% to about 57 bps, reducing significantly the attractiveness of bonds over deposits. Thus, the observed reshuffling from bank bonds to term deposits is consistent with a price elasticity of 0.29 (as given by the 19% drop in bank bonds

[8] These figures are all gross of fees. Accounting for differences in fees between bank bonds and deposits yields a larger net spread of about 207 bps as household deposit accounts carry on average fees of about 53 bps, while retail bank bonds do not typically carry any fees (Grasso et al., 2010).

over the 66% decrease in the spread between bonds and deposits). This figure is in line with estimates of household demand elasticity to interest rates found in recent studies (e.g., Egan et al., 2017; Artavanis et al., 2019).

Overall, the patterns in Figs. 1 and 2 are consistent with the hypothesis that the tax reform created a shock in household demand for bonds and deposits, leading households to substitute bank bonds with term deposits. There could be, however, other factors that contributed to this reshuffling at the aggregate level. The reform coincides with the European sovereign debt crisis. It is therefore possible that the observed reshuffling is not driven by the tax changes, but by a general "flight to quality" due to this crisis.

We think this is unlikely for several reasons. First, as shown in Fig. 2, term deposits increased sharply only right after the reform, while they were completely flat before, despite significant increases in bank risk after the first Greek bailout in 2010. Second, a similar reshuffling is not observed in other European countries, such as Spain and Portugal, that experienced similar pressures on their banking system during the sovereign debt crisis (Fig. 3). It is worth observing that the 1996 tax reform, which took place in a non-crisis period, increased the relative taxation of bank deposits over bank bonds and led to opposite changes in bank funding sources (Fig. IA.1 in the Internet Appendix).

(Insert Figure 3 here)

Nevertheless, there could be other factors that may have affected bank funding, such as liquidity interventions from the European Central Bank (ECB) over the same period.[9] In what follows, we propose an identification strategy that is geared to absorb such confounding factors by exploiting within bank-time variation in the intensity of the shock arising from pre-existing geographical heterogeneity in bank presence and household portfolios.

3. Data and summary statistics

For the empirical analysis, we rely on three data sets: (1) deposit volumes at the bank-province level from the supervisory reports; (2) bank bond volumes held by households at the bank-province level from the Securities Holding Statistics (SHS) and bond pricing from the Centralized Securities Database (CSDB); and (3) bank-firm credit from the Italian Credit Register (CR). These data sets are merged with balance sheet data for banks from the Bank of

[9] The most noteworthy intervention is the announcement of the ECB's three-year long-term refinancing operation (LTRO) in December 2011, consisting of an unlimited offering of three-year maturity collateralized cash loans on two "allotment" dates, December 21, 2011 and February 29, 2012 (Carpinelli and Crosignani, 2021).

Italy and for non-financial firms from CERVED. Province characteristics, such as population and GDP as of 2012, are taken from census data by the National Statistical Office (ISTAT).

Data on deposits volumes from households and non-financial firms are reported monthly, broken down by type of deposits (demand or term), and the depositors' province of residence or headquarters. Data coverage is available for about 500 banking groups across 110 provinces.[10] Information by size of deposit account is available with less granularity i.e., at the bank-level, with an annual frequency and including deposits from all types of investors (households, non-financial firms, other financial firms, foreigners). The data allow us to distinguish between three account size categories: accounts with amounts below €50,000, between €50,000 and €250,000, and above €250,000. Accounts in the second and third size categories are partially insured up to €100,000.

Information on bank bonds is obtained from the SHS and the CSDB. The SHS covers the securities issued, held, and traded by euro area residents broken down by holder sector and province of residence at a quarterly frequency since 2008. The SHS data are at the security level (ISIN) and are obtained directly from the banks that manage the securities on behalf of clients. Since the SHS records security holdings at their market values, we obtain changes in household bond holdings net of any market valuation effects by dividing each security with its market price, obtained at quarterly frequency from CSDB.

Data on credit to Italian non-financial firms is obtained from the Italian CR ("Centrale dei Rischi"). CR is maintained by the Bank of Italy and collects information on individual borrowers with an outstanding exposure with a single intermediary over €30,000. The registry tracks the amount of credit granted to each borrower from each institution by loan type and maturity class. In particular, the data allows us to distinguish between two key credit products (credit lines and term loans) and three maturity classes (less than one year, between one year and five years, and longer than five years). For identification purposes, in our credit analysis we use firms with both credit lines (drawn or undrawn) and term loans from at least two banks. This yields a sample of 315,774 bank-firm relationships to about 107,670 firms.

Our sample covers the period between September 2010 and December 2012 (a two-year window around the tax reform). Panel A of Table 1 provides an overview of key bank characteristics (funding sources, size, and loan quality) in Italy at the beginning of the sample

[10] Italy is divided in 20 regions and each region is subdivided into provinces, each surrounding a large city. The number of provinces was between 107 and 110 in 2005-2016. In terms of population, Italian provinces are about the size of US Metropolitan Statistical Areas (MSAs). For example, in 2012 Italian provinces had an average (median) population of 544,000 (377,000), similar to corresponding figures for US MSAs at 660,000 (200,000) from the 2010 US Census Bureau.

period (December 2009). Deposits from both households and firms are banks' largest funding source (38.27% of total assets), followed by bonds (22.54%), equity (11.81%), and interbank funding (3.95%). There is, however, significant variation across banks in terms of funding sources.

(Insert Table 1 here)

The share of retail deposits in Italy is considerably smaller than in other countries. For example, in the US, core deposits are on average about 75% of total assets (Hanson et al., 2015). The difference is partly made up by bank bonds, which in Italy represented about 22.5% of total assets in 2011, half of which are held by households (Coletta and Santioni 2016). In terms of size, deposits are equally split in each of the three size categories (below €50,000, between €50,000 and €250,000, and above €250,000), each representing roughly one-third of total deposits. The vast majority of term deposits (93.74%) have a contractual maturity of up to one year, while retail bank bonds have longer maturities. As of December 2009, there were 26,836 bank bonds held by retail investors. These securities have an average contractual maturity of about 4.3 years, with 90% of these securities having a contractual maturity between 2 and 7 years.

Panels B and C of Table 1 report the summary statistics of the variables used to estimate our empirical specifications. We return to these below when we discuss our models.

4. The impact of the tax reform on bank funding

4.1. Identification strategy

To estimate the impact of the reform on bank deposits and bond funding, we rely on disaggregated deposit and bank bond data at the bank-province level. Using bank-province information, as opposed to bank-level information, allows us to employ a differences-in-differences analysis and evaluate the impact of the reform on deposits, controlling for economy-wide and bank-level shocks. Identification of treatment is obtained by comparing changes in household deposits before and after the reform within the same bank across different provinces. All else equal, a shock in the households' net returns from bonds and deposits will lead to larger changes in household demand at the bank-province level in provinces where households held larger volumes of bank bonds. Cross-sectional variation may arise either because these provinces are larger (a given change in household demand is aggregated across more households leading to a larger effect at the bank-province level) or because they are richer (the per capital

changes in household demand are larger due to higher per capita holdings). Our analysis exploits both sources of variation.

We begin by estimating the following differences-in-differences specification:

$$Log(Dep)_{b,p,t} = \beta\, BB_{p,2009} \times Post_t + \alpha_{b,t} + \alpha_p + \varepsilon_{b,p,t}, \quad (1)$$

where $Log(Dep)_{b,p,t}$ denotes the natural logarithm of household (total, demand, and term) deposits of bank b in province p before and after the reform ($t = 0, 1$, respectively). It is constructed by collapsing and time-averaging the volume of deposits at the bank-province level in the twelve months before the announcement of the reform (September 2010 to September 2011) and the twelve months after the reform went into effect (January 2012 to December 2012), thus excluding the last quarter of 2011, when the reform was approved, but not yet in effect.

$BB_{p,2009}$ denotes the volume of bank bonds held by households in province p scaled by total bank bonds across all Italian provinces in 2009. We use predetermined values as of December 2009, two years prior to the reform, to avoid a simultaneity bias. Provinces with larger $BB_{p,2009}$ values tend to be larger and richer i.e., they have larger population and account for a larger fraction of GDP (Fig. IA2 and Table IA.1 in the Internet Appendix). As can be observed in Panel B of Table 1, there is significant bank-province variation in the sample with respect to both measures. $BB_{p,2009}$ has a mean value of 1.4% and a standard deviation of 1.5%.

$Post_t$ is a dummy variable that equals one after the reform, and equals zero otherwise. $\alpha_{b,t}$ and α_p denote bank-time and province fixed effects, respectively, while $\varepsilon_{b,p,t}$ denotes the idiosyncratic error term. All else equal, we expect a positive and statistically significant β.

The inclusion of bank-time fixed effects, $\alpha_{b,t}$, is important as it helps absorb economy-wide and bank-level shocks that may influence the average levels of bank deposits during the event window. The inclusion of province fixed effects, α_p, absorbs the level effect of $BB_{p,2009}$ and the effects of any other time-invariant province characteristic on the level of deposits. Given our narrow event window, province characteristics, such as overall economic and financial development, as well as household demographics can be considered time-invariant.

To allow for different time trends across provinces, we also estimate growth specifications by replacing the dependent variable in Eq. (1) with the deposit growth rate, $\Delta Log(Dep)_{b,p,t}$. Growth specifications with province fixed effects control for province-specific time trends on the levels of deposits (this would not be possible in our level specifications as province-time fixed effects would absorb our key explanatory variable, $BB_{p,2009} \times Post_t$).

Similar growth specifications are also estimated, for example, in Gilje et al. (2016) and Drechsler et al. (2021).

4.2. Parallel trends assumption

The internal validity of Eq. (1) rests on the assumption that in the absence of treatment (the tax reform), the difference in deposit volumes in "high" and "low" bond provinces is constant over time— known as the parallel trends assumption. Visual inspection of deposit volumes in high and low bond provinces prior to the reform shows that this assumption is likely to hold.

(Insert Figure 4 here)

Fig. 4 reports the average deposit volume for total, demand, and term deposits in provinces with $BB_{p,2009}$ values below or above the median. The figure confirms with confidence that the parallel trends assumption is satisfied for all types of deposits. In particular, term deposits in high and low bond provinces are very stable and move in parallel trends before the reform.

We provide a more formal test below by estimating Eq. (1) where $Post_t$ is replaced with monthly time dummies. The coefficients on the interaction terms with $BB_{p,2009}$ thus estimate the change in the dependent variable relative to the omitted baseline period (October 2010). This allows us to also visually inspect and test when the break takes place.

4.3. Results on bank funding structure: deposits vs. bonds

Table 2 reports our findings for Eq. (1). We report results for the total, demand, and term deposits of households in both levels and growth rates. The latter are more conservative as they control for province-specific time trends in the volumes of deposits. For each dependent variable, we report two specifications: one with bank fixed effects and one with bank-time fixed effects. For the former, we include a dummy variable, $Post_t$, to control for the average post-reform trends in deposits. In all cases, we use standardized $BB_{p,2009}$ so that the estimated coefficients measure the percentage change in the dependent variable due to a one standard deviation increase in $BB_{p,2009}$. This also facilitates the comparison of coefficients across different measures.

(Insert Table 2 here)

Consistent with the unconditional results in Fig. 4, we find that banks experienced larger increases in the levels and growth rates of their deposits in provinces where households held larger volumes of bank bonds before the reform, driven mainly by increases in term deposits.

In particular, we find that total deposits at the bank-province level increased on average

by 9.6%.[11] Banks in provinces with 1.5 percentage points higher $BB_{p,2009}$ (i.e., one standard deviation) saw larger increases in total deposits by 27.1% per annum (column 2)[12] and higher growth rates by about 0.127% per month or 1.5% per annum (column 8). Demand deposits feature an overall downward trend in the post-reform period (coefficient of $Post_t$ in column 3) that is somewhat less pronounced in areas with higher values of $BB_{p,2009}$ (coefficient of $BB_{p,2009} \times Post_t$ in columns 3 and 4). These differences, however, are not sustained when we estimate growth specifications (columns 9 and 10) either because they are not sufficiently large or because they are driven by province-specific trends, absorbed in growth specifications. Instead, term deposits grew significantly after the reform: the estimated coefficient of $Post_t$ in column 5 indicates that in the post-reform period, term deposits increased on average by 132.1%. The differences-in-differences coefficient in column 6 indicates that in provinces with a one standard deviation increase in $BB_{p,2009}$, the same bank experienced larger increases in its term deposits by about 4.4% per month or 67.5% per annum. The coefficient in column 12 also points to faster growth rates by about 0.284% per month or 3.5% per annum.[13]

To study how the impact of the reform may have varied over time and evaluate the internal validity of our identification strategy, we estimate a modified version of Eq. (1) using the full bank-province panel at a monthly frequency with monthly time dummy variables instead of $Post_t$. We use the first month of the event window as the omitted group. Fig. 5 reports the estimated coefficients and the 95% confidence intervals. The results show that the break occurs as soon as the tax reform law was approved (September 2011) and before it went into effect (January 2012). We do not find substantial differences between the treatment and control group before then, confirming that the parallel trend assumption is satisfied in our setting.

(Insert Figure 5 here)

To further evaluate the internal validity of our identification strategy, we also estimate similar specifications for non-financial firms, whose tax rates were not changed. We find no significant treatment effects. The coefficients of the interaction terms between $BB_{p,2009}$ and

[11] The coefficient $Post_t$ in column 1, 0.092, measures the percentage increase in $Log(TotDep)_{b,p,t}$ in the post-reform period. The effect on the level of $TotDep_{b,p,t}$ is then equal to (exp(0.092)-1) = 0.096.

[12] The annualized compounded percentage change is $0.271 = (1 + 0.02)^{12} - 1$.

[13] In robustness tests, we also explore an alternative measure with bank bonds scaled by the population of province p in 2009 ($PerCapitaBB_{p,2009}$). This alternative measure absorbs cross-sectional variation in $BB_{p,2009}$ due to the size of the province and draws on differences in household demographics (e.g., wealth). The results are qualitatively similar (see Table IA.2 in the Internet Appendix). In additional robustness checks, we also allow for additional interactions between $Post_t$ and economic and demographic province characteristics (e.g., GDP, population). Our key coefficient of interest $BB_{p,2009} \times Post_t$ remains unchanged and the new interaction terms are not found to matter (see Table IA.3 in the Internet Appendix).

$Post_t$ are close to zero and statistically insignificant (see Appendix Table A2). The results on placebo tests for firms, along with the results in Fig. 5, lend further support to our identification strategy.

We next evaluate the impact of the reform on banks' funding mix between household bonds and deposits. The results are reported in Table 3. Consistent with households substituting bank bonds with deposits, we find that in the areas where banks experienced larger increases in household deposits, they also experienced larger drops in bond funding from households. We find that in provinces with higher $BB_{p,2009}$ values, banks experienced larger decreases and lower growth rates in bond funding from households (column 1). We find that, on average, there are no systematic differences in total funding from bonds and deposits (column 2), implying an average pass-through of around one (i.e., on average, one euro decrease in bank bonds is associated with a one euro increase in term deposits),[14] resulting in an increase in banks' average reliance on household deposits over bonds (column 3).

(Insert Table 3 here)

We next study the heterogeneity in the estimated treatment effect on term deposits with respect to the maturity and seniority of household bond holdings and bank characteristics. This analysis helps to further understand how households responded to the reform, which banks were able to raise deposits more easily, and evaluate plausible alternative explanations for our findings. The results are reported in Table 4. In all cases, we report the results for our more conservative growth specifications with bank-time fixed effects.

We begin by distinguishing the household holdings of bank bonds in 2009 with respect to their time to maturity by splitting our key explanatory variable, $BB_{p,2009}$, into three components depending on whether they mature before, during or after 2012. We find that only the share of bonds maturing during 2012 ($BBmat = 2012_{p,2009}$) has significant predictive power in explaining the increase in term deposits after the reform (see column 1 of Table 4). This result indicates that households waited for their bonds to mature to reinvest their proceeds into term deposits, rather than selling them prior to maturity. This is not surprising, given that most banks in the sample are not publicly listed (only 25 banks are publicly listed), resulting in low secondary market liquidity for their retail bonds. This result lends further support to our identification strategy as it suggests that the province variation we exploit is related to a

[14] This is likely to vary across different banks and time horizons depending on the amount of bonds maturing at each point in time. In robustness tests, using shorter event windows (e.g., six months), we find that in the initial months substitution is unequal, with deposits increasing on average more than bonds fall. We do not expect that such temporary increases in balance sheet capacity should influence banks' long-term credit policies, given that banks were aware that the market for retail bonds was going to dry up.

substitution of bonds with deposits rather than other province-specific confounding factors that may happen to correlate with $BB_{p,2009}$ and changes in household deposits.

(Insert Table 4 here)

Next, we distinguish the household holdings of bank bonds in 2009 with respect to their seniority by splitting $BB_{p,2009}$ between senior and junior (subordinated) bonds. We find a positive and significant treatment effect of similar size for both senior and junior bank bonds (columns 2-3), indicating that households with both senior and junior bank bonds reshuffled their portfolios towards term deposits and the seniority of their bond holdings did not play a role. Consistent with earlier findings, this result further suggests that households' substitution of banks bonds with term deposits is unlikely to be driven by a flight to quality as this would predict a larger treatment effect for junior bonds that bear more risk.

We next examine which banks experienced larger increases in deposits. We find that it is the banks that had a higher dependence on bank bonds prior to the reform that increase their term deposits more (columns 4-6). This is intuitive insofar as these banks had to make up for larger negative shocks in bond financing, following the new more unfavorable taxation of bonds. We find that term deposits grow twice as fast for banks with above median dependence on bond funding in areas with more bank bonds. Interactions with bank characteristics also show that riskier banks (with more non-performing loans and lower capital) experienced larger increases in term deposits, which is again inconsistent with flight to quality. We also find no significant heterogeneity with respect to interbank funding.

Overall, our findings indicate that the 2011 tax reform in Italy shocked bank funding structure by inducing a substitution of retail bank bonds with deposits that led to an increase in the share of retail deposit funding, without changing bank total funding or investor class. More broadly, these findings also indicate that changes in taxation can prompt substantial changes in bank funding sources in line with insights from other taxation changes in Schepens (2016) and Célérier, et al. (2017). In this regard, it is important to note that in our setting the effects are sizable not because the treated investors (households) are very price sensitive, but because they hold large volumes of the securities whose returns are being shocked by changes in taxation. Because of the unusually high reliance of Italian banks on retail bond funding, the tax reform examined here provides a rare opportunity to isolate the impact of the demandable nature of the deposit contract on bank lending.

5. The effect of higher deposit funding on bank lending

5.1. Identification strategy

In the second part of the analysis, we trace the impact of the reform on bank lending policies (i.e., credit availability, type of loans, willingness to lend to riskier firms). Studies indicate that banks use internal capital markets to reallocate available liquidity from one region to another (Gilje et al., 2016; Bustos et al., 2020). We thus use the cross-sectional variation in household bond holdings and bank geographical presence, analyzed earlier, to construct a bank-level instrument of changes in deposit funding and trace their impact on bank credit supply. Identification is obtained using within-firm variation by comparing changes in the supply of credit to the same firm across banks that were differentially affected by the reform. Exploiting within-firm variation helps absorb possible confounding changes in firms' demand for credit that are common across differentially affected banks (Khwaja and Mian, 2008). More formally, we estimate the following specification:

$$\Delta\text{Log}(Credit)_{b,f} = \gamma\ \Delta\text{Log}(Term\ Dep)_b + \delta\ Controls_{b,2009} + \alpha_f + \varepsilon_{b,f}\ , \qquad (2)$$

where $\Delta\text{Log}(Credit)_{b,f}$ denotes the growth rate in credit of bank b to firm f before and after the reform and $\Delta\text{Log}(TermDep)_b$ denotes the growth rate of bank b's term deposits before and after the reform. $Controls_{b,2009}$ is a vector of bank characteristics that may influence bank lending policies. It includes a set of dummy variables for each quintile of bank assets, as well as the ratios of nonperforming loans (NPLs), equities, bonds, retail deposits, interbank wholesale funding, liquid assets, and net income to total assets, all predetermined as of December 2009. α_f denotes firm fixed effects and $\varepsilon_{b,f}$ denotes the idiosyncratic error term.

The key problem we face is that $\Delta\text{Log}(TermDep)_b$ may be endogenous, either because of reverse causality or omitted variables influencing both the growth rate of deposits and growth of credit at the same time. Banks with better lending opportunities may, for example, increase their supply of deposits because they want to increase their supply of loans. To obtain exogenous variation in $\Delta\text{Log}(TermDep)_b$, we construct a bank-level instrument to measure a bank's exposure to the reform using the cross-sectional variation in household holdings and bank presence by aggregating across the provinces in which each bank was present in 2009:

$$Exp\_BB_{b,2009} = \sum_p w_{b,p,2009} \times BB_{p,2009}, \qquad (3)$$

where $w_{b,p,2009}$ denotes the share of bank b's household deposits in province p in 2009 over the total deposits of the bank and $BB_{p,2009}$ denotes the volume of bank bonds held by households in province p scaled by total bank bonds across all Italian provinces in 2009.

In line with the results in Table 2, we hypothesize that banks with a geographical presence in bond-rich areas experienced larger increases in deposits, especially if they had a larger deposit base in that province. Besides relevance, a valid instrument must satisfy the exclusion restriction. We think this is likely to be the case in our context for several reasons.

First, the instrument is constructed using predetermined values, which reduces simultaneity concerns. Second, $Exp\_BB_{b,2009}$ draws on variation in household demand for deposit products, which is less likely to correlate with contemporaneous changes in firms' demand for different credit products as depositors and firms value different services from banks (Egan et al., 2017). Third, aggregating across provinces reduces concerns that increases in household deposits may be driven by changes in local bank lending opportunities. As in Drechsler et al. (2017), we assume that because of internal capital markets, a bank's decision to raise deposits in one province is independent of its lending opportunities and lending decisions in another province. Fourth, the results in Table 5 show that banks with below or above median values of $Exp\_BB_{b,2009}$ are not too different with respect to other bank characteristics. We find that banks with below median values of $Exp\_BB_{b,2009}$ tend to be somewhat less profitable with somewhat higher ratios of nonperforming loans than banks with above median values. The two groups have similar average size, capital, dependence on bonds, retail deposits, interbank funding, liquid assets, and sovereign bond holdings. Given the non-random nature of $Exp\_BB_{b,2009}$, these results provide some assurance that the treatment and control banks are not too different with respect to key bank characteristics that may also influence their lending policies. In our specifications, we control for these bank characteristics.

(Insert Table 5 here)

We cannot, however, exclude the possibility that the two groups of banks are different with respect to unobservable characteristics. Hence, in our analysis we provide several additional tests supporting the internal validity of our approach, such as including changes to central bank funding during the event window due to the LTRO among the control variables and a placebo test in the period prior to the reform.

Eq. (2) is estimated using 2SLS for the sub-sample of firms that have term loans with multiple bank-lending relationships. This corresponds to about 89% of all firms, confirming that multiple bank lending relationships are very common in Italy (Detragiache, Garella, and Guiso, 2000). Identification is obtained by comparing how the supply of credit to the same firm varies across banks whose household deposits increased differentially due to the reform.

We also run separate regressions for different types of loans (credit lines, short- and long-term term loans, using the five-year maturity cut-off available in the data). We thus compare the growth rates of the same type of loan across banks that were differentially affected by the reform. This further addresses concerns that treatment effects may be influenced by different banks specializing in different types of loans (Paravisini, Rappoport, and Schnabl, 2017) as we condition on the type of credit granted.

We also employ interactions with firm risk and bank characteristics to uncover possible mechanisms driving changes in lending policies. We use Altman's Z-score as our baseline measure of firm risk. Firms with a Z-score score greater than seven are classified as high-risk firms (Rodano, Serrano-Velarde, and Tarantino, 2018).

5.2. Results: Bank lending policies

5.2.1. Baseline Results

Panel A of Table 6 reports our baseline results using 2SLS. We report results for total credit to a firm, as well as different types of credit. For each specification, we report the second stage coefficients and *F*-stat values, indicating the strength of the instrument in the first stage regression. In Panel B, we report OLS results for comparison.

(Insert Table 6 here)

In all specifications, the *F*-stat values are between 20 and 30, well above the rule of thumb of 10, indicating that in all cases the instrument is strong. The 2SLS estimates show that the increased reliance on deposit funding did not change the overall credit supply of banks, but it did lead to important compositional changes. Larger increases in deposits are associated with relatively more credit lines. Although the total amount of term loans is not significantly affected, there is a compositional change towards more long-term credit. Term loans with longer maturities (≥ five years) have a positive statistically significant coefficient, while those with shorter maturities have a negative but insignificant coefficient. The coefficient of term loans ≥ five years to total loans is also positive and statistically significant, indicating that larger increases in deposits are associated with more long-term loans as a fraction of the total credit to the firm (i.e., inclusive of credit lines).

In terms of magnitudes, our estimates indicate that a bank with a one standard deviation increase in the growth rate of term deposits (i.e., by about 36%) increases credit lines and long-term loans by 2.3 (0.36×0.064) and 5.72 (0.36×0.159) percentage points, respectively. Relative to their respective mean values, these estimates point to a 69% larger increase in the growth rates of credit lines and a 19% larger increase in the grow rate of long-term loans. Both are

economically significant, considering that our sample period is characterized by marked decreases in credit availability in both short- and long-term credit.[15]

OLS estimates in Panel B of Table 6 indicate that failing to account for endogenous changes in term deposits biases the coefficients of $\Delta\text{Log}(Term\ Dep)_b$ towards zero in most cases. The point estimate for credit lines is still positive and statistically significant, but substantially smaller (by about 59%). More importantly, we find no increase in long-term credit in the OLS specification. The estimated coefficients for term loans with longer or shorter maturities are both statistically insignificant and close to zero. The same holds for the ratios of long-term credit to term loans or total credit. Overall, these results underscore the importance of addressing the endogeneity in bank deposit funding.

To evaluate the internal validity of our identification strategy, we perform several tests. First, one concern with Eq. (2) is that contemporaneous changes in bank capital or the provision of central bank funding (e.g., through the ECB LTRO program in December 2011 and February 2012) correlate with our exposure measure, influencing our inference. Fig. 6 shows that this is not the case. Equity to total capital ratios move in parallel trends both before and after the reform, with the 95% confidence bands overlapping in both periods. Similarly, the dependence on central bank funding, which increases for all banks in 2012 after the three-year LTRO does not appear to be markedly different between the two groups. We investigate this further in Panel A of Table 7 by estimating an augmented Eq. (2) including bank-level changes in central bank funding among the control variables. Results remain unchanged, both qualitatively and quantitatively.

(Insert Figure 6 and Table 7 here)

Second, in Panel B of Table 7 we also exclude the sample banks with branches in only one province as reallocation of funds through internal capital markets for such banks is limited (i.e., these banks collect deposits and lend in the same province). This decreases the number of banks in the sample from 482 to 386, but leaves the sample of loans and results virtually unchanged as these are very small (mostly cooperative) banks that account for only a very small fraction of loans in our sample.[16] This reassures that our baseline estimates are not affected much by the presence of many, but small, single-province banks.[17]

[15] During the event window, total credit granted to all firms decreased on average by 13%, with credit lines decreasing by 3% and term loans by 24%. Longer maturity term loans decreased even more by around 29%.
[16] Similar results are obtained if we drop banks with branches in a single region (on average, a region is a collection of five adjacent provinces). A region is the relevant unit for local lending markets for anti-trust purposes. The number of banks (loans) in this case drops to 280 (296,475). The estimated coefficients are very similar to Panel A (0.060*** for credit lines, 0.153*** for long-term loans, and 0.032*** and 0.061*** for the two ratios).
[17] Results in Table 8 are also robust to using a two-year window after the reform (see Appendix Table A3).

We also perform a placebo test by re-estimating our augmented model prior to the reform, using as event window the period between January 2009 to December 2010. Pre-reform tests can be informative as to whether the identified treatment effects are driven by omitted variable biases that are likely to also be present in the recent pre-reform period (such as systematic differences in lending policies due to, for example, differences in expertise, lending technologies, or preferences). We find this is not the case. Re-estimating the model prior to the reform yields no significant treatment effect (see last panel of Table 7).

To sum up, the greater reliance on deposits after the reform led to an increase both in credit lines and long-term credit. The former result is consistent with Kashyap et al. (2002), while the latter is consistent with different theories. It could be the equilibrium outcome of greater discipline associated with runnable debt (Calomiris and Kahn, 1991; Flannery, 1994; Diamond and Rajan, 2001) or of greater reliance on stable funding sources due to government guarantees (Hanson et al., 2015) or market power (Drechsler et al., 2021). From the perspective of a prudential regulator, these channels are very different. While the discipline channel predicts a decrease in bank risk-taking incentives, a lower funding sensitivity to risk may lead to an increase in bank risk-taking incentives. Below we study in more detail the mechanisms driving our baseline findings.

5.2.2. Synergies between deposits and credit lines

In this section, we study the mechanisms driving the credit lines result. Kashyap et al. (2002) argue that bank provision of liquidity on demand to depositors on the liability side creates synergies for the provision of liquidity on demand to borrowers on the asset side. Such synergies emerge because banks save on costly liquidity holdings (that are needed to honor both deposits and credit lines) and exist so long as: i) deposit withdrawals and credit line drawdowns are not positively correlated, and ii) banks cannot simply raise new external liquidly at a moment's notice, creating a need for costly liquidity buffers in the first place.

Both conditions seem likely in our case. First, evidence in Gatev and Strahan (2006) for the US indicates that banks experience deposit inflows in times of market stress, pointing to a negative, rather than positive, correlation between deposit withdrawals and credit line drawdowns.[18] A positive correlation is even more unlikely in our setting. The increase in deposit funding in our experiment draws from a reshuffling of previously accumulated wealth, invested

[18] Evidence for the US during the 2007-2009 financial crisis underscores the importance of government guarantees. Acharya and Mora (2015) find that during the initial phases of the crisis, credit line takedowns outpaced the aggregate deposit inflows until the US government increased its backing of the banking sector (e.g., with an increase of the deposit insurance limit to $250,000, among other measures) and deposit inflows soared.

for future consumption in the form of bank bonds. Withdrawals on such funds are thus unlikely to coincide with the credit line drawdowns of firms. Second, accessing external liquidity at a moment's notice is also unlikely for any bank in our sample period due to the sovereign debt crisis. However, there may be important cross-sectional variation in this dimension that could allow us to test the underlying mechanism behind the credit lines result. All else equal, better capitalized banks should have better access to external liquidity. Synergies for better capitalized banks should be smaller and thus should exhibit a smaller increase in credit lines in response to the reform. The results in Table 8 are consistent with this prediction. We find that increases in term deposits in banks with higher ratios of equity to total assets or higher Tier 1 capital ratio exhibit systematically smaller increases in credit lines.

(Insert Table 8 here)

An additional important prediction in Kashyap et al. (2002) explaining why deposits and loan commitments do not crowd out each other (given that they both compete for the same scarce resource) is that banks optimally increase their liquid asset holdings as their reliance on deposit funding increases. This ensures that they will be better able to cover the risk of deposit withdrawals and commitment drawdowns. Consistent with this, Fig. 7 shows in fact that banks experiencing larger increases in term deposits (i.e., banks with above median values of $Exp\_BB_{b,2009}$) increase their holdings of liquid assets more. Prior to the reform, both groups have much lower levels of liquid assets that move in parallel.

(Insert Figure 7 here)

Overall, our results provide strong empirical support to the predictions in Kashyap et al. (2002) and indicate that a banking system funded with more deposits is better able to provide liquidity insurance to firms in crises periods, reinforcing and complementing key insights from Gatev and Strahan (2006).

5.2.3. Demandability and government guarantees

In this section, we evaluate the role of demandability and government guarantees. As discussed earlier, the increase in the provision of long-term credit could be driven by different forces. It could be the equilibrium outcome of greater discipline emanating from the demandable nature of the deposit contract or conversely it could be the outcome of greater funding stability, stemming, for example, from stronger government guarantees. While the two channels have similar predictions with respect to loan maturity, they have contrasting predictions on the type of borrowers that banks should be directing their credit to. The discipline channel predicts a shift in credit availability away from riskier borrowers towards safer borrowers, particularly when

the threat of runs is higher. The guarantee channel instead predicts an increase in credit to riskier firms (Merton, 1977), particularly by riskier banks more exposed to runs.

Hence, to disentangle these two channels, we first distinguish between high- and low-risk firms by allowing for an interaction between $\Delta\text{Log}(Term\ Dep)_b$ and $Risky_f$, a dummy variable that equals one for firms with an Altman Z-score greater than seven and zero otherwise. The results are reported in Table 9. The coefficient of $\Delta\text{Log}(Term\ Dep)_b$ measures the treatment effect for low-risk firms (omitted group). The sum of the coefficients of $\Delta\text{Log}(Term\ Dep)_b$ and its interaction with $Risky_f$, reported at the bottom of Table 9, measures the overall treatment effect for high-risk firms.

(Insert Table 9 here)

The results do not provide support for the government guarantee channel. We find that the higher provision of credit lines and longer-maturity term loans, observed earlier, is concentrated in low-risk firms. Total credit to these firms is also found to increase. We find no such increases for riskier firms, as visible in the sum of coefficients at the bottom of Table 9. If anything, total term-credit to riskier firms seems to decrease. This is more evident for term loans with shorter maturities that are arguably faster to record any decreases in bank credit availability.[19] The point estimates indicate that a one standard deviation increase in $\Delta\text{Log}(Term\ Dep)_b$ leads to a 1.72 (6.48) percentage point higher growth in credit lines (long-term loans) to low-risk firms and a 7 percentage point lower growth in term loans to riskier firms.

Overall, the results in Table 9 are consistent with theories predicting that the demandable nature of the deposit contract, which exposes banks to runs, decreases their willingness to take risk in the first place. This mechanism requires that the threat of a run is credible. We believe this holds in our sample for several reasons. First, term deposits can be withdrawn before contractual maturity simply by forgoing interest payments. Artavanis et al. (2019) find that early withdrawals on time deposits are common and households exhibit a high willingness to pay for early withdrawals when fundamental and strategic uncertainty increases. Second, as shown in Panel B of Fig. 1, the substitution of bonds with deposits induced by the reform shifted the distribution of deposits towards larger accounts (e.g., with more than €250,000), which are largely uninsured. These accounts are expected to be less "sleepy" as households behind them are better able and have stronger incentives to exercise their demandability rights when

[19] Term loans track a bank's outstanding loan amount to a firm. Due to lags in repayment, decreases in the availability of term loans are naturally less precisely estimated than increases. Credit lines may also be slow to record decreases in credit availability as riskier firms may be more likely to draw on pre-committed credit lines.

concerned about the safety of their funds. Existing studies confirm that retail depositors, particularly if uninsured, are prone to runs and responsive to deterioration in bank fundamentals (e.g., Iyer et al., 2016; Egan et al., 2017; Artavanis et al., 2019). Third, since our sample period coincides with a period of crisis both in the sovereign and banking sector, we expect banks, particularly those with weak fundamentals, to be under a credible threat of depositor run and thus decrease their exposure to risky firms. The results in Table 10 confirm this hypothesis.

(Insert Table 10 here)

Overall, our results provide new evidence that, when not neutralized by government guarantees, the deposit contract can be an effective disciplinary mechanism on banks, limiting credit to riskier firms and enabling the provision of more long-term credit to the real economy.

5.2.4. Depositor runs and stability of retail bonds at stressed banks

The interpretation of our results above relies on the hypothesis that retail deposits, including time deposits, are indeed prone to runs and, all else equal, are a less stable funding source than bank bonds, given their longer maturities and limited secondary market liquidity.

To further strengthen this key hypothesis, we provide novel evidence on the run-like behavior of deposits, including term deposits, relative to retail bonds. In particular, in Fig. 8 we trace the evolution of the retail deposit and bond funding of seven Italian banks—Monte dei Paschi, Banca Carige, Banca Etruria, Banca Marche, CariFerrara, and CariChieti—that have come under stress recently due to weak fundamentals.[20] All stress event dates are collapsed into a single date (time 0) and deposit and bond values are normalized to 1 at time 0.

(Insert Figure 8 here)

Consistent with the Italian financial press pointing to significant depositor withdrawals on these banks, we observe that in the six-month window after the event date, total household deposits of the stressed banks fell rapidly (by around 15%) even though deposits for the entire banking system were increasing (Panel A of Fig. 8). Splitting the total deposits of stressed banks into demand and term deposits reveals that they experienced large drops in both (Panel B of Fig. 8). In percentage terms, drops in term deposits are even larger (-20% vs. -12%), indicating that term deposits, our key variable of interest, are indeed demandable and potentially even more

[20] Monte dei Paschi came under intense stress in July 2016 after failing the ECB stress test. The crisis in Banca Carige, a smaller regional lender, instead intensified in November 2017, after a failed recapitalization attempt. The four small banks, Banca Etruria, Banca Marche, CariFerrara, and CariChieti, came under pressure in November 2015 after the announcement of the bail-in or burden sharing of retail junior bondholders. The Italian financial press indicates that around these periods these banks experienced significant runs from retail depositors (see "La grande fuga dei client dalla banca: depositi giù di 14 miliardi in nove mesi," Fabio Pavesi, December 12, 2016, IlSole24ore "Carige: nel 2018 "in fuga" 2.4 miliardi," Stefano Neri, April 9, 2019, FinanzaReport.it; "Senza salvataggio, a rischio stipendi e apertura degli sportelli," Marco Ricci, Novembre 28, 2015, Cronache Maceratesi).

prone to runs than deposits in checking accounts. Retail bond funding, instead, shows no abnormal drops around the event dates, trailing on the same downward trend before and after the stress event, like the rest of the system, with no acceleration after the event date (Panel C of Fig. 8).

Collectively, we view these results as key evidence that retail bonds are quite stable, whereas retail deposits, including term, quickly evaporate when bank fundamentals deteriorate. This is crucial to understanding the mechanism underlying our credit results as it underscores the importance of the demandable nature of the deposit contract and shows that the tax reform increased the share of bank liabilities that are potentially exposed to the threat of runs.

6. Conclusion

In this paper, we study how a greater reliance on deposit funding affects bank lending policies. The analysis exploits a tax reform in Italy, which led households to substitute their holdings of bank bonds with deposits, leading to a significant increase in demandable liabilities. Consistent with seminal theories in banking, we find that banks funded with more deposits provide more credit lines and long-term credit to the real economy. These benefits emanate from the demandability of deposits and bank market power over retail depositors.

An additional important insight from the paper is that changes in taxation can be a powerful financial stability tool to induce changes in bank funding structures and lending policies. This complements insights for other studies analyzing different taxation reforms.

Appendix

Market power on depositors

Drechsler et al. (2021) highlight that bank market power in deposit markets is a key mechanism behind their maturity transformation. The idea is that operating a deposit franchise (i.e., the bank branch network) gives banks market power over retail depositors, allowing them to pay interest rates insensitive to market rates. Since running the deposit franchise has high operating costs, banks must hold long-term illiquid assets to make a profit. Extending this idea, Li et al. (2019) show that banks raising deposits in more concentrated markets have less pro-cyclical funding costs, enabling them to originate more long-term loans.

To evaluate the extent to which our baseline results on long-term credit are driven by market power on depositors, we estimate an augmented specification of Eq. (2) including the same measure of bank market power as in Li et al. (2019). Similarly to $Exp\_BB_{b,2009}$, this measure is constructed as the weighted average of the Herfindahl-Hirschman Index (HHI) of deposits in 2009 in each province where the bank was present in 2009:

$$HHI_{b,2009} = \sum_p w_{b,p,2009} \times HHI_{p,2009}, \qquad \text{(A.1)}$$

where $HHI_{p,2009}$ is the HHI of deposits in province p in 2009. The weights, $w_{b,p,2009}$, are defined as in Eq. (2) as the share of bank b's household deposits in province p in 2009 over the total deposits of the bank. The correlation between $Exp\_BB_{b,2009}$ and $HHI_{b,2009}$ is 0.283.

The results are presented in Table A1. Consistent with Drechsler et al. (2021) and Li et al. (2019), we also confirm that bank presence in high HHI provinces increases the provision of long-term loans. Our estimates imply that a one standard deviation increase in $HHI_{b,2009}$ (i.e., by 0.047) leads to a 3.11 percentage point increase in the growth rate of long-term loans. This corresponds to an 11% increase relative to the mean. Crucially though, the coefficient of deposit growth, instrumented by Exp_BB_b, barely changes compared to the baseline (0.142 vs. 0.159), implying that our results on long-term credit are independent of the market power channel. In terms of magnitudes, a one standard deviation increase in deposit growth leads to a 5 percentage point larger increase in the growth rate of long-term loans, which is quantitatively similar to the economic significance of the coefficient of $HHI_{b,2009}$.

Overall, our results indicate that both depositor discipline and market power over depositors facilitate the bank maturity transformation and provision of long-term credit. Both channels appear of similar economic magnitude and independent of each other. This may be due to several reasons. First, households' initial holdings of bonds were independent of bank market

power in local markets as bonds are sold nationally with uniform pricing. Second, earlier results show that banks' funding at the bank-province level remained constant, suggesting that market power in local deposit markets played a limited role in households' substitution from bonds to deposits. In fact, the estimated coefficient of $HHI_{\text{p,2009}} \times Post_t$ in augmented specifications of our first stage is not statistically significant.

Table A1

Bank market power on depositors

This table provides the 2SLS estimates for credit, controlling for market power in deposits. $\Delta\text{Log}\ (Term\ Dep)_b$ is the bank growth rate in term deposits over the event window. Exp_BB_b is the bank exposure to the reform. $HHI_{b,2009}$ is the weighted average of province deposit HHI at the bank level. All bank controls are dated as of December 2009. We include bank-size fixed effects as dummies for each quartile of bank total assets. Standard errors are two-way clustered at the bank and firm level. *T*-statistics are reported in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Total Credit	*Credit Lines*	*All Term*	*Term<5Y*	*Term>5Y*	*Term>5Y /Total*	*Term>5Y /Term*
$\Delta Log\ (Term\ Dep)_b$	0.031	0.068***	-0.043	-0.075	0.142***	0.025***	0.041***
	(1.26)	(3.01)	(-0.94)	(-1.22)	(3.37)	(3.04)	(2.92)
$HHI_{b,2009}$	0.058	-0.020	0.026	-0.218	0.661***	0.020	0.010
	(0.73)	(-0.30)	(0.14)	(-0.82)	(3.39)	(0.71)	(0.20)
Fixed Effects							
Firm	Y	Y	Y	Y	Y	Y	Y
Bank-size	Y	Y	Y	Y	Y	Y	Y
Observations	315708	222052	315708	181881	116008	315708	315708
R^2	0.400	0.375	0.368	0.391	0.415	0.361	0.346
No of firms	107654	77189	107654	62736	46235	107654	107654
No of banks	482	468	482	454	474	482	482
1st stage F-stat	37.90	18.99	37.90	28.73	49.95	37.90	37.90

Table A2

Placebo test: Non-financial firm deposits

This table provides the estimates for a placebo effect of the reform on bank deposits held by non-financial firms. The dependent variable is the time averaged monthly log or log-change in deposits at bank *b* in province *p* in twelve months before the announcement of the reform (September 2010 to September 2011) and the twelve months after the reform came in effect (January 2012 to December 2012). $BB_{p,2009}$ is the standardized share of bank bonds held by households in province *p* over total bank bonds held by Italian households in 2009. $Post_t$ is a dummy equal to one for the twelve months after the reform and zero before. Standard errors are clustered at the province level. *T*-statistics are reported in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	log(Total Dep)		*log(Demand Dep)*		*log(Term Dep)*		*Δ log(Total Dep)*		*Δ log(Dem Dep)*		*Δ log(Term Dep)*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$BB_{p,2009} \times Post_t$	-0.004	0.001	-0.008	-0.005	0.017	0.020	-0.015	0.048	-0.065	0.034	-0.060	0.017
	(-0.36)	(0.12)	(-0.83)	(-0.49)	(0.51)	(0.81)	(-0.19)	(0.46)	(-0.71)	(0.29)	(-1.06)	(0.17)
$Post_t$	0.065**		0.016		0.869***		0.714***		0.598**		0.970***	
	(2.60)		(0.67)		(12.73)		(2.78)		(2.10)		(8.43)	
Fixed Effects												
Province	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Bank	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N
Bank-Time	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y
Observations	15287	15220	15118	15049	6226	5969	15047	14978	14871	14799	6089	5825
R^2	0.379	0.385	0.384	0.389	0.291	0.302	0.069	0.111	0.065	0.106	0.203	0.264
No of provinces	107	107	107	107	107	107	107	107	107	107	107	107
No of banks	500	500	499	499	361	361	498	498	497	497	355	355

Table A3

Bank credit: Two-year window after the reform

This table provides the estimates for the effects of the growth rate of deposits on credit lines and term loans, broken down by maturity (Eq. (2)). The dependent variable in each column is the log-change in the time averaged amount of credit granted from bank b to firm f twelve months before the announcement of the reform (September 2010 to September 2011) and the twenty-four months after the reform went into effect (January 2012 to December 2013) by type of credit. $\Delta\text{Log}\,(Term\ Dep)_b$ is the bank growth rate in term deposits over the event window. Exp_BB_b is the bank exposure to the reform. Panel A reports the 2SLS estimates (using Exp_BB_b as the IV), Panel B reports the OLS estimates. All bank controls are dated as of December 2009. We include bank-size fixed effects as dummies for each quartile of bank total assets. Standard errors are two-way clustered at the bank and firm level. *T*-statistics are reported in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Total Credit	*Credit Lines*	*All Term*	*Term<5Y*	*Term>5Y*	*Term>5Y /Total*	*Term>5Y /Term*
$\Delta\text{Log}\,(Term\ Dep)_b$	0.045	0.067**	0.026	-0.024	0.159***	0.032***	0.039**
	(1.50)	(2.37)	(0.35)	(-0.24)	(2.90)	(2.82)	(2.41)
Fixed Effects							
Firm	Y	Y	Y	Y	Y	Y	Y
Bank-size	Y	Y	Y	Y	Y	Y	Y
Observations	324096	228918	324096	189267	118872	324096	324096
R^2	0.411	0.386	0.373	0.399	0.417	0.362	0.351
No of firms	110110	79237	110110	64963	47271	110110	110110
No of banks	475	464	475	449	468	475	475
1st stage F-stat	21.39	11.42	21.39	19.52	27.56	21.39	21.39

References

Acharya, V., Mora, N., 2015. A crisis of banks as liquidity providers. Journal of Finance 70, 1-43.

Artavanis, N., Paravisini, D., Robles-Garcia, C., Seru, A., Tsoutsoura, M., 2019. Deposit withdrawals. Unpublished working paper.

Bessembinder, H., Spatt, C., Venkataraman, K., 2020. A survey of the microstructure of fixed-income markets. Journal of Financial and Quantitative Analysis 55, 1-45.

Bond, S., Ham, K.Y., Maffini, G., Nobili, A., Ricotti, G., 2016. Regulation, tax and capital structure: evidence from administrative data on Italian banks. Bank of Italy WP 361.

Bustos, P., Garber, G., Ponticelli, J., 2020. Capital accumulation and structural transformation. Quarterly Journal of Economics 135, 1037-1094.

Calomiris, C., Kahn, C., 1991. The role of demandable debt in structuring optimal banking arrangements. The American Economic Review 81, 497-513.

Carpinelli, L., Crosignani, M., 2021. The design and transmission of central bank liquidity provisions. Journal of Financial Economics, forthcoming.

Célérier, C., Kick, T., Ongena, S., 2017. Changes in the cost of bank equity and the supply of bank credit. Unpublished working paper.

Coletta, M., Santioni, R., 2016. Le obbligazioni bancarie nel portafoglio delle famiglie italiane. Unpublished working paper. Bank of Italy.

Detragiache, E., Garella, P., Guiso, L., 2000. Multiple versus single banking relationships: theory and evidence. The Journal of Finance 55, 1133-1161.

Diamond, D., Dybvig, P., 1983. Bank runs, deposit insurance, and liquidity. Journal of Political Economy 91, 401-419.

Diamond, D., 1984. Financial intermediation and delegated monitoring. Review of Economic Studies 51, 393-414.

Diamond, D., Rajan, R., 2001. Liquidity risk, liquidity creation, and financial fragility: a theory of banking. Journal of Political Economy 109, 287-327.

Drechsler, I., Savov, A., Schnabl, P., 2017. The deposits channel of monetary policy. The Quarterly Journal of Economics 132, 1819-1876.

Drechsler, I., Savov, A., Schnabl, P., 2021. Banking on deposits: maturity transformation without interest rate risk. Journal of Finance, forthcoming.

Egan, M., Hortaçsu, A., Matvos, G., 2017. Deposit competition and financial fragility: evidence from the US banking sector. The American Economic Review 107, 169-216.

Flannery, M., 1994. Debt maturity and the deadweight cost of leverage: optimally financing banking firms. The American Economic Review 84, 320-331.

Gambacorta, L., Ricotti, G., Sundaresan, S.M., Wang, Z., 2017. The effects of tax on bank liability structure. Unpublished working paper. Centre for Economic Policy Research.

Gatev, E., Strahan, P.E., 2006. Banks' advantage in hedging liquidity risk: theory and evidence from the commercial paper market. The Journal of Finance 61, 867–892.

Gilje, E., Loutskina, E., Strahan, P., 2016. Exporting liquidity: branch banking and financial integration. The Journal of Finance 71, 1159-1184.

Goldstein, I., Pauzner, A., 2005. Demand-deposit contracts and the probability of runs. The Journal of Finance 60, 1293-1327.

Grasso, R., Linciano, N., Pierantoni, L., Siciliano, G., 2010. Le obbligazioni emesse da banche italiane. Unpublished working paper. Consob.

Hanson, S.G., Shleifer, A., Stein, J., Vishny, R., 2015. Banks as patient fixed-income investors. Journal of Financial Economics 177, 449-469.

Heider, F., Saidi, F., Schepens, G., 2019. Life below zero: bank lending under negative policy rates. The Review of Financial Studies 32, 3728-3761.

Hoffmann, P., Langfield, S., Pierobon, F., Vuillemey, G., 2019. Who bears interest rate risk? The Review of Financial Studies 32, 2921-2954.

Imbens, G.W., Wooldridge, J.M., 2009. Recent developments in the econometrics of program evaluation. Journal of Economic Literature 47, 5-86.

Ippolito, F., Peydrò, J., Polo, A., Sette, E., 2016. Double bank runs and liquidity risk management. Journal of Financial Economics 122, 135-154.

Iyer, R., Puri, M., 2012. Understanding bank runs: the importance of depositor-bank relationships and networks. The American Economic Review 102, 1414–1445.

Iyer, R., Puri, M., Ryan, N., 2016. A tale of two runs: depositor responses to bank solvency risk. The Journal of Finance 71, 2687-2725.

Jacklin, C., Bhattacharya, S., 1988. Distinguishing panics and information-based bank runs: welfare and policy implications. Journal of Political Economy 96, 568-592.

Kashyap, A.K., Rajan, R.G., Stein, J.C., 2002. Banks as liquidity providers: an explanation for the co-existence of lending and deposit-taking. The Journal of Finance 57, 33-74.

Khwaja, A.I., Mian, A., 2008. Tracing the impact of bank liquidity shocks: evidence from an emerging market. The American Economic Review 98, 1413-42.

Li, L., Loutskina, E., Strahan, P., 2019. Deposit market power, funding stability and long-term credit. Unpublished working paper. National Bureau of Economic Research.

Martin, C., Puri, M., Ufier, A., 2018. Deposit inflows and outflows in failing banks: the role of deposit insurance. Unpublished working paper. National Bureau of Economic Research.

Merton, R., 1977. An analytic derivation of the cost of deposit insurance and loan guarantees: an application of modern option pricing theory. Journal of Banking and Finance 1, 3-11.

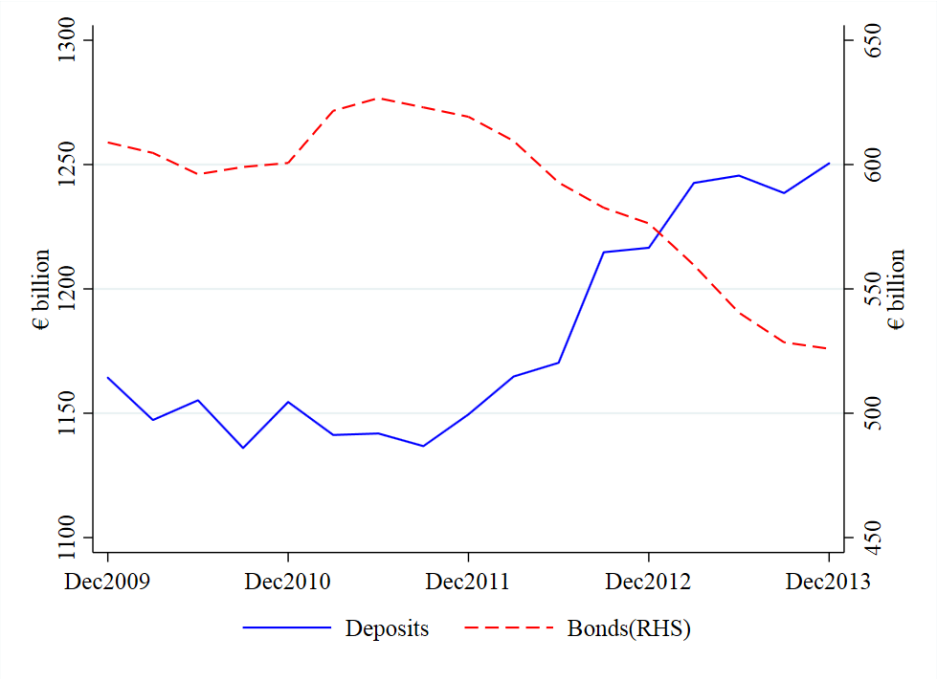
Paravisini, D., Rappoport, V., Schnabl, P., 2017. Specialization in bank lending: evidence from exporting firms. Unpublished working paper. National Bureau of Economic Research.

Ricotti, G., Sanelli, A., 2008. Financial accounts and taxation: a historical analysis. Unpublished working paper. Bank of Italy.

Rodano, G., Serrano-Velarde, N., Tarantino, E., 2018. Lending standards over the cycle. The Review of Financial Studies 31, 2943-2982.

Schepens, G., 2016. Taxes and bank capital structure. Journal of Financial Economics 120, 585–600.

Panel A: Total deposits and bonds



Panel B: Small and large deposit shares

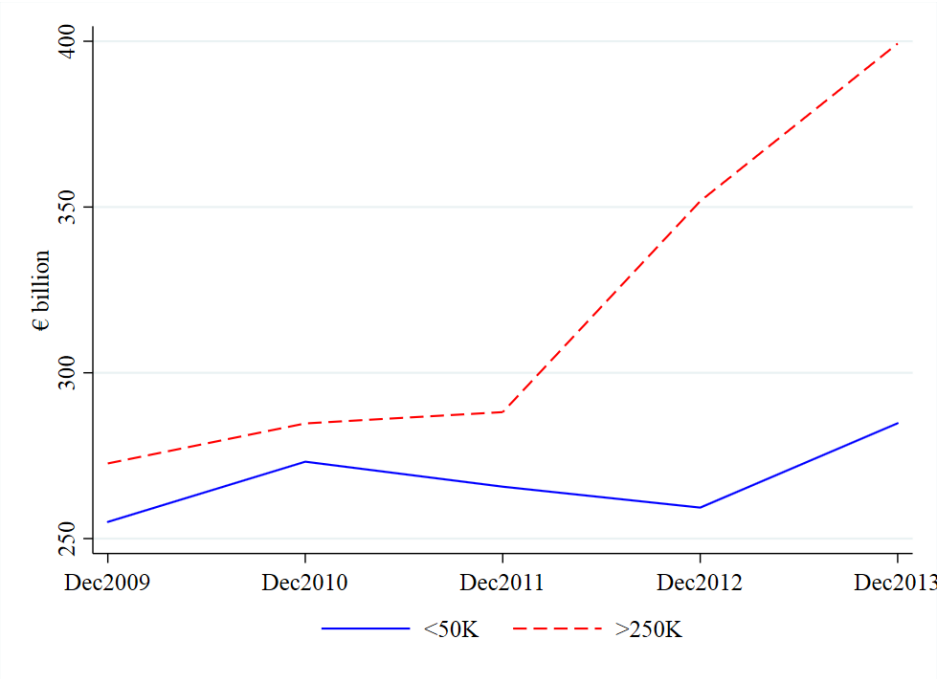


Fig. 1: Bank deposits and bonds

This figure shows total deposits and bank bonds from December 2009 to December 2013. Panel A shows total deposits (solid line) and bonds (dashed line) from aggregate banking sector statistics including all counterparties (e.g., households, firms). Panel B shows total deposits below €50,000 (solid line) and above € 250,000 (dashed line) from bank balance sheet data.

Panel A: Total deposits

Panel B: Demand and term deposits

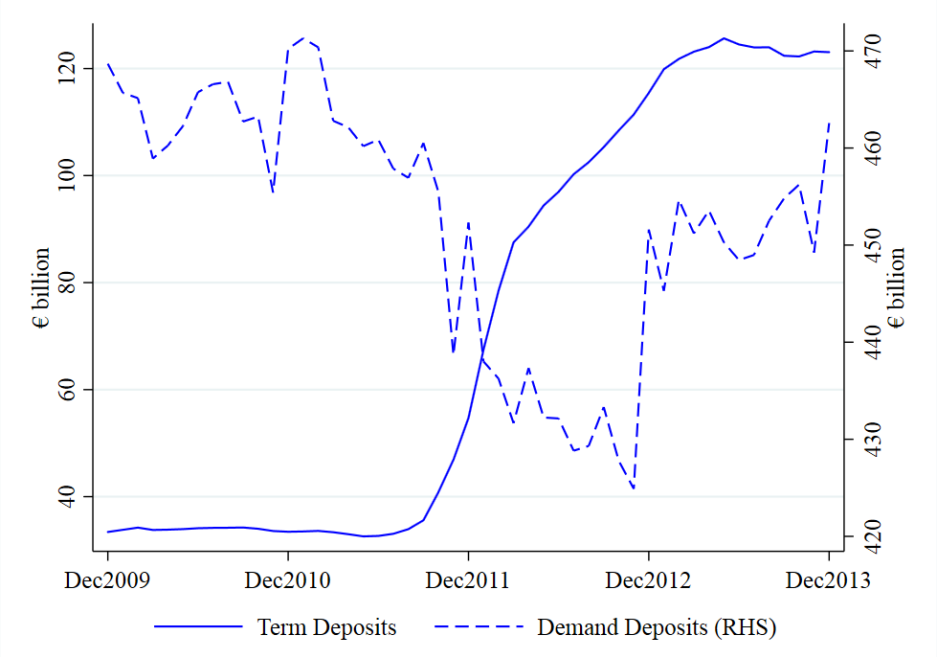


Fig. 2. Household deposits

This figure shows household deposits from December 2009 to December 2013. Panel A shows total deposits while Panel B shows demand (dashed line) and term (solid line) deposits.

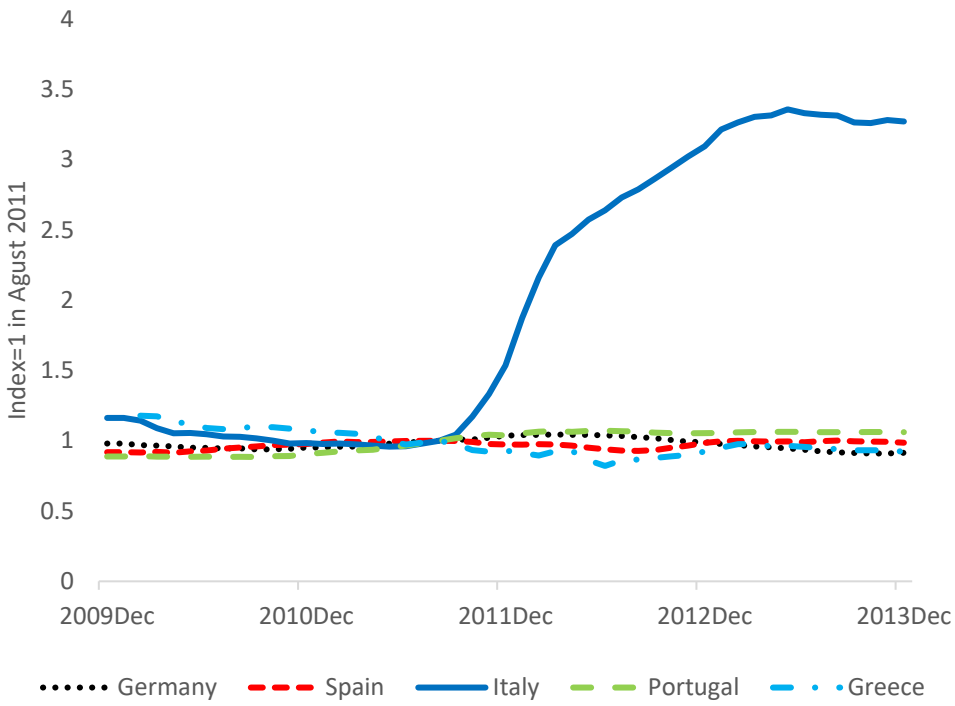
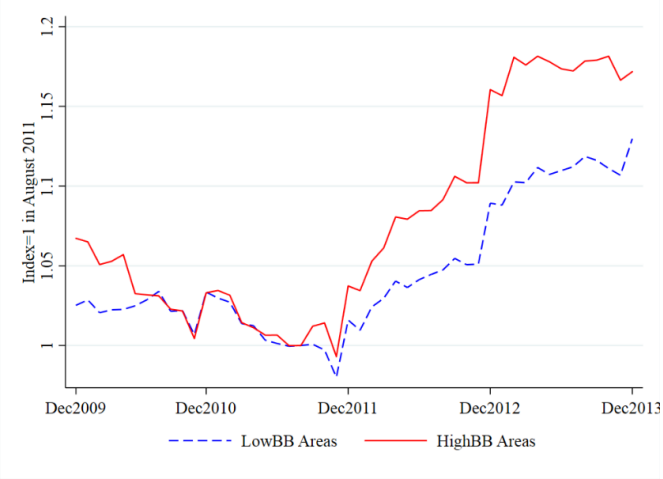


Fig. 3. Term deposits in other countries and the 1996 tax reform

This figure shows household term deposits using monthly data from December 2009 to December 2013 for several European countries: Germany (dotted), Spain (dashed), Italy (solid), Portugal (long dash) and Greece (dash dot). All deposit series have been normalized to have a value of one as of the reform approval date (i.e. index value =1 in August 2011). Source: ECB Statistical Data Warehouse.

Panel A: Total deposits



Panel B: Demand deposits

Panel C: Term deposits

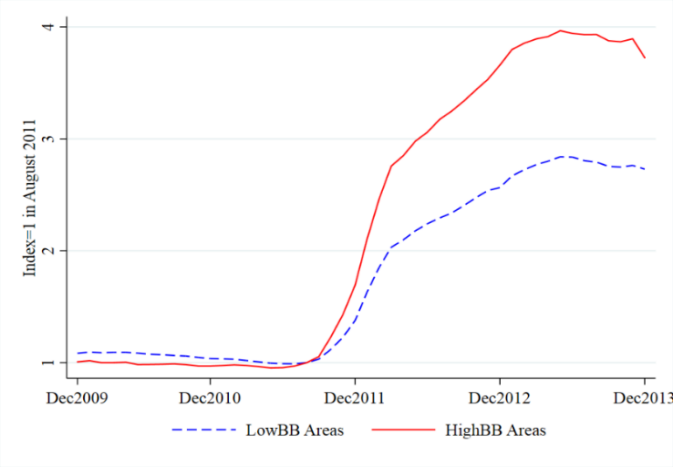
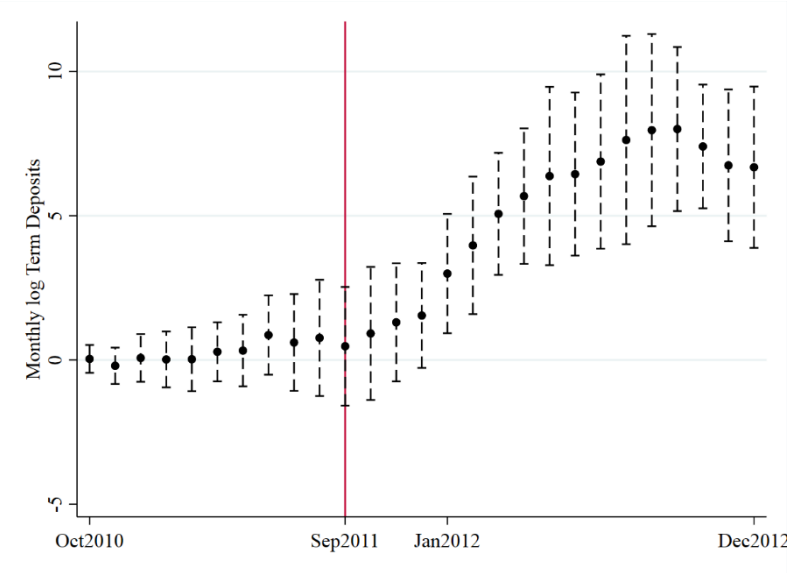


Fig. 4: Household bank deposits by province

This figure shows the evolution of household (total, demand, and term) deposits between provinces with above the median holdings of bank bonds $BB_{p,2009}$ (solid line) and below the median holdings (dashed line) using monthly data from December 2009 to December 2013. All deposit series are normalized to have a value of one as of the reform approval date (i.e. index value =1 in August 2011). Panels A, B, and C report total deposits, demand deposits, and term deposits, respectively.

Panel A: Log (Term Deposits)



Panel B: Δ Log (Term Deposits)

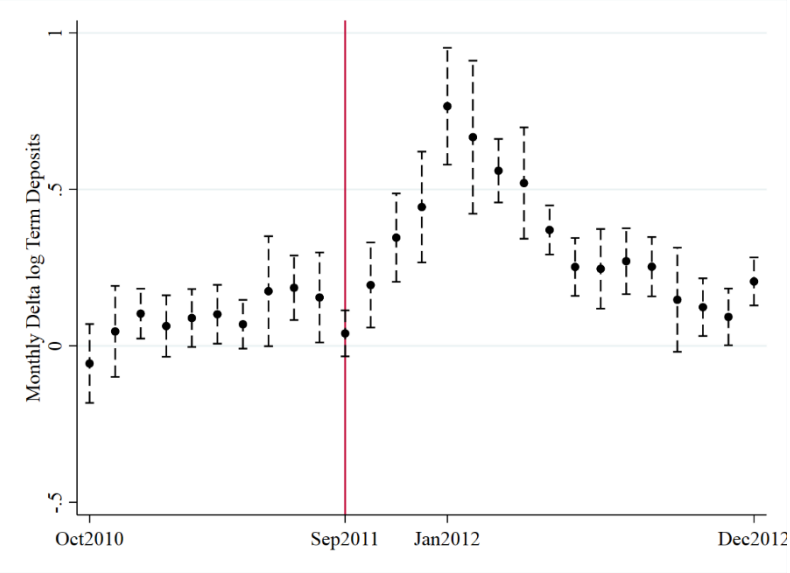


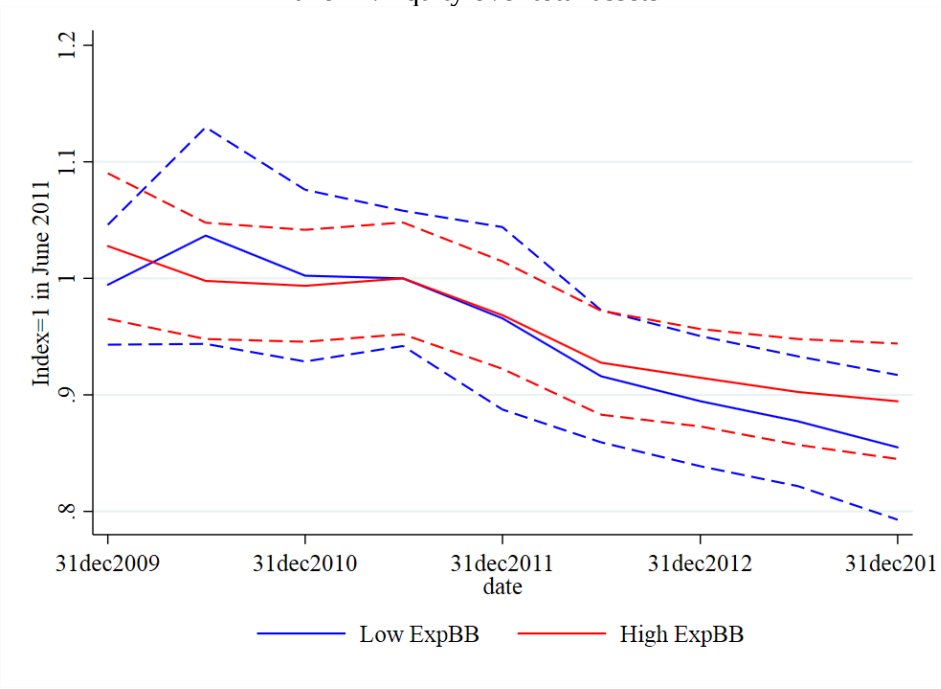
Fig. 5. Dynamic effect of tax reform

This figure shows the β coefficients and associated 95% confidence interval from the following regression:

$$Y_{b,p,t} = \beta_t BB_{p,2009} + \alpha_p + \alpha_{b,t} + \varepsilon_{b,p,t},$$

where $Y_{b,p,t}$ is the $Log(TermDep)_{b,p,t}$ in Panel A and the $\Delta Log(TermDep)_{b,p,t}$ in Panel B. $BB_{p,2009}$ are bank bonds held by households in province p as of 2009 and β_t measures the impact of $BB_{p,2009}$ in each month from October 2010 to December 2012 (omitting September 2010). Standard errors are clustered at the province level.

Panel A: Equity over total assets



Panel B: Central bank funding over total assets

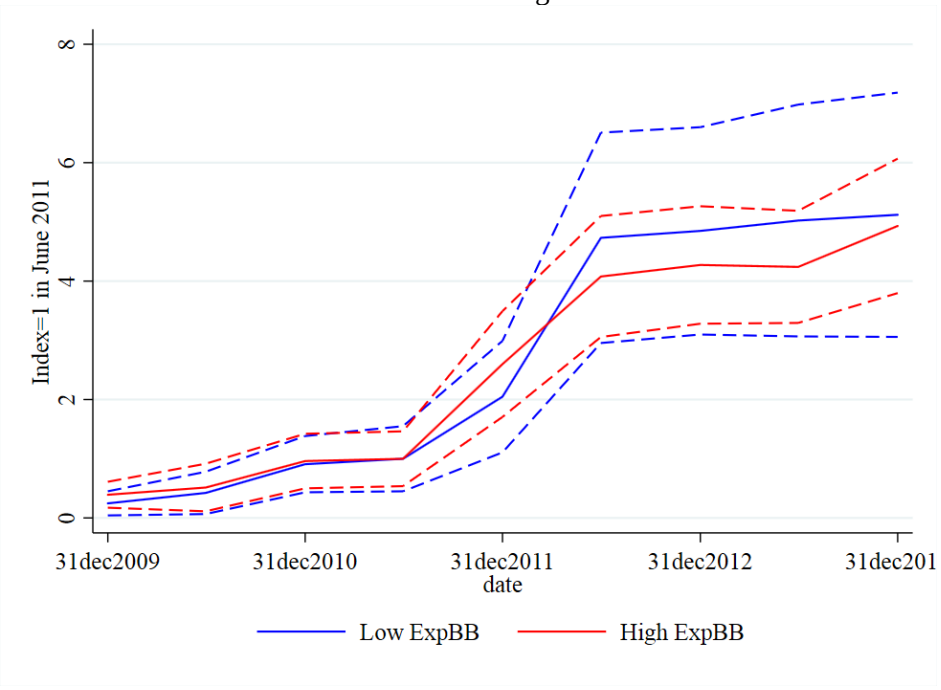


Fig. 6. Bank funding by bank exposure

This figure shows the bank funding between banks with above the median (solid line) and below the median (dash-dot line) exposure to the reform (Exp_BB_b) with the associated standard errors. Panel A shows the fraction of bank capital over total assets. Panel B shows the fraction of total central bank funding, including the three-year LTRO, as a fraction of assets. All series are normalized to have a value of one as of the reform approval date (i.e., index value =1 in June 2011, given that balance sheet information is only available semi-annually)

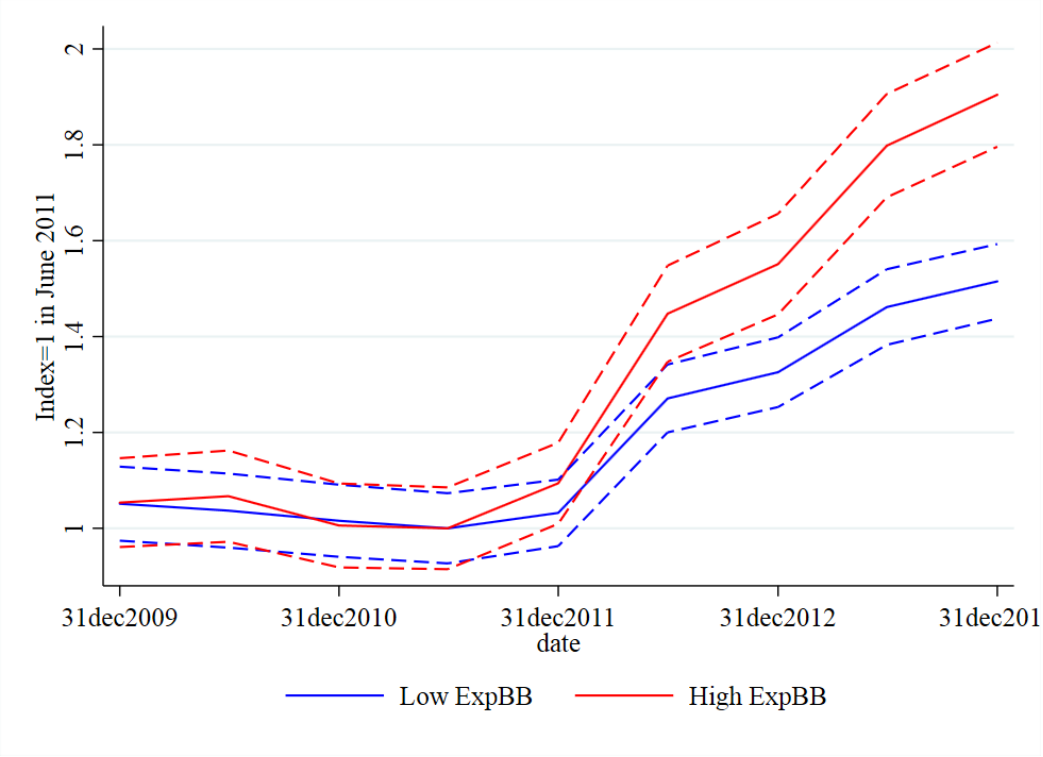
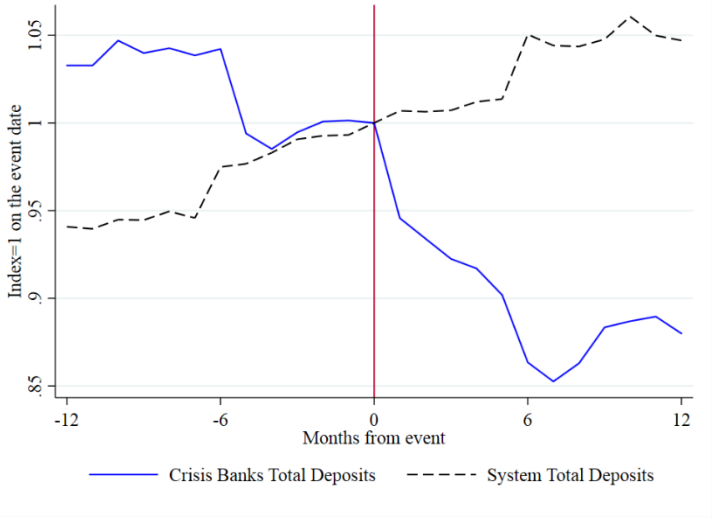


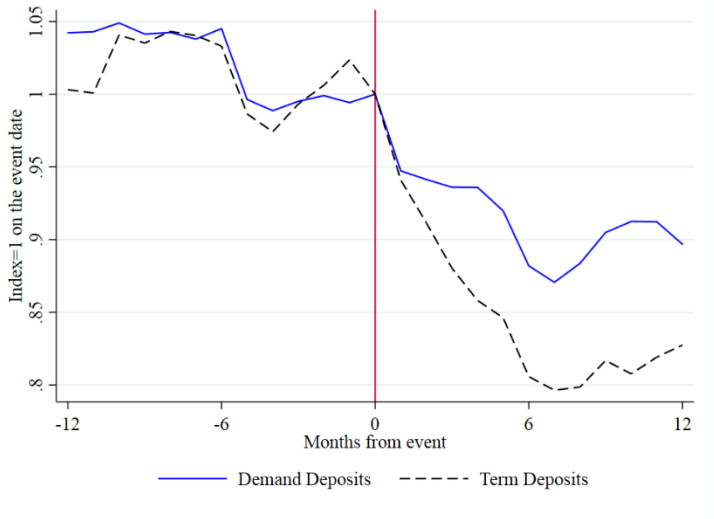
Fig. 7. Liquidity ratio by bank exposure

This figure shows the liquidity ratio (cash and other short-term securities over total assets) for banks with above the median (solid line) and below the median (dash-dot line) exposure to the reform (Exp_BB_b) with the associated standard errors. The series has been normalized to have a value of one before the reform approval date (i.e., index value =1 in June 2011, given that balance sheet information is only available semi-annually)

Panel A: Total deposits



Panel B: Demand and term deposits at stressed banks



Panel C: Retail bonds

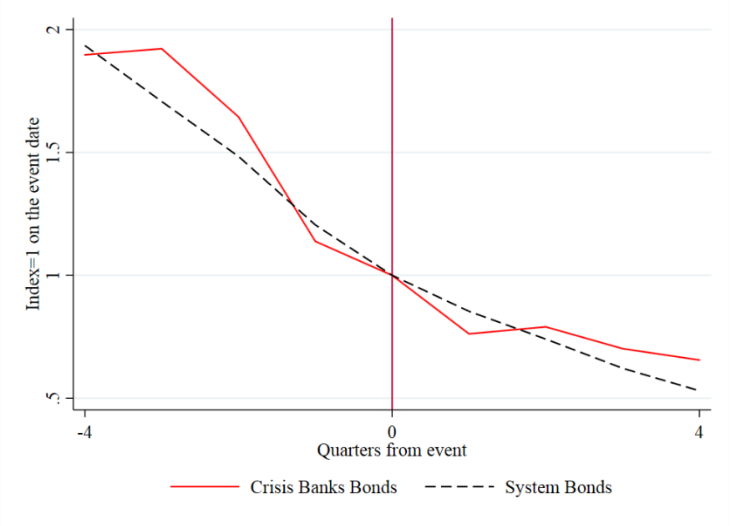


Fig. 8. Deposit runs at stressed banks

This figure shows the evolution of household deposits and bonds for a selected group of stressed banks against household deposits and bonds of all Italian banks over the same period. All series are normalized to have a value of one as of the event date (i.e., index value =1 as of date 0). Panel A shows total household deposits for stressed banks (solid line) against total household deposits of all Italian banks (dashed line); Panel B shows the demand (solid line) and term deposits (dashed line) for stressed banks only and Panel C shows the retail bank bonds at stressed banks (solid line) against total retail bonds of all Italian banks (dashed line)

Table 1

Summary statistics

This table provides summary statistics for all variables used in the empirical analyses, 2009-2012.

	Obs.	Mean	Std. Dev.	Median	Min	Max
Panel A: Bank characteristics as of 2009, in % (bank level)						
Household Deposits/Total Assets	523	32.39	13.68	30.19	9.70	77.39
Firm Deposits/Total Assets	523	5.878	5.47	4.62	.40	36.78
Deposits<€50,000/Total Deposits	520	34.28	15.80	36.40	0	100
Deposits>€250,000/Total Deposits	520	32.09	24.12	26.17	0	100
Bank Bonds/Total Assets	475	22.54	11.67	24.26	2.74	45.76
Equity/Total Assets	523	11.81	6.86	10.55	6.528	91.54
Interbank Funding/Total Assets	523	3.95	9.37	1.35	0	75.93
Nonperforming Loans/Total Assets	517	4.88	3.22	4.63	0	20.58
Total Assets (€ billions)	524	6.79	63.47	0.37	0.05	1261
Exp_BB_b	513	0.015	0.014	0.013	0	0.087
Term Deposits <1Y/Term Deposits	509	93.74	14.10	98.74	0.089	1
Retail bonds maturity (days – security level)	26836	1637.47	1026.84	1153	733	16619
Panel B: Household deposits and bonds (bank-province level)						
$Log(Total\ Dep)_{b,p,t}$	29190	12.64	2.79	11.90	4.74	17.76
$Log(Demand\ Dep)_{b,p,t}$	28517	12.32	2.86	11.64	4.72	17.61
$Log(Term\ Dep)_{b,p,t}$	19827	11.16	3.81	11.12	2.19	17.11
$Log(Bonds)_{b,p,t}$	16426	13.43	3.01	12.67	4.10	19.41
$\Delta Log(Total\ Dep)_{b,p,t} \times 100$	29045	0.629	8.44	0.324	-105.7	102.9
$\Delta Log(Demand\ Dep)_{b,p,t} \times 100$	28360	-0.166	9.29	-0.051	-116.9	112.6
$\Delta Log(Term\ Dep)_{b,p,t} \times 100$	19592	2.33	4.92	0.917	-19.1	34.27
$\Delta Log(Bonds)_{b,p,t} \times 100$	16082	-0.61	6.36	-0.178	-28.02	30.74
$BB_{p,2009}$	29045	0.014	0.015	0.09	0.0001	0.095
$GDP_{p,2009}$	28964	0. 014	0.021	0.007	0.0008	0.096
$Population_{p,2012}$ (thousand head)	29045	774.4	852.2	473.6	86.9	3995.2
Panel C: Bank credit (bank-firm level)						
$\Delta Log(Credit)_{b\,f}$	315708	-0.136	0.387	0	-1.779	1.056
$\Delta Log(Credit\ Lines)_{b\,f}$	222052	-0.033	0.420	0	-1.707	1.397
$\Delta Log(Term\ Loans)_{b\,f}$	315708	-0.246	0.773	-0.181	-2.972	1.999
$\Delta Log(Term\ Loans < 5Y)_{b.f}$	181881	-0.250	0.955	-0.153	-3.572	2.589
$\Delta Log(Term\ Loans > 5Y)_{b.f}$	116008	-0.292	0.704	-0.201	-2.865	1.450
Altman Z-score	315708	4.62	4.98	5	1	9
$Risky_f$	315708	0.151	0.358	0	0	1
$Dshare250K_b$	315708	0.635	0.48	0	0	1
$\Delta Log(Term\ Dep)_b$	315708	0.783	0.366	0.003	0.51	2.17
Exp_BB_b	315708	0.024	0.013	0.025	0	0.062

Table 2

The effect of the tax reform on bank deposits

This table provides the estimates for the effect of the reform on bank deposits held by households (Eq. (1)). The dependent variable is the time averaged monthly log or log-change in deposits at bank *b* in province *p* in twelve months before the announcement of the reform (September 2010 to September 2011) and the twelve months after the reform came in effect (January 2012 to December 2012). $BB_{p,2009}$ is the standardized share of bank bonds held by households in province *p* over total bank bonds held by Italian households in 2009. $Post_t$ is a dummy equal to one for the twelve months after the reform and zero before. Standard errors are clustered at the province level. *T*-statistics are reported in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	log(Total Dep)		*log(Demand Dep)*		*log(Term Dep)*		*Δ log(Total Dep)*		*Δ log(Dem Dep)*		*Δ log(Term Dep)*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$BB_{p,2009} \times Post_t$	0.016*	0.020*	0.011	0.020*	0.022	0.043***	0.153***	0.127**	0.078	0.068	0.124***	0.284***
	(1.86)	(1.98)	(1.29)	(1.81)	(1.32)	(3.33)	(2.78)	(2.16)	(1.21)	(0.94)	(4.14)	(6.91)
$Post_t$	0.092***		-0.070***		0.842***		0.570***		-0.252		1.319***	
	(7.16)		(-5.58)		(20.84)		(4.10)		(-1.58)		(18.64)	
Fixed Effects												
Province	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Bank	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N
Bank-Time	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y
Observations	29190	29169	28517	28494	19827	19795	29045	29026	28360	28338	19592	19558
R^2	0.497	0.500	0.488	0.491	0.358	0.371	0.172	0.212	0.093	0.132	0.404	0.530
No of provinces	107	107	107	107	107	107	107	107	107	107	107	107
No of banks	520	520	520	520	503	503	519	519	518	518	501	501

Table 3

The effect of the tax reform on the substitution between bonds and deposits

This table provides the estimates of the effect of the reform on bank bonds and banks' debt financing mix between deposits and bonds. The dependent variables, either in log-level (Panel A) or in quarterly log difference (Panel B), are the following: bonds issued by bank *b* held by households in province *p* in the pre- and post-reform period (± 12 months from the reform) in column (1); total deposits and bonds in column (2) or the share of deposits over deposits plus bonds issued by bank *b* held by households in province *p* in column (3). $BB_{p,2009}$ is the standardized share of bank bonds held by households in province *p* over total bank bonds held by Italian households in 2009. $Post_t$ is a dummy equal to one for the twelve months after the reform and zero before. All estimations include province and bank-time fixed effects. Standard errors are clustered at the province level. *T*-statistics are reported in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: In log-levels

	Log(Bonds)	*Log(Bonds+Total Dep)*	*Total Dep/ (Total Dep+Bonds)*
	(1)	(2)	(3)
$BB_{p,2009} \times Post_t$	-0.014**	0.002	0.006***
	(-2.19)	(0.31)	(5.09)
Fixed Effects			
Province	Y	Y	Y
Bank-Time	Y	Y	Y
Observations	16426	16426	16426
R^2	0.451	0.488	0.393
No of provinces	107	107	107
No of banks	446	432	448

Panel B; In log differences (ΔLog)

	Δlog(Bonds)	*Δlog(Bonds+Total Dep)*	*ΔTotal Dep/ (Total Dep+Bonds)*
	(1)	(2)	(3)
$BB_{p,2009} \times Post_t$	-0.223***	0.082	0.116***
	(-4.50)	(1.16)	(3.43)
Fixed Effects			
Province	Y	Y	Y
Bank-Time	Y	Y	Y
Observations	16082	16082	16082
R^2	0.285	0.186	0.189
No of provinces	107	107	107
No of banks	446	432	448

Table 4

Heterogeneity by bond and bank characteristics

This table provides estimates for the heterogeneity of the impact of the reform on term deposits from households. The dependent variable in all specifications is the time averaged monthly growth rate of term household deposits at bank *b* in province *p* in the pre- and post-reform period (± 12 months from the reform). $BB_{p,2009}$ is the standardized share of bank bonds held by households in province *p* over total bank bonds held by Italian households in 2009. $BBmat < 2012_{p,2009}$, $BBmat = 2012_{p,2009}$, and $BBmat > 2012_{p,2009}$ are the standardized shares of bank bonds held by households in 2009 maturing before, during, and after 2012, respectively. $BBsenior_{p,2009}$ and $BBjunior_{p,2009}$ are the standardized shares of senior and junior (subordinated) debt held by households in 2009. $Post_t$ is a dummy equal to one for the twelve months after the reform and zero before. $HighBond_{b,2009}$, $HighNPL_{b,2009}$, $HighEquity_{b,2009}$, and $HighInterbank_{b,2009}$ are dummies equal to one if bank *b* is above the median in the following characteristic: bond funding over total assets, Nonperforming loans (NPLs) over total assets, equity over total assets, and interbank funding over total assets in 2009, zero otherwise. All estimations include province and bank-time fixed effects. Standard errors are clustered at the province level. *T*-statistics are reported in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Bond Maturity	*Bond Seniority*		*Bank Characteristics*		
	(1)	(2)	(3)	(4)	(5)	(6)
$BBmat < 2012_{p,2009}$	-0.010					
$\times Post_t$	(-0.06)					
$BBmat = 2012_{p,2009}$	0.358***					
$\times Post_t$	(3.01)					
$BBmat > 2012_{p,2009}$	-0.099					
$\times Post_t$	(-0.53)					
$BBsenior_{p,2009}$		0.280***				
		(6.91)				
$BBjunior_{p,2009}$			0.248***			
			(6.54)			
$BB_{p,2009} \times Post_t$				0.177***	0.162**	0.164***
				(3.10)	(2.10)	(3.00)
$BB_{p,2009} \times Post_t$				0.153**	0.130*	0.130**
$\times HighBond_{b,2009}$				(2.47)	(1.97)	(2.00)
$BB_{p,2009} \times Post_t$					0.159**	0.159**
$\times HighNPL_{b,2009}$					(2.58)	(2.57)
$BB_{p,2009} \times Post_t$					-0.133	-0.134*
$\times HighEquity_{b,2009}$					(-1.50)	(-1.69)
$BB_{p,2009} \times Post_t$						-0.004
$\times HighInterbank_{b,2009}$						(-0.06)
Fixed Effects						
Province	Y	Y	Y	Y	Y	Y
Bank-Time	Y	Y	Y	Y	Y	Y
Observations	19558	19558	19558	19381	19381	19381
R^2	0.529	0.529	0.529	0.499	0.499	0.499
No of provinces	107	107	107	107	107	107
No of banks	501	501	501	498	498	498

Table 5

Balancing of bank characteristics

This table reports the average values of bank characteristics as of December 2009 computed by the median of bank exposure (Exp_BB_b) at the bank-firm level. Tier1 Ratio is Tier 1 capital over risk-weighted assets, equity is total equity capital, interbank is total wholesale funding from interbank deposits, liquidity ratio is the ratio of liquid assets (cash and other short-term marketable securities such as government bonds) over total assets. Numbers in parentheses are the normalized differences (the difference between the average below/above the median and the average above/below, normalized by the square root of the sum of the corresponding variances, see Imbens and Wooldridge 2009). The last column shows the overall average for the sample.

	Below median	**Above median**	**Overall average**
Assets (€ mil)	271,242	272,748	271,795
	(-0.01)	(0.00)	
Tier1 Ratio	8.85	8.72	8.80
	(0.05)	(-0.04)	
Equity/Assets	7.68	8.24	7.90
	(-0.43)	(0.26)	
Interbank/Assets	7.47	8.71	7.96
	(-0.12)	(0.18)	
Retail Deposits/Assets	44.16	42.95	43.72
	(0.12)	(-0.15)	
Bonds/Assets	23.83	25.29	24.34
	(-0.16)	(0.17)	
NPL/Assets	5.16	4.29	4.85
	(0.59)	(-0.33)	
ROA	0.24	0.32	0.27
	(-0.32)	(0.20)	
Liquidity Ratio	8.30	7.94	8.17
	(0.10)	(-0.07)	
Sovereign Bonds/Assets	6.91	6.61	6.80
	(0.08)	(-0.06)	

Table 6

Bank credit: Credit lines and term loans

This table provides the estimates for the effects of the growth rate of deposits on credit lines and term loans, broken down by maturity (Eq. (2)). The dependent variable in each column is the log-change in the time averaged amount of credit granted from bank b to firm f twelve months before the announcement of the reform (September 2010 to September 2011) and the twelve months after the reform came in effect (January 2012 to December 2012) by type of credit. $\Delta\text{Log}\,(Term\ Dep)_b$ is the bank growth rate in term deposits over the event window. Exp_BB_b is the bank exposure to the reform. Panel A reports the 2SLS estimates (using Exp_BB_b as the IV), while Panel B reports the OLS estimates. All bank controls are dated as of December 2009. We include bank-size fixed effects as dummies for each quartile of bank total assets. Standard errors are two-way clustered at the bank and firm level. *T*-statistics are reported in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: 2SLS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Total Credit	*Credit Lines*	*All Term*	*Term<5Y*	*Term>5Y*	*Term>5Y /Total*	*Term>5Y /Term*
$\Delta\text{Log}\,(Term\ Dep)_b$	0.032	0.064***	-0.038	-0.071	0.159***	0.032	0.064***
	(1.52)	(3.16)	(-0.88)	(-1.20)	(3.89)	(1.52)	(3.16)
Fixed Effects							
Firm	Y	Y	Y	Y	Y	Y	Y
Bank-size	Y	Y	Y	Y	Y	Y	Y
Observations	315708	222052	315708	181881	116008	315708	315708
R^2	0.400	0.376	0.368	0.391	0.413	0.361	0.345
No of firms	107654	77189	107654	62736	46235	107654	107654
No of banks	482	468	482	454	474	482	482
1st stage F-stat	32.79	22.08	32.79	27.52	40.97	32.79	32.79

Panel B: OLS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Total Credit	*Credit Lines*	*All Term*	*Term<5Y*	*Term>5Y*	*Term>5Y /Total*	*Term>5Y /Term*
$\Delta\text{Log}\,(Term\ Dep)_b$	0.014	0.026***	-0.021	-0.003	0.015	-0.002	-0.002
	(1.34)	(2.71)	(-1.53)	(-0.15)	(0.88)	(-0.83)	(-0.51)
Fixed Effects							
Firm	Y	Y	Y	Y	Y	Y	Y
Bank-size	Y	Y	Y	Y	Y	Y	Y
Observations	315708	222052	315708	181881	116008	315708	315708
R^2	0.402	0.376	0.369	0.392	0.417	0.363	0.349
No of firms	107654	77189	107654	62736	46235	107654	107654
No of banks	482	468	482	454	474	482	482

Table 7

Bank credit: Identification and robustness

This table provides robustness tests for the 2SLS estimates of Eq. (2). Panel A reports augmented specifications with a bank's three-year LTRO funding as an additional control. Panel B reports corresponding specifications excluding banks with bank branches in a single province. Panel C reports corresponding specifications for a placebo period. The post-reform placebo period in Panel C is January 2010 - December 2010 and the pre-reform period is January 2009 – December 2009. All bank controls are dated as of December 2009. We include bank-size fixed effects as dummies for each quartile of bank total assets. Standard errors are two-way clustered at the bank and firm level. *T*-statistics are reported in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Including 3-year LTRO funding

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Total Credit	*Credit Lines*	*All Term*	*Term<5Y*	*Term>5Y*	*Term>5Y /Total*	*Term>5Y /Term*
ΔLog $(Term\ Dep)_b$	0.033	0.066***	-0.041	-0.084	0.159***	0.025***	0.041***
	(1.47)	(3.06)	(-1.00)	(-1.62)	(3.87)	(3.48)	(3.23)
$\Delta CBFund/Assets_b$	0.001	0.001	-0.003	-0.010***	0.002	0.002***	0.004***
	(0.83)	(0.95)	(-1.22)	(-3.18)	(0.58)	(3.83)	(5.97)
Observations	315708	222052	315708	181881	116008	315708	315708
R^2	0.402	0.376	0.369	0.392	0.414	0.361	0.348
No of firms	107654	77189	107654	62736	46235	107.654	107.654
No of banks	482	468	482	454	474	482	482
1st stage *F*-stat	26.87	14.75	26.87	21.66	37.82	26.87	26.87

Panel B: Excluding single-province banks

ΔLog $(Term\ Dep)_b$	0.031	0.066***	-0.045	-0.086	0.164***	0.025***	0.042***
	(1.37)	(2.95)	(-1.09)	(-1.64)	(3.91)	(3.49)	(3.29)
Observations	308452	217110	308452	178356	112828	308452	308452
R^2	0.403	0.376	0.370	0.393	0.415	0.362	0.349
No of firms	105440	75642	105440	61629	45050	105440	105440
No of banks	386	373	386	363	379	386	386
1st stage *F*-stat	26.22	13.92	26.22	21.09	37.01	26.22	26.22

Panel C: Placebo 2010-2009

ΔLog $(Term\ Dep)_b$	-0.015	-0.029	-0.024	-0.027	-0.044	0.010	0.016
	(-1.10)	(-1.38)	(-1.17)	(-1.06)	(-1.27)	(1.18)	(1.36)
Fixed Effects							
Firm	Y	Y	Y	Y	Y	Y	Y
Bank-size	Y	Y	Y	Y	Y	Y	Y
Observations	320008	229549	320008	183253	117225	320008	320008
R^2	0.374	0.364	0.365	0.386	0.415	0.352	0.345
No of firms	107670	77194	107670	62742	46246	107670	107670
No of banks	489	472	489	458	477	489	489
1st stage *F*-stat	2.18	3.83	2.18	3.18	2.39	2.18	2.18

Table 8

Bank credit lines

This table provides the 2SLS estimates for credit lines. $Equity/Assets_b$ and $Tier1/RWA_b$ are the de-meaned bank leverage and regulatory capital ratio as of 2009. All bank controls are dated as of December 2009. We include bank-size fixed effects as dummies for each quartile of bank total assets. Standard errors are two-way clustered at the bank and firm level. *T*-statistics are reported in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
	Credit Lines	*Credit Lines*
$\Delta\text{Log}\ (Term\ Dep)_b$	0.082***	0.061***
	(3.51)	(3.20)
$\Delta\text{Log}\ (Term\ Dep)_b$	-0.011***	
$\times\ Equity/Assets_b$	(-2.62)	
$\Delta\text{Log}\ (Term\ Dep)_b$		-0.009***
$\times\ Tier1/RWA_b$		(-3.30)
Observations	222052	222052
R^2	0.376	0.376
No of firms	77189	77189
No of banks	468	468
1st stage *F*-stat	8.11	10.31

Table 9

Bank credit: Firm risk

This table provides the 2SLS estimates for the effects of the growth rate of deposits on credit lines and term loans by firm risk. $Risky_f$ is a dummy equal to one for firms with Z-score equal to or above seven. All bank controls are dated as of December 2009. We include bank-size fixed effects as dummies for each quartile of bank total assets. Standard errors are two-way clustered at the bank and firm level. *T*-statistics are reported in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Total Credit	*Credit Lines*	*All Term*	*Term<5Y*	*Term>5Y*	*Term>5Y/ Total*	*Term>5Y/ Term*
$\Delta\text{Log}\,(Term\ Dep)_b$	0.048**	0.073***	-0.010	-0.048	0.180***	0.025***	0.040***
	(2.11)	(3.16)	(-0.23)	(-0.91)	(4.06)	(3.62)	(3.38)
$\Delta\text{Log}\,(Term\ Dep)_b \times Risky_f$	-0.089**	-0.047**	-0.186***	-0.235***	-0.117**	0.005	0.005
	(-2.41)	(-1.97)	(-3.02)	(-3.43)	(-2.14)	(0.47)	(0.48)
$\Delta\text{Log}\,(Term\ Dep)_b + \Delta\text{Log}\,(Term\ Dep)_b \times Risky_f$	-0.041	0.026	-0.196***	-0.283**	0.063	0.029**	0.045***
	(-1.02)	(1.10)	(-3.24)	(-3.73)	(1.17)	(2.26)	(2.36)
Fixed Effects							
Firm	Y	Y	Y	Y	Y	Y	Y
Bank-size	Y	Y	Y	Y	Y	Y	Y
Observations	315708	222052	315708	181881	116008	315708	315708
R^2	0.401	0.375	0.368	0.391	0.414	0.361	0.348
No of firms	107654	77189	107654	62736	46235	107654	107654
No of banks	482	468	482	454	474	482	482
1st stage *F*-stat	13.23	7.29	13.23	10.63	7.27	13.23	13.23

Table 10

Bank term loans

This table provides the 2SLS estimates for term loans. $Equity/Assets_b$ and $Tier1/RWA_b$ are the de-meaned bank leverage and regulatory capital ratio as of 2009. All bank controls are dated as of December 2009. We include bank-size fixed effects as dummies for each quartile of bank total assets. Standard errors are two-way clustered at the bank and firm level. *T*-statistics are reported in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Bank leverage ratio

	(1)	(2)	(3)
	All firms	High-Risk $Risky_f = 1$	Low-Risk $Risky_f = 0$
$\Delta Log\ (Term\ Dep)_b$	-0.077*	-0.164***	-0.061
	(-1.84)	(-3.61)	(-1.38)
$\Delta Log\ (Term\ Dep)_b$	0.019**	0.013	0.021***
$\times\ Equity/Assets_b$	(2.45)	(1.23)	(2.59)
R^2	0.369	0.377	0.367
1st stage *F*-stat	14.31	21.03	13.20
Observations	315708	48950	266758
No of firms	107654	17761	89893
No of banks	482	451	480

Panel B: Bank regulatory ratio

$\Delta Log\ (Term\ Dep)_b$	-0.044	-0.144***	-0.024
	(-1.04)	(-3.24)	(-0.53)
$\Delta Log\ (Term\ Dep)_b$	0.015***	0.015***	0.015***
$\times\ Tier1/RWA_b$	(3.22)	(2.95)	(3.01)
R^2	0.369	0.378	0.367
1st stage F-stat	17.20	23.85	16.12
Observations	315708	48950	266758
No of firms	107654	17761	89893
No of banks	482	451	480