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Deposit Inflows and Outflows in Failing Banks: The Role of Deposit Insurance

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Abstract

Using unique, daily, account-level balances data we investigate the drivers of deposit outflows and inflows in a distressed bank. We observe an *outflow* of uninsured depositors from the bank following bad regulatory news. Both regular and temporary deposit insurance measures reduce the outflow of deposits. We provide important new evidence that, simultaneous with deposit outflows, deposit *inflows* are large and of first-order impact — a result which is missed when looking at aggregated deposit data alone. Outflows of uninsured deposits were largely offset with inflows of new insured deposits as the bank approached failure, with the bank increasing term deposit interest rates. We show this phenomenon holds more generally in a large sample of banks that faced regulatory action. Our results suggest that inflows into insured deposits are an important mechanism that weakens depositor discipline.

Keywords: deposit insurance, deposit inflows, funding stability, depositor discipline
JEL Classification: G21, G28, D12, G01

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1 Introduction

Bank failures are important. There were many bank failures during and after the financial crisis of 2007-2009. The inability of financial institutions to maintain stable funding sources was central to the crisis, which resulted in the high-profile failure or near failure of many financial institutions and unprecedented emergency liquidity support by governments around the world.

Since the Great Recession, a lot of attention has been paid to systemically important institutions. However, looking closely at the roughly 500 banks that failed during the Great Recession, most of these were smaller banks. Individually, very few of these banks were systemic (Granja, Matvos, and Seru, 2017). However, the large number of such bank failures during the crisis were very costly to the FDIC Deposit Insurance Fund, which backs the insured deposit provision of banks. From 2008 to 2013 almost 500 banks failed at a cost of approximately $73 billion to the Deposit Insurance Fund (DIF) with the DIF falling to a negative $20.9 billion by year-end 2009 (FDIC, 2017).[1] Understanding these failed banks and the drivers of deposit flows is hence of importance in its own right.

In this paper we are able to access a unique, highly granular dataset, collected by the FDIC from a failed US bank[2], to examine the drivers of both deposit inflows and outflows. Most of the attention in bank failures and distressed banks has been on deposit outflows. In deposit outflows, theoretically, one of the most important factors should be deposit insurance. Large deposits are uninsured. In principle these deposits provide discipline. However, what about deposit inflows? While the outflow of large, uninsured depositors can impose some depositor discipline, if a bank is able to easily attract new insured deposits then this suggests very little depositor discipline. The theoretical model of Egan, Hortaçsu, and Matvos (2017) suggests that distressed banks may increase deposit rates to attract insured depositors but there has been limited systematic evidence to suggest that distressed banks behave this way and that depositors respond to these rates meaningfully.[3] This paper fills the gap by examining deposit inflows in depth.

To study these issues we first use our uniquely detailed dataset. These data allow us to

[1]The DIF went negative on an accounting basis (incorporating the contingent loss reserve for expected future bank failures), but did not deplete its liquid assets.

[2]Throughout, unless otherwise noted, we use the term "bank" to refer to any insured depository institution, whether it be a commercial bank, thrift, or credit union. We use the term "financial institution" when needed, which includes the term "bank," as well as institutions such as non-bank finance companies, insurance companies, hedge funds and other entities often referred to as "shadow banks."

[3]The evidence has been mainly anecdotal, focusing on a single bank example and rates (see, e.g., the Ally bank example cited in Egan et al., 2017), but no one has documented a systematic response by depositors.

measure daily, account-level balances and attributes for several years. Importantly, unlike with aggregated data such as Call Reports, we are able to separately assess inflows and outflows — a distinction that turns out to be of first-order importance. We find that simultaneous with large deposit outflows, the bank experienced large deposit inflows — just below the deposit insurance limit — with the bank raising its interest rates. We next ask if this phenomenon is observed more generally by studying a large panel of US banks that faced regulatory actions. We find that large insured deposits with these banks increased after enforcement actions, similar to the phenomenon that we observe in the failed bank we study. We further gather data on deposit interest rates offered by large banks before and after regulatory actions through survey data in RateWatch. We find that the larger banks facing regulatory action raise interest rates, suggesting that the pattern of interest rates hikes and deposit inflows that we see in the failed bank under study is a broader phenomenon.

Expanding on our analysis in greater detail, we first examine deposit outflows in our daily-frequency data. We find that FDIC insurance and other government guarantees, including temporary measures such as the Transaction Account Guarantee program (TAG), significantly reduce the withdrawals of insured depositors in response to ailing bank health. Our results thus support the notion that deposit insurance — even temporary measures which one might worry are not well-understood by depositors — improves funding stability. Uninsured depositors are much more likely to withdraw their funds. We additionally find account characteristics that are related to deposit stability, in that checking accounts are more stable than savings accounts, and depositors receiving regular direct deposits such as payroll are less likely to leave the bank. We also find that depositors who have been with the bank longer are less likely to exit, even when faced with bad regulatory news. Finally, we show that when uninsured depositors leave the bank under stress, they typically withdraw a large share even of *insured* funds. This result is especially relevant for financial stability, as even a substantial share of banks' insured funding may flee in response to bad news.

Next, we study deposit inflows. Surprisingly, the failed bank we study was able to replace about a third of its deposit base in the last year of its life, while it was publicly known to be under supervisory scrutiny for its declining condition. About half of these new deposits arrived in the last ninety days before failure, after public regulatory reports showed the bank to be critically undercapitalized. The bank attracted these deposits largely from small financial institutions around the US, most with no previous relationship, using internet deposit listing services.[4] The new deposits were almost all term deposits paying

[4]Listing services are firms which provide potential depositors with a list of deposit rates (one for each

above-market interest rates and structured to fall just under the FDIC insurance limit.

We then use a mix of public data and confidential supervisory data to see if the phenomenon of insured deposit inflows to the bank in distress holds more broadly in other US banks. We identify over 2,000 other banks that were subject to regulatory actions similar to the one faced by this studied bank. We then show that these banks substitute funding away from brokered deposits and time deposits over \$250,000, but increase their reliance on listing service deposits and time deposits below \$250,000. Banks especially increase reliance on term deposits with balances above \$100,000 but below \$250,000, the range in which term deposits structured to fall just under the insurance limit would be. Another question is whether it is just small banks (which are the majority of failed banks) that raise interest rates or whether larger banks also operate the same way. To address this question we gather additional detailed data from RateWatch surveys of interest rates offered by the largest banks facing regulatory action. Consistent with the behavior of our case study bank and the predictions of Egan et al. (2017), we find that large banks facing regulatory action increase the interest rates offered on insured term deposits. These results suggest our findings from the detailed micro data hold more broadly in US banks facing enforcement actions related to undercapitalization or distress.

To the best of our knowledge, we are the first to show that in the presence of government guarantees, gross funding *inflows* are of first-order impact — even in imminently failing banks. This has significant implications for depositor discipline. While large, uninsured deposits provide depositor discipline through outflows, if banks can easily attract new insured deposits then there is little practical depositor discipline. Our results suggest that inflows into insured deposits are an important mechanism that weakens depositor discipline exerted by uninsured depositors.

Further, our results from examining the source of new deposits for the failed bank we study suggest that depositors' knowledge of the mechanics of bank failure and deposit insurance is possibly asymmetric. Unlike in many other countries, FDIC insurance makes bank failure essentially seamless for depositors – if the bank closes on Friday, insured depositors

participating bank) for a number of standard deposit products, often sorted from the highest rate to the lowest and displayed on a website. For supervisory purposes, being classified as a listing service need not imply that one is a third-party deposit placement service, though some deposits may fall in both categories. For the sake of clarity we therefore use the terms "placed deposit" and "listing service deposit" as mutually exclusive terms, unless otherwise noted; if a deposit could be considered both, we code it as a placed deposit. For more detail on the supervisory definition and treatment of listed, placed, and brokered deposits, see FDIC's "Frequently Asked Questions on Identifying, Accepting and Reporting Brokered Deposits," FIL-42-2016, June 30, 2016.

have always been able to access their funds by or before the following Monday. However, as our studied bank approached failure, even yields on riskless insured deposits rose, possibly reflecting an "inconvenience yield" compensating depositors for the potential inconveniences of bank failure. Sophisticated depositors (namely, other insured banks and credit unions) flow into the bank to capture this premium while ordinary depositors stay away.

Our paper contributes to the existing literature in a number of ways. Much of the empirical literature on bank runs employs aggregate data. This literature in general finds that banks with worse fundamentals experience greater deposit withdrawals in a crisis (Gorton (1988); Saunders and Wilson (1996); Calomiris and Mason (1997)), and that large amounts of uninsured deposits can lead to unstable banks (Egan, Hortaçsu, and Matvos (2017)). A small set of papers examines responses of individual deposit(or)s to bank runs. These papers either use snapshots of data (Davenport and McDill (2006)) or data from banks in other countries, such as India (Iyer and Puri (2012); Iyer, Puri, and Ryan (2016)); Denmark (Iyer, Jensen, Johannesen, and Sheridan (2019)); and Switzerland (Brown, Guin, and Morkoetter (2020)). The theoretical model of Egan et al. (2017) provides a framework in which to understand our results. For example, their model predicts that uninsured depositors flee distressed banks, distressed banks pay higher rates to attract depositors, and insured depositors respond little or even flow *into* distressed banks — all of which we document empirically. The deposit flows we find are related to the causes of bank funding instability, the rationale for deposit insurance, and the literature on panic- versus fundamentals-driven bank runs (Diamond and Dybvig (1983), Jacklin and Bhattacharya (1988), Gorton (1988), Saunders and Wilson (1996), Calomiris and Mason (1997)). Finally, several prominent scholars have recently highlighted the dearth of academic empirical research on the stability and liquidity of various funding sources, in spite of liquidity concerns in the last financial crisis (Diamond and Kashyap (2016), Allen and Gale (2017)).

The remainder of the paper is organized as follows: Section 2 provides a brief history of the bank to highlight our key findings and provide context for later analysis. Then, Section 3 presents regression results on the drivers of deposit liquidation; Section 4 presents results on inflows of new depositors; and Section 5 generalizes our qualitative findings to a large sample of US banks. Section 6 concludes.

2 Data Description and Background

We construct our dataset from data collected by the FDIC shortly after the bank's failure, building daily account balances for each deposit account. We are able to reliably construct account-level daily deposit balances from early 2006 until the bank's failure. We observe all account transactions over this period at a granular level. We checked our constructed account balances against Call Reports on total deposits and deposits by account category, and deposits by branch against the FDIC Summary of Deposits data.[5] General summary statistics about these bank accounts are shown in Table 1, broken out to highlight periods of special interest, discussed further in Section 2.1, below.

Until mid-2007, this bank appeared relatively healthy. The bank had approximately $2 billion in assets and primarily made residential real estate loans, but it also offered wealth management services. The bank sourced deposits from physical branches as well as internet depositors with a focus on savings accounts. The balances in accounts with some uninsured funds, both transaction and term deposits[6], were steadily rising (see Figure 1).[7]

By mid-2007, there were signs of the growing financial-system-wide stress at this bank. Insured term balances fell as depositors shifted to other asset categories and the bank managed the size of its wholesale CD portfolio to purchase or sell residential real estate. Between this time and August 2008, there was net run-off in uninsured balances. Figure 1 shows that this was particularly rapid among uninsured term deposits. While less than 40% of uninsured transaction balances ran off during the period, over 50% of uninsured term deposit balances did so. There was comparatively little change in insured deposits. Perhaps because of the inherently forward-looking nature of term deposits, or perhaps because term depositors are relatively sophisticated, term deposits appear more risk sensitive than transaction deposits. While this period excludes the worst of the financial crisis, stress was building in the financial sector[8] Thus, depositors, particularly sophisticated depositors, began to react. During

[5]We also, for example, checked individual accounts to ensure that accounts had zero balance before account opening and after closing, which ensures no transactions were missed.

[6]Throughout this paper, we use the phrase "transaction account" to refer to all non-maturity accounts, namely, both checking and savings accounts. We acknowledge that the phrase "transaction account" has a more precise meaning in certain contexts, such as in the Federal Reserve's Regulation D. Additionally, we use "term deposit" and "certificate of deposit" ("CD") as synonyms. We classify accounts as insured or uninsured using an approximation of the deposit insurance process, aggregating deposit accounts based on their owners and ownership categories before applying the deposit insurance limit for each category.

[7]While the bank employed Federal Home Loan Bank advances (FHLBs) as funding sources, we find no evidence that it took discount window loans or Troubled Asset Relief Program (TARP) funds.

[8]Bear Stearns and IndyMac failed, Northern Rock experienced a run, and some investment funds froze withdrawals.

this time period, the bank significantly curtailed its residential lending activities. Thereafter and up until failure, the bank continued to make commercial and personal loans, along with some residential mortgage loans.

Fall of 2008 saw severe credit and liquidity risks realized across the financial system as well as significant changes in financial policy. The most important policy change for our purpose was the increase in the FDIC's deposit insurance limit from $100,000 to $250,000 effective October 3, 2008. Additionally, the FDIC's TAG program became effective on October 14, 2008, covering all categories of checking accounts.[9] The change in deposit insurance is evident in Figure 1, where uninsured deposits drop and insured deposits jump between the Pre-Crisis and Post-Crisis periods denoted with grey bars. Much of the sudden change in balances by insurance status is mechanical, as deposit accounts between $100,000 and $250,000 suddenly became insured. Much of the remaining change among transaction accounts reflects the almost simultaneous application of TAG guarantees. In contrast, changes in term deposit balances are partly driven by the bank's rapid acquisition of placed deposits, as shown in Figure 2 and discussed at greater length below. Further supporting the notion that term depositors at the bank are more sophisticated and risk-sensitive, uninsured term balances never increase substantially after October 2008.

The inflow of uninsured transaction deposits suggests that the time immediately after the financial crisis was one of limited stress at this bank. The acute system-wide stress of the crisis had receded and the bank's health had not yet significantly deteriorated.[10] About a year before the bank's failure, its primary federal regulator took its first publicly announced action to address the declining health of the bank through a Cease and Desist (C&D) order.[11] The C&D order cited many issues at the bank including insufficient capital as well as poor board and management oversight, and was made public immediately, appearing in the local press within a couple of business days.[12] As can be seen in Figure 1, there is an increase in

[9] Initially, the deposit insurance limit increase was through the end of 2010, but it was made permanent by the Dodd Frank Act. TAG temporarily providing unlimited deposit insurance for negotiable order of withdrawal (NOW) accounts, non-interest-bearing demand deposit accounts, and interest on lawyer trust accounts (IOLTAs), which cover all categories of checking accounts.

[10] Acharya and Mora (2015) document a similar inflow of deposits into the banking system after government actions in late 2008, suggesting the actions reaffirmed markets' confidence in the financial safety net and thus the safety of the financial system (see also Pennacchi (2006), Gatev and Strahan (2006)).

[11] The bank had previously been subject to a non-public memorandum of understanding (MOU) as well as a later troubled condition letter (TCL). These were intended to address many of the same problems which led to the bank's demise. Such confidential, informal enforcement actions are a common element of regulators' response to ailing bank health in earlier stages, when failure is relatively unlikely.

[12] It was described by a banking analyst quoted in the local press as unusually harsh and indicative of high supervisory concern about the bank. Reports in the local press also remarked on the bank's poor health as

aggregate run-off for transaction accounts — both insured and uninsured — unsurprisingly given the negative attention on the bank. As noted above, there were few uninsured term deposits left at the bank, although the few that remained still responded to the news.

Finally, three to four months before the bank failed, the banks' public regulatory filings (including amendments to previous filings) began showing the bank to be "significantly undercapitalized" and, within weeks, to be "critically undercapitalized." Importantly, Prompt Correction Action (PCA) guidelines generally require federal regulators to place a bank into receivership or conservatorship (i.e., fail the bank) within 90 days of it becoming critically undercapitalized.[13] Depositors would expect the bank to fail soon, and uninsured deposit run-off accelerated substantially, as shown in the far right of the top panel of Figure 1.

Ultimately, the bank failed, and its primary federal regulator concluded that its failure was a result of heavy credit losses on the loan portfolio, especially adjustable rate mortgages. The resolution of the bank cost the FDIC approximately 10% of the bank's assets. For context, of the 54 banks with assets between $1 and $10 billion which failed[14] between 2007-2014, the average cost was 18% of bank assets with a right skew, placing this bank's losses in the middle third of the loss rate distribution.

2.1 Defining Time Periods of Special Relevance

For the purpose of our empirical analysis, we separately analyze depositor behavior in each of four windows of time available to us, described below. We identified these time periods using the bank's data and macroeconomic events in order to conduct our tests. In reverse chronological order, the time periods are:

- *Formal Enforcement Action.* This is a period of significant bank-specific distress and represents the primary time period of interest. This period begins with the C&D order (a formal enforcement action) and ends with the failure of the bank. Unlike earlier periods, the stress arose from bank-specific adverse information, rather than from system-wide anxiety. This is generally abbreviated as the Formal period.

- *Post-Crisis.* The Post-Crisis period begins in December 2008, shortly after the government's emergency actions in fall 2008, and runs until the end of May 2009. The

revealed by its financial ratios in a recent public regulatory report.

[13]The term "critically undercapitalized" is defined by law as the lowest of five ranges for bank capitalization ratios. Banks are considered critically undercapitalized if their leverage ratio falls below 2%; nearly insolvent in book value terms. See 12 U.S.C. §1831o for more detail on PCA guidelines.

[14]We exclude open bank assistance (OBA) from our definition of failure in computing this statistic.

Post-Crisis period was a period of considerable distress across the financial system. Unlike in the Formal period, there were not significant revelations of bank-specific trouble. Hence, the Post-Crisis period allows us to compare depositor behavior in response to market-wide stress. We exclude a few months in the fall of 2008 to avoid the confounding effects of emergency actions by the US government, as well as markets' expectations related to those actions.

- *Pre-Crisis.* The next time period we focus on is the year-long period, ending just before September 2008, before the financial crisis. As discussed above, uninsured deposits began running off during this period, particularly uninsured term deposits.
- *Placebo.* We utilize a period of time in 2006 as a placebo period, establishing baseline depositor behavior when neither the bank nor the financial system were perceived to be especially troubled.

3 Analysis of Deposit Outflows

This section presents an analysis using several regression models. We regress a dummy, indicating whether an account liquidates[15], on a variety of account and depositor characteristics in the context of OLS-estimated linear probability models (LPMs). Because the liquidation behavior of term deposits is quite different from that of transaction deposits, we run regressions separately on the two categories for each of the four time periods described above: Placebo, Pre-Crisis, Post-Crisis, and Formal Enforcement Action.

All variables used in the regressions are defined in Table 2. In addition, note that TAG and Dodd Frank Act (DFA) deposit guarantees were effective only after their implementation in the crisis; coverage under these temporary programs was only available in our Post-Crisis and Formal periods. That said, we include a *TAG/DFA Eligible* dummy in all regressions; estimates for the Placebo and Pre-Crisis periods are for baseline/comparison purposes only.[16]

[15] An account is considered to liquidate if its balance falls by 75% or more relative to the balance as measured at the beginning of the period, and the balance stays at or below 25% of the starting balance for at least 61 days; see Table 2.

[16] Note TAG/DFA coverage was designed to effectively remove covered accounts from a depositor's exposure to the bank for the purposes of determining insurance coverage subject to the $250,000 limit. This means that TAG/DFA could indirectly result in other accounts gaining insurance coverage, even if they were not directly guaranteed under TAG or DFA. Further, TAG ends and DFA guarantees begin midway through the Formal period, with the ultimate effect that NOW accounts are no longer covered by unlimited insurance. Given that TAG's expiration was known in advance, we may expect depositors in large NOW accounts to liquidate balances prior to the scheduled end of their deposit guarantees. This would generate a positive

3.1 Drivers of Transaction Deposit Outflows

Focusing first on transaction deposits, Table 3 presents our baseline LPM regressions, one for each of the four time periods of interest.[17] Table 4 presents Probit and Cox proportional hazard model estimates for the Post-Crisis and Formal periods only, demonstrating that our results are robust to various model specifications.[18] In the discussion below, we refer to the LPM model results (Table 3) unless otherwise noted.

The Placebo period in 2006 establishes a baseline for "normal" depositor behavior with little financial stress. First, we find that the *Uninsured* dummy is significant, implying uninsured accounts liquidate about 2.5% more often than the baseline hazard, meaning insured deposits are more stable than uninsured deposits. Second, the *TAG/DFA Eligible* dummy is not statistically different from zero. This is perhaps unsurprising given that TAG and DFA were not yet in effect. This serves as a baseline against which to assess the impacts of TAG; during and after the crisis, this set of accounts was covered by the temporary, unlimited FDIC insurance provided by TAG. Next, the negative, significant coefficient on checking indicates that they are a relatively stable funding source. Fourth, we show that accounts which are receiving direct deposits roughly every two weeks (indicative of direct-deposited paychecks or other regular transactions) are also less likely to liquidate, doing so around 10% less often than non-direct deposit accounts, as indicated by the significant *Direct Deposit* dummy. Finally, the *Trust* dummy is insignificant, meaning that accounts held by trusts liquidate at about the same rate as the baseline account.

We also control for other account and depositor characteristics. Because there is relatively little variation across time periods in our coefficient estimates for these additional controls, we will discuss them mainly with respect to the Placebo period. For instance, depositors with a longer relationship with the bank are generally more stable as shown by the coefficients on *Log(Age)*. The rate at which depositors conduct transactions has a significant, non-linear relationship with liquidation behavior, as both *Prior Transactions* coefficients are significant but with opposite signs. Accounts with very infrequent transactions (unaware or inactive depositors) and accounts with very frequent transactions (operationally important accounts, from the depositors' perspective) are less likely to liquidate than other accounts.

relationship between NOW status and liquidation at the same time that non-interest checking and IOLTA accounts (both still covered by DFA) may show a negative relationship. Thus, we only mark accounts covered by the DFA guarantees (but not TAG) with 1 for this dummy in the Formal period.

[17]We use asymptotically normal standard errors to measure significance, but our findings are qualitatively robust to clustering standard errors at the branch (office) level — see Tables 22 and 23 in the Appendix.

[18]Figure 8 in the Appendix presents the baseline hazard rates corresponding to the Cox results, and Figure 7 presents non-parametric Kaplan-Meier survival curves for the same time periods.

Accounts in the middle, with moderate usage, are more likely to liquidate. While there are statistically significant differences in this basic result across time periods, the differences are economically insignificant. Finally, transaction accounts marked by the *Institutional* dummy are not significantly more or less likely to liquidate than other accounts, and this is true in all periods.

Moving to the Pre-Crisis period (column 2 of Table 3), we see that little changes. The coefficient estimates for the *Uninsured* dummy and *TAG/DFA Eligible* dummy are statistically insignificant, and checking accounts and accounts receiving regular direct deposits remain roughly as stable as in the Placebo period. The finding of similarities between the Placebo and Pre-Crisis periods is generally consistent with the historical discussion above, where transaction deposits did not much react to building financial weaknesses before the peak of the crisis.

Next, in the Post-Crisis period, the *Uninsured* dummy point estimate is larger — such accounts liquidate 7% more often than other accounts at the time. Similarly, the *TAG/DFA Eligible* dummy shows that such accounts liquidate nearly 10% less and the estimate is statistically significant. This reflects the fact that the accounts are actually covered by TAG for the first time (recall that temporary insurance programs were not in place in prior periods), and TAG dampens withdrawal behavior similarly or more effectively (per the point estimate) than ordinary deposit insurance.

Finally, column 4 of Table 3 presents results for the Formal period. The impact of FDIC insurance is stronger than in prior periods: uninsured accounts liquidate 18% faster than other accounts according to the *Uninsured* dummy. This is statistically stronger in the Formal period than the Placebo period at the 1% level of significance. We also find that checking accounts; accounts receiving direct deposits every other week; and accounts held by depositors with longer relationships with the bank continue to be statistically significantly stickier than other accounts. Checking accounts remain sticky following bank-specific bad news, but less so than in response to market-wide stress. In contrast, the impact of the length of depositor relationships is stronger in the Formal period than in the Placebo period; such accounts are more sticky according to the *Log(Age)* dummy. Trust accounts reverse their behavior from the Post-Crisis period and run off 6.98% *more* than other accounts, as shown by the *Trust* dummy. Similar results obtain in the probit and Cox regressions as can be seen in Table 4.

We also include Table 7, which incorporates interest rate spreads over market rates as well as account fees paid; for brevity, we report results only for the Post-Crisis and Formal periods. The addition of the rate and fee variables does not meaningfully change the other coefficients or their significance. Estimates for the rates and fees variables themselves indicate that higher net returns on accounts (either from lower fees or higher rates) are significantly associated with fewer liquidations. The estimates on rates and fees are potentially subject to endogeneity bias; the left hand side is a measure of quantity, and rates and fees measure pricing. Nonetheless, our estimated effects are consistent with the usual intuition that higher rates make depositors more likely to stay with the bank. To the extent that high-return accounts tend to attract rate-seeking or rate-sensitive depositors who generally turn over more often, our estimates might arguably be lower bounds on the causal impacts of net returns.

These results have several important implications. First, we provide clear evidence that funds covered by deposit insurance are more stable, particularly in periods of stress. More generally, the large impacts in periods of stress demonstrate that depositors were aware of the bank's declining health and the limit of deposit insurance. For outflows, absent the gross deposit inflows we analyze in the next section, this suggests active depositor discipline. Second, in the Post-Crisis period, when TAG was in effect, the point estimates for *Uninsured* and *TAG/DFA Eligible* are not statistically different from one another. The point estimates in the first two rows of column 3 of Table 3 are similar in size, and a t-test of differences in the magnitudes of the coefficients between TAG and regular deposit insurance fails to reject the null of no difference with a p-value of 0.67, indicating that the magnitude of the effect of TAG is the same as that of regular deposit insurance.[19] Given that TAG was new and unconventional, the program and its operational details would have been unfamiliar to depositors; the magnitude of the impact we estimate bodes well for the effectiveness of such programs. We do not observe a significant impact of the DFA guarantees in the Formal period, but there are relatively few accounts covered by DFA guarantees so we have significantly lower power than in earlier periods. Third, our finding that checking accounts and accounts receiving regular direct deposits are relatively stable in all environments supports assumptions made in rules such as the LCR and NSFR.[20] Finally, our finding on trust accounts suggests that such depositors are more sophisticated. Trust depositors are less likely

[19]Given the definitions of the variables, the signs are opposite, but this implies the same effect on liquidation behavior. We take the absolute value before conducting the t-test.

[20]To be considered the most stable form of funding for LCR purposes, deposit accounts must be fully insured retail deposits and either 1) a checking account or 2) held by a depositor with other relationships with the bank (such as loans, other accounts, bill payment services, etc.; Basel Committee (2013)). Note that our definition of "checking account" is synonymous with the definition of "transaction account" in Federal Reserve Regulation D.

than others to flee in periods of general distress (Post-Crisis) when the bank itself is not near failure, but more likely to do so as the bank approaches failure in the Formal period; this may reflect the fact that such depositors are typically wealthier and more financially savvy, and thus they may be more able to determine the solvency of the bank.

3.2 Drivers of Term Deposit Outflows

Next, we conduct a parallel analysis of run-off in term deposits (see Tables 5 and 6; we will again focus on the linear probability model estimates in Table 5).[21] Focusing on the Placebo period (Table 5, column 1) first, the *Uninsured* dummy is statistically insignificant, meaning that uninsured term deposits do not liquidate more than insured accounts, probably because bank solvency was not a concern. Turning to the Pre-Crisis period (column 2), the *Uninsured* dummy is now significant with 4.3% more uninsured term deposits liquidating than insured deposits, consistent with the fact that uninsured term deposits began running off during this period (see Figure 1). Column 3 of Table 5 shows responses in the Post-Crisis period. Point estimates for the impact of FDIC insurance are substantially higher than in earlier periods — uninsured accounts are 8.2% less likely to liquidate than other accounts. The results also show that brokered and placed deposits, which we expect would be particularly risk-sensitive, run off very rapidly, with the coefficient on the *Brokered/Placed* dummy indicating 28% more liquidations among these accounts. Although a longer term to maturity (*Log(Days to Maturity)*) continues to be a stabilizing feature of term deposits, relationship age (*Log(Age)*) becomes insignificant.

Finally, in the Formal period, the FDIC insurance dummy remains large and significant, and it is also larger than the point estimates from prior periods; uninsured term deposits are 14.7% more likely to liquidate. Accounts with a longer relationship to the bank remain stickier than other deposits. Term deposits further from maturity are still less likely to liquidate, as seen in the negative *Log(Days to Maturity)* coefficient. Like trust transaction accounts in the Formal period, the *Trust* dummy demonstrates trust term accounts are more likely to liquidate, though the estimate for term accounts is not statistically significant. Finally, the results show a large response from wholesale accounts. *Institutional - Listed/Faxed* deposits, many newly arrived at the bank, are much less likely to liquidate. The *Brokered/Placed* deposits dummy, on the other hand, attests that such deposits run off 55% more than other term deposit accounts, a high response relative to other periods and deposits, showing the

[21] In some time periods, some term deposit account variables are thinly populated, precluding the estimation of coefficients. When this occurs we put a – in the table corresponding to the affected variable.

high risk sensitivity of these wholesale deposits.

We also include Table 7 which incorporates interest rate spreads and fees paid; for brevity, we report results only for the Post-Crisis and Formal periods. To construct the rate spreads, we take the difference between the rate the depositor would have received had they renewed their term deposit that day and the market average rate. Much like in transaction accounts, these new variables do not much change the other coefficients. And higher interest rates are again associated with fewer liquidations. Fees for CDs are rare and only appear in the Post-Crisis period, when they are positively and significantly associated with liquidation probability. Acknowledging the same caveat regarding endogeneity as in the transaction account regressions, our results are consistent with the intuition that higher returns make depositors less likely to exit the bank.

These results provide some significant insights. First and most obviously, the results for term deposits again confirm the stabilizing impact of deposit insurance. Additionally, we show that brokered and placed deposits exhibit a high degree of churn in all periods, but they respond even stronger under stress; this supports the view that such deposits are hot money. As in the transaction deposit regressions, we find that longer depositor relationships tend to help stabilize bank funding.

3.3 Policy Change During Crisis

As we can observe depositors at a high level of frequency, we can study individual events with good specificity. We perform an event study on unconditional liquidation propensity around the time of the deposit insurance limit change, looking at the 36 days before and after.[22] The liquidation probability among deposits uninsured under the old limit of $100,000 and insured under the new limit of $250,000 falls from 0.0512 to 0.0465, with the drop being particularly strong for CDs going from 0.0806 to 0.0512. The effect of this change is harder to disentangle on transaction accounts, due to TAG being implemented approximately a week after the insurance limit change. These results further support the efficacy of deposit insurance in reducing withdrawals.

[22] We chose 36 days because this was the widest window we could use which was symmetric around the deposit insurance limit change and did not overlap with the other time periods we study.

3.4 Account Liquidation and the Withdrawal of Insured Funds

Having established the increased propensity of uninsured depositors to draw down their deposits, we now investigate whether such depositors tend to draw down either to the insurance limit or well below it.

Table 8 presents our results for withdrawals from transaction accounts.[23] Results here incorporate changes in bank conditions and macroeconomic conditions over time. Each row represents one of our four periods. For each period we consider the set of accounts with balances above \$2,000 under insurance limit at the start of the period. The columns then show balances of these accounts at the end of the period, in six account-balance bins. Relative to the Placebo and Pre-Crisis period, depositors in the latter two periods, especially the Formal period, tend to draw down well below the limit: the largest groupings in the Formal period, relative to previous periods, are accounts with \$1 or less and those between \$2000 and \$2000 under half the insurance limit (\$2000 to \$123000, in this period)[24], with far fewer accounts remaining above the deposit insurance limit than in other periods. Under stress, uninsured depositors tend to withdraw much more than required to achieve full insurance coverage, either drawing down to less than half of the insurance limit or liquidating all funds.

This finding has significant implications for financial stability, since even some insured funds are likely to flee banks in response to stress, and can serve to inform banking theory models (such as Davila and Goldstein (2021)).[25]

4 Analysis of Deposit Inflows

The previous section focused on deposit outflows, which is traditionally the area of attention with respect to bank funding stability. In this section, we demonstrate that deposit inflows are also important to funding stability, even in a bank publicly known to be at high risk of failure. After providing an overview of the deposit inflow dynamics at the bank, we use a regression framework to establish the characteristics of new depositors; present time series evidence that these were not solely driven by factors external to the bank; and provide evidence that the deposit inflows were instead attracted by the combination of credible

[23] This is also presented as Figure 6 in the Appendix. We do not show a comparable table for term deposits because their behavior is simpler: generally, they remain with the bank in full or exit entirely.

[24] \$2000 was chosen based on where we observed depositors bunching and based on how much interest they may accumulate.

[25] Iyer et al. (2019) find similar behavior among uninsured Danish bank depositors: in response to bad news about the bank during the financial crisis, they tended to follow the heuristic of splitting accounts in half between two banks to achieve full insurance coverage.

deposit insurance and above-market rates. We complete the section with a discussion of the policy implications of this new finding.

In the last year of its life, the bank attracted new, insured deposits, about half of which arrived in the last 90 days before failure — when the bank was publicly known to be critically undercapitalized. Figure 3 shows that the inflows of insured term deposits from new depositors to the bank totaled nearly $400 million, about a third of the bank's deposit base and roughly equal to the volume of fleeing deposits; because of these flows, the bank's total deposit balances declined little as the bank approached failure. Figure 2 shows term deposits by various wholesale funding categories in the bank over time. This figure reveals that the inflows represented a shift in deposit composition: as placed term deposits (and transaction accounts) fled the bank, they were replaced by institutional term deposits, attracted mostly through internet deposit listing services.

Table 1 provides additional detail. Reflecting new deposits being structured to fall just under the insurance limit, only 2.7% of new deposit accounts in the Formal period were uninsured, down from 6.3% in the Placebo period. Moreover, the average opening balance among new depositors in the Formal period was $186,909. Relatedly, the share of term deposits in new deposits is increasing over time; in the Formal period, 82% of new accounts were term deposits. Finally, 81% of new deposits in the Formal period came from institutional depositors (Listed, Faxed, and Other Institutional), up from 3.1% in the Placebo period.

Additional analysis of the bank's records provides further detail. The institutional deposit inflows were mostly CDs from out-of-state banks and credit unions. As noted above, 81% of the 2600 new deposit accounts in the Formal period were from institutional deposits. Most were in term deposits — 74% of the 2600 were institutional term depositors. Of those nearly 2,000 accounts, about 65% were from credit unions and 32% from banks, with just a few percent from other businesses. Geographically, only 4% were from the same state as the bank (as measured by the depositors' addresses in the deposit system), and the remaining 96% were spread widely across the US. In terms of balances, about three quarters of those institutional CDs had opening balances between $100,000 and 250,000, reflecting the fact that they were structured to fall close to the insurance limit.[26]

Finally, internal bank records indicate the bank began utilizing two deposit listing services during the Formal period, and the timing of the bank's utilization of these services corresponds closely to the surges of institutional deposit inflows shown in Figure 2. In one

[26]Note that the particular dollar range of $100,000 to 250,000 is consistent with Call Report variables used in the generalization exercise below, in Section 5.

case, internal emails indicate the bank began posting rates on a listing service where they apparently had not previously advertised their deposits; in the other case, we found a signed and dated contract with another listing service. These two events are each within a week of either the surge at the beginning of the Formal period or the surge than began about 90 days before the bank failed.

4.1 Characteristics of New Depositors

Having shown that the bank saw substantial deposit inflows, especially late in life, we conduct a set of classification regressions to formally characterize the differences between new and extant depositors in each period (Table 9). We conduct a set of six regressions (one in each column) in which the dependent variables are dummy variables capturing deposit(or) characteristics such as *Uninsured* or *Institutional - Listed/Faxed*. Explanatory variables are the same across all regressions and consist solely of the interaction of a dummy indicating a new versus extant depositor with the time period dummies.[27,28]

The results of these regressions (Table 9) formalize the findings discussed above and previously shown in Figure 2.[29] The first column shows that, relative to the extant depositors in the Placebo period, uninsured deposit accounts became much rarer in periods of stress. In the Post-Crisis and Formal periods, uninsured accounts were about five percentage points less common among existing depositors, and their prevalence among new depositors also declined. At failure, only 1.4% of accounts had any uninsured funds in them (obtained by summing the constant and Extant Depositors/Failure Date coefficient estimates), down from 6.5% in the Placebo period (read directly from the estimate on the constant term). These patterns reflect the general run-off of uninsured accounts, as well as the inflows of insured institutional CDs from listing services. Further reflecting these Institutional inflows, the fourth column shows that Institutional - Listed/Faxed deposits were very rare at the bank

[27]Throughout the paper, unless otherwise noted, a depositor is considered new in any given time period if they open an account within the period and have never previously appeared in the bank's deposit records. Depositors already in the bank's deposit records are referred to as extant depositors.

[28]The observational unit is account × time period, and with five time periods it is possible for an individual account to appear up to five times in this regression. The omitted category is extant depositors in the Placebo period. Thus, the coefficient estimate for the constant term represents the share of extant depositors in the Placebo period exhibiting that characteristic. Coefficient estimates on the other controls represent differences relative to extant depositors in the Placebo period, in percentage points. Adding any coefficient to the coefficient on the constant yields the absolute share of that characteristic among the relevant depositor type (new or extant) in the relevant time period. Note that we also include a Failure Date dummy to summarize depositors extant at the bank when it failed.

[29]See also Table 1 for related summary statistics.

until the Formal period, when they represented 71% of new depositors. Similarly, column six shows that while CDs had generally represented 15-25% of existing depositors and a little less than half of new depositors, they jumped to 82% of new depositors in the Formal period.

Finally, note also that the bank's heavy reliance on brokered and placed deposits following the crisis is reflected in the table, notably among new depositors in the Post-Crisis period. Although total brokered/placed deposit balances were high and relatively flat throughout the Post-Crisis period (see Figure 2), the high rate of churn among these accounts generated many new depositors.

4.2 Drivers of Gross Depositor Inflows

While the previous section illustrates the prevalence of certain depositor characteristics among extant and new depositors, it does not explain the overall prevalence of new compared to old depositors. This section builds upon the last by analyzing the time series of new deposits as a share of total deposits. The left hand side of the regression is either the proportion of deposits that are new as of that day or the log of the dollar volume of deposits that are new that day, while the explanatory variables are time period dummies and economic controls. Among the time dummies, the omitted period is the Placebo period, with dummies for the remaining three periods — Pre-Crisis, Post-Crisis, and Formal — as well as dummies for the spans of time between those periods, plus a prior-to-the-placebo dummy.

Table 10 presents regression estimates explaining the share of newly arrived deposits, while Table 11 presents results for the log of new deposit dollars. Focusing first on the macroeconomic controls in Table 10, higher current quarter GDP growth is associated with higher deposit inflows, consistent with wealth effects. Other macro variables such as housing starts, stock returns, stock market volatility (VIX), OFR's Financial Stress Index, or the bank's growth profile, are not statistically significant. The time series of new depositors' share of deposits is strongly persistent at the daily frequency, as shown by the positive, significant AR(1) term.[30] In contrast, Table 11 shows that the log level of new deposits, correlates with the VIX, the OFR Financial Stress Index, and the autoregressive term.

Now consider the time period dummies in Table 10. Even after the inclusion of macroeconomic controls, some time dummies remain significant. The dummies for the two early time periods are significant, and we note that this was a time in which the bank was growing strategically. Depending upon how one defines a "de novo" bank, the bank we study

[30] Note that this is not a mechanical result of constructing the series with overlapping measurement periods, as we define "new depositors" at the daily frequency.

could be considered de novo during periods before the Pre-Crisis period.[31] The dummies in the last three periods before failure also remain significant, and the point estimate for the Formal period is especially large relative to all others. Thus, the Formal period stands out as a period of especially high inflows.[32] Table 11 shows the uniqueness of the Formal period even more clearly, as the Formal period dummy is the only significant time dummy when all controls are included. Given our set of controls, these results suggests that the inflows late in the bank's life are explained by bank-specific conditions.

Figure 4 suggests the bank-specific cause was the high deposit rates offered by the bank in the Formal period. The figure compares the rates the bank paid on newly issued 12-month CDs, a common deposit product that is representative of the bank's product portfolio and relative market position, showing both the actual rate and its relative ranking along with market percentiles.[33] The figure shows the bank paid relatively high deposit rates throughout its life. However, as deposits flowed in over the last year of its life, the bank consistently paid rates above the 95th percentile of the industry distribution, often approaching the top 1%. Our evidence of the distressed bank raising deposit rates to attract insured deposits is in line with predictions of Egan et al. (2017). Including these interest rate measures in the regressions in columns 3 and 4 of Tables 10 and 11 shows that the bank attracts more deposits on days where it pays higher interest, although depositors do not respond to variation in account fees. Due to potential endogeneity concerns, we view these results on deposit pricing as merely suggestive.

Additionally, we use the regressions of Tables 10 and 11 to calculate the interest elasticities of demand, obtaining an answer very close to other estimates in the literature. Specifically, we calculate an elasticity of 0.61.[34] Artavanis, Paravisini, Robles-Garcia, Seru, and

[31]The regulatory definition of de novo status has changed several times over the years, especially with regard to how many years after opening a bank remains de novo.

[32]Because the Placebo period is omitted, all estimates are relative to the Placebo period. Nonetheless, the Formal period's uniqueness is not driven by the choice of omitted time period. The point estimate is much larger than in any other period, and the Formal period estimate is statistically significantly different from both the Pre-Placebo and Placebo-to-Pre-Crisis, as well.

[33]Rather than taking the average deposit rate being paid on all 12-month CDs at each date, we construct the series as the 31-day centered moving average of rates offered on newly issued term deposits. In this way, the rate series better reflects the rate a hypothetical depositor would have faced had they approached the bank on that date, and there also are some days in which no new 12-month CDs are issued.

[34]To obtain this elasticity from the regression tables, we first calculate the elasticities of the share of new depositors and the quantity of new deposits. These can then be leveraged to calculate the elasticity of existing deposits. The mean share of new deposits as a share of total deposits is 4.29 basis points, the product-weighted spread for these new products over the market interest rate on a given day averages 1.17 percentage points, and the coefficient on this interest rate in column (3) of Table 10 is 5.55. Thus, raising rates by 1 percentage point (an 85.38% increase) raises the share of new by 5.55 basis points (a 129%

Tsoutsoura (2019) find an interest rate elasticity of demand for the quantity of existing depositors of 0.6, while Egan et al. (2017) find an elasticity of 0.56 for insured depositors; both extremely close to our calculated elasticity of 0.61.

4.3 Policy Implications of Deposit Inflows

The deposit inflow phenomenon we document has several important policy implications. First, while some depositors enforced discipline on the bank by leaving, and new depositors were able to demand somewhat higher rates, new depositors offset the disciplining effect by opening new accounts. This finding is important given the Basel framework considers market (in this context, depositor) discipline of banks to be the third of three "pillars" of financial stability. Our finding suggests insured deposit inflows are an important, hitherto undocumented, phenomenon that undermines any such disciplining power.[35] We generalize this finding on inflows empirically in the next section, but we note here that anecdotal evidence supporting these findings was given by our discussant at the Chicago Financial Institutions Conference, who stated he had witnessed such deposit interest rate increases at Indymac Bank, a $30 billion dollar bank, right before its failure in 2007-2008, and had himself moved deposits in response to these higher interest rates. He also noted observing that such interest rate increases were not limited to this one bank.

Second and closely related, our finding emphasizes the importance of studying *gross* deposit flows rather than net deposit flows in understanding the implications of deposit insurance. By making depositors less sensitive to bank risk, deposit insurance stabilizes deposit funding; the inflows from new deposits makes this effect stronger.

Third, the large inflow of new deposits suggests that deposit rate restrictions placed on

increase). Taking their ratio, the interest rate elasticity of the new deposit share is 1.52. Similarly, the coefficient on the interest rate in Table 11 is 2.61; given that the dependent variable is in logs, this coefficient implies that the same 1 percentage point rise in interest rates (an 85.38% increase) drives a 261% increase in new deposits. Thus, the interest elasticity of the quantity of new deposits is 3.05. Using these figures, we can then calculate the elasticity of existing deposits. The average quantity of new deposits on any given day is $558,000 (4.29 basis points of the $1.30 billion daily average total deposits). Using the elasticity of 3.05 from above, a 100% increase in rates therefore increases new deposit balances to $2.26 million (305%). Using the elasticity of 1.52, we know this also increases the new deposit share to 10.79 basis points. For the balances and shares of new deposits to match, total existing depositors' balances must increase to $2.09 billion, an increase of 61% relative to the average such balance. Thus, the interest elasticity of the quantity of deposits from existing depositors is 0.61.

[35] Clearly there are many forms that moral hazard emanating from deposit insurance can take e.g., excessive risk taking on the lending side. Deposit insurance can also inhibit the reallocation of deposit funding away from an insolvent bank. Our objective is not to look at all possible mechanisms - nor do we have the data to do so - but to clearly illustrate one possible effect of deposit insurance that has been hitherto undocumented i.e., its effect on deposit inflows which our results suggest can be large and a first order effect.

troubled banks are insufficient to prevent rapid insured deposit acquisition, certainly in a low rate environment. Motivated by the concerns above, US law and regulation prohibits less than well capitalized institutions from paying deposit rates more than 75 basis points above the national average deposit rate on deposits solicited nationally. Egan et al. (2017) present a theoretical model that suggests such rate caps can rule out particularly bad banking market outcomes where failing banks attract large shares of insured deposit funds. The bank we study was subject to these restrictions during the Formal period, and yet was able to attract deposits equal to around a third of its deposit base. The top panel of Table 1 shows that the bank complied with the rate restrictions; the spread to the market average on new accounts in the Formal period was around 69 basis points.[36] Because the bank was able to attract so many new deposits while under the restrictions, we conclude the rate restrictions were at best a minimally binding constraint on the bank's behavior. However, it remains unclear whether the rate caps would be more effective if short term, riskless rates were substantially above zero; the fed funds rate was at the zero lower bound for the entire period in which the rate caps were in place for this bank. To the extent that the dispersion of deposit rates is reduced when average rates are low (as suggested in Figure 4), the 75bp cap on the deposit rate spread would be less binding while at the zero lower bound compared to periods when rates are above it. Of course, in the absence of any rate restrictions, the bank may well have attracted even more insured funding than it actually did.

These high rates may be a sign of an "inconvenience yield" of deposits issued by a bank close to failure. FDIC resolution of failed banks is close to seamless — if the bank closes on Friday, insured depositors have access to their funds by or before the following Monday. Less sophisticated depositors may be unaware of the process and have concerns about speed and frictions of repayment, and hence refrain from putting insured deposits in a failing bank. Meanwhile, sophisticated, informed depositors (such as other insured banks) flow into the bank to capture this premium. Alternatively, the bank may be willing to pay higher rates for insured deposits because the value of the bank's "insurance put" embedded in insured deposits is higher (Egan et al. (2017)). As the risk of bank failure increases, so does the likelihood that the FDIC, rather than the bank, will end up bearing the costs of these new,

[36] Note that the spreads reported in the table are relative to our computed national average rate rather than that defined by the FDIC. We calculate our own national average series using a method identical to that used for the FDIC series. We use our computed series as the official data do not cover our entire sample period, and we wish to keep series consistency across our sample. The source data underlying the official average data changes with vintage, and we have not been able to recover the vintages used to construct the FDIC series. As a result, our averages tend to differ slightly from the official data. Using the official data over the supported period gives the same qualitative conclusions.

insured deposits. As a result, the bank might be willing to pay more for insured funds.

The final reason that the shift in deposit composition matters to policymakers is that it transfers risk to the FDIC. In addition to fleeing insured deposits, about $150 million of uninsured transaction deposits also left. Because the bank replaced these fleeing uninsured deposits with insured term deposits, the share of the bank's deposits covered by insurance and the credit risk exposure of the FDIC increased as the bank approached failure.

5 Generalization to Other Banks

The unusually granular data for this bank allows us to identify changes in deposit composition as it approached failure, but we unfortunately have such data for only a single bank despite considerable effort and investment to try and secure such data for additional banks.[37]

To generalize our results, we conduct two additional tests. First, we use Call Report data for all US banks to investigate whether banks that face a regulatory action see similar changes in deposit composition. In particular, we investigate the impact of "treatment" with a regulatory action on five funding measures. The five funding measures are the share of each bank's total deposit funding in the form of brokered deposits, listing service deposits, small term deposits (those under $100,000), medium term deposits (those over $100,000 but under $250,000), and large term deposits (those over $250,000).[38] Each series is regressed on a dummy ("treatment") variable for whether or not the bank was facing regulatory action similar to the studied bank, as well as a set of control variables. We define a bank to be facing regulatory action if it is under a formal enforcement action that includes capital-

[37]When we initiated this project, we asked for data from a sample of 10 banks to be recovered and put on a secure server on which we could access the data. We then examined deposit data in each bank. Unfortunately, for many of the banks, the deposit data is incomplete. For some of the banks, the data between systems cannot be appropriately linked; for example, databases sometimes lack identifiers to link transactions (from one database, and necessary for calculating account balances) with deposit accounts (from another database, necessary for many permanent account characteristics) or customer systems (containing separate customer characteristics.) Other banks might keep only the most recent three months of detailed transaction history. Each bank has different storage and retention policies. Compounding these data challenges is the fact that the data contain large volumes of sensitive and personally identifiable information, such that access to the data is highly restricted, and uploading the data to secure IT environments with statistical analysis software is time-consuming. Due to the combination of these factors, it took well over a year for us to obtain access to data for a sample of just 10 failed banks, and after analyzing their data, we determined only the single bank we study had suitable deposit data. As reported earlier, for the bank we study, we are confident that the deposit data are complete by matching to the Call Reports, but this is not true for the other banks.

[38]The average bank in our sample has 3.1% of its deposits classified as brokered, 1.6% as listed, 20.2% as small term deposits, 13.1% as medium term deposits, and 5.5% as large term deposits.

related provisions or if it is less than well capitalized[39] without specific written permission from the regulator to continue taking brokered deposits, usually referred to as a brokered deposit waiver. Less than well capitalized institutions are forbidden from taking new brokered deposits or rolling over old ones unless they have a brokered deposit waiver. Note that any bank meeting our definition of regulatory treatment will also be subject to deposit rate restrictions. The treatment variable is defined using data from public Call Reports and confidential FDIC data, which provides the details of the enforcement actions and brokered deposit waivers. The advantage of this approach is that it gives us a large panel of banks — around 10,000 banks, of which 2,358 faced regulatory action.

The control variables are derived from Call Reports. Control variables are non-performing assets as share of assets, to capture bank health; one-year asset growth rate, to capture the growth and current risk profile of the bank; the natural logarithm of assets, to capture size; deposits as a share of assets, to capture the banks' reliance on deposits generally; and term deposits as a share of deposits, to capture their reliance on term deposits particularly.[40] We use quarterly data for all US banks from 2000 to 2016, with 2,358 banks facing regulatory action and 9,158 not facing them at some point during this time. However, because we rely on the Call Report taxonomy of deposit accounts and because this taxonomy has changed through time, some regressions use shorter samples.[41] Note that regressions also include bank and quarter fixed effects.

Finally, we conduct our analysis under three different model specifications. Two of the specifications are simple OLS models and differ only in the specification of the treatment dummy. In one, we have a single treatment dummy which is equal to one in any bank-quarter where regulatory action was in place; in this case, the untreated ("control") group is all banks not contemporaneously under a regulatory action. In another, we use separate dummy variables for each quarter from four quarters before the imposition of treatment

[39]See 12 U.S.C. §1831o for capital category definitions.

[40]We altered the raw Call Report data by correcting for apparent reporting errors and by winsorizing. Specifically, in a handful of bank-quarters, banks appear to have reported brokered deposits in dollars, inconsistent with the Call Report standard of thousands of dollars, requiring us to divide by 1000. When funding shares calculated from Call Reports were a fraction of a percent above 100% or below 0%, we assume this is due to rounding error, and we round to 100% or 0%, respectively. Finally, we bounded one-year asset growth rates between −50% and 100%, affecting about 2% of bank-quarters, with large asset shifts usually due to new small banks growing rapidly in the first few quarters. Importantly, none of these changes materially affects the point estimates of the treatment variable.

[41]Listing service deposits were not separately identified or reported on Call Reports before the first quarter of 2011, and data necessary to disaggregate term deposits by size is available beginning in 2010. This limited our listing service deposit sample to 559 treated and 7,020 untreated banks and our term deposit sample to 807 treated and 7,141 untreated banks.

to four quarters after, plus an additional dummy for five or more quarters of continuous treatment; in this case, the control group is banks which will not face such action for at least the next four quarters. Finally, we estimate a third specification on propensity-score-matched banks. Banks' propensity to be treated is determined by a logistic regression using the same covariates as in the above regressions, plus contemporaneous term deposit size shares. Then, banks with similar propensity scores — where one was treated and the other was not — are compared after four quarters of continuous treatment to observe the effects of that treatment. The results are consistent across all specifications.

Table 12 shows the results of regressions with a single regulatory action dummy variable. Consistent with our earlier findings, banks under regulatory action reduce their reliance on brokered deposits while increasing listing service deposits. These two compositional shifts do not completely offset one another, but banks may also be seeking other classes of deposits. In addition, there is an increase in the reliance on term deposits below $100,000 as well as between $100,000 and $250,000, with a decrease in deposits above $250,000.

Table 13 and the accompanying Figure 5 demonstrate the time path of the effects of regulatory action on the same deposit categories. Relative to banks who are more than four quarters away from regulatory action, banks one to four quarters before an action have statistically significantly more brokered deposits. These banks become much *less* likely to source such deposits, reflecting the concurrent application of brokered deposit restrictions. The exact opposite pattern appears with listing service deposits, with banks prior to such events having fewer and those after having more. Presumably, this pattern reflects inflows of listing service deposits conceptually similar to those documented previously. Small time deposits are relatively more prevalent in banks in the last few quarters before regulatory action than in the control group, and the difference becomes even more stark after regulatory action. Medium time deposits make up a smaller share of funding at banks prior to regulatory action compared to the control group, but also become more common following regulatory action. Finally, large time deposits are equally as common among banks far from regulatory action as well as those within only a few quarters of action, but they become much less common among banks following regulatory action. Table 14 shows that our generalization results are robust to using a propensity-score-matched specification.

This analysis generalizes our earlier findings along several dimensions. These regressions consistently find that banks under regulatory action reduce reliance on brokered deposits (due to concurrently applied brokered deposit restrictions) and deposits above the insurance limit (reflecting the flight of uninsured depositors from the ailing bank). These regressions show that banks under regulatory action increase reliance on listing service deposits, much as the bank featured earlier in this paper did. Treated banks also increase reliance on term deposits under the insurance limit, and especially those between $100,000 and $250,000. Recall that the bank featured earlier in this paper structured most of its new term deposits during the Formal period to fall just under the insurance limit — within this range.

Another question is whether these patterns hold only for small banks or also for larger banks. The approximately 500 banks that failed during the Great Recession led to significant depletion of the deposit insurance funds and costs to the FDIC hence this finding is important in its own right even if it applies only to smaller banks. However, we also provide evidence that this phenomenon is common even to larger banks. To show that this behavior generalizes even to larger banks, we collected deposit pricing data from RateWatch for large banks which we know faced regulatory enforcement actions similar to the bank we study. For the purposes of this analysis, we define large banks to be those with assets over $5 billion; to avoid sample selection issues, we use total banks assets as of 2008Q4 for this size determination. We chose a relatively low threshold for "large banks" in order to include a sufficient number of observations of banks which faced enforcement action; beyond the substantial right-skew in the distribution of all banks in the US by asset size, the enforcement actions we study are particularly uncommon against very large banks.[42]

We use rates offered on the 12-month retail CD with a $100,000 balance as the representative deposit rate in this analysis, and we construct the spread on these accounts relative to the FDIC national average rate data. To measure large banks' deposit interest rates, we use survey data collected by RateWatch. The raw survey data collected by RateWatch is at the weekly frequency, at the branch level, and includes rates for a large variety of deposit products. We drop promotional rate offers, relationship-based special offers, and business-focused offers, leaving us with regular, retail deposit offerings. We then exclude non-bank institutions. Next, we adjust the correspondence between banks and branches to reflect branch sales; raw survey data takes the branch as the unit of observation, and we use a file containing changes in branch ownership to reconstruct the history of banks to which those branches (and their survey responses) belonged. Having generated an accurate correspondence between branches' weekly deposit rates and the bank which owns the branch, we take an unweighted average across all branches within the bank at each point in time and for each given product; this yields bank-level average rates by deposit product. Finally, we

[42]We considered higher asset size thresholds to define large banks, but cannot disclose the results, as the sample sizes are sufficiently small that releasing those results may reveal agency sensitive information and would violate best practices for disclosure review.

keep the last weekly survey report for each bank within the quarter, yielding quarter-end deposit rates by bank and product.

Focusing only on banks facing enforcement actions, we conduct a pooled OLS regression (Table 15). We regress these large banks' 12-month CD rate spreads on (1) a dummy variable indicating whether they are currently under an enforcement action and (2) a set of quarterly (time) dummies. Here the coefficient on the enforcement action dummy represents the difference in rate spreads offered by banks under enforcement action versus those banks which are about to be under enforcement action (within four quarters). This regression reveals that these larger banks raise their rates by a statistically significant 41 basis points around the imposition of enforcement actions. Adding this result to the constant, we find that large banks under enforcement action on average pay almost exactly 75 basis points above the FDIC national average – that is, at or near the limit for such banks.[43]

6 Conclusion

In this paper we use a highly granular and unique dataset to identify important new findings related to deposit inflows and outflows in a failing bank. Our most important finding is that gross deposit *inflows* are of first order impact in failing banks' balance sheets, despite the banks' elevated default risk and supervisory actions meant to prevent costly and rapid deposit acquisition. Even though there are substantial deposit outflows in the bank under study – the bank loses one-third of its existing deposits – these are made up by substantial deposit inflows, with new deposits typically just below the deposit insurance limits. The new deposit inflows arrive as the bank increases its interest rates - in line with the theoretical predictions of Egan et. al. (2017). Though our focus is one bank, we demonstrate that our main findings qualitatively generalize to other banks by using a combination of confidential supervisory data and publicly available but less granular data on other US banks, and by collecting additional data on interest rates.

We also identify a number of policy-relevant findings related to gross deposit *outflows*. Most importantly, we provide further evidence that deposit insurance improves funding stability. We also provide the first empirical evidence that temporary, crisis-era expansions of deposit insurance, such as FDIC's TAG, are as effective as ordinary deposit insurance in preventing deposit outflows. Many of our findings on outflows support the intuition which is

[43]The above results are based on a quarterly frequency regression with data coming from a total of 19 unique banks, and the panel data are imbalanced/censored.

reflected in regulations, such as that checking accounts and accounts receiving regular direct deposits are more stable. Ultimately, our results suggest that focusing on deposit outflows alone in times of stress or bank failures is inadequate; deposit inflows are also first order important, worthy of further attention by regulators and academicians alike.

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Table 1: Summary Statistics, by Period

(a) New Depositors

	Placebo (1)	*Pre-Crisis* (2)	*Post-Crisis* (3)	*Formal* (4)
Number of New Accounts	3,028	2,146	927	2,600
Uninsured at Start of Account	0.063	0.087	0.044	0.027
TAG/DFA Eligible	0.015	0.038	0.016	0.008
↪ *(Covered in Post-Crisis & Formal)*				
Starting Balance	43,520	90,840	141,000	186,900
Term (count-weighted)	0.461	0.478	0.417	0.824
Savings (count-weighted)	0.487	0.379	0.408	0.084
Checking (count-weighted)	0.052	0.144	0.175	0.092
Starting Interest Spread to Market	2.561	1.656	0.796	0.671
Institutional - Listed/Faxed	0	0.006	0.013	0.707
Institutional - Other	0.031	0.252	0.245	0.100
Brokered/Placed	0.002	0.035	0.221	0
Trust	0.038	0.037	0.094	0.041

(b) Extant Depositors

	Placebo (1)	*Pre-Crisis* (2)	*Post-Crisis* (3)	*Formal* (4)	*Failure* (5)
Number of Accounts	41,366	44,910	38,374	30,342	25,141
Uninsured at Start of Period	0.065	0.087	0.009	0.021	0.014
TAG/DFA Eligible	0.006	0.008	0.004	0.004	0.005
↪ *(Covered in Post-Crisis & Formal)*					
Starting Balance	28,310	27,710	31,450	43,970	49,750
Term (count-weighted)	0.190	0.242	0.222	0.123	0.191
Savings (count-weighted)	0.734	0.690	0.700	0.768	0.678
Checking (count-weighted)	0.076	0.068	0.079	0.109	0.130
Starting Interest Rate	4.121	4.367	2.486	0.941	0.882
Starting Interest Spread to Market	2.604	2.576	1.492	0.673	0.632
Institutional - Listed/Faxed	0	0	0	0.002	0.084
Institutional - Other	0.013	0.015	0.025	0.047	0.065
Brokered/Placed	0.013	0.012	0.045	0.037	0.005
Trust	0.015	0.017	0.016	0.023	0.028
Direct Deposit	0.028	0.030	0.023	0.035	0.032
Past Month Fees	-0.237	-0.061	0.084	0.174	0.171
Age of Relationship in Years	2.214	3.076	4.031	5.587	6.032
Years Since Start of Previous Period	-	1.25	1.25	1.78	0.92

Panel (a) shows summary statistics across all new depositors arriving within each of the four event periods, excluding existing depositors. Panel (b) shows corresponding statistics for depositors who were extant at the bank at the beginning of each period as well as those at the bank on the day it failed (*Failure*).

Table 2: Variable Definitions for the Regressions of Section 3

Liquidation: A dummy variable equal to 1 if the deposit account balance falls by 75% or more relative to the balance as measured at the beginning of the period, and the balance stays at or below 25% of the start-of-period balance for at least 61 days, which includes the account closing. This notion of account liquidation is generally consistent with related studies (for example, Iyer and Puri (2012)). Results in this paper are robust to different thresholds of 50% and 80%.

Uninsured: A dummy variable equal to 1 if there are *any* uninsured balances in the account at the start of the period. Deposit insurance limits apply separately to different ownership types, so we account separately for individual, corporate, municipal, joint, IRA, employee benefit plans, revocable trust, and irrevocable trust ownership categories. An exact insurance determination can sometimes be difficult, as joint and trust accounts have complex ownership structures which are often incompletely documented, hence we construct this variable conservatively. Accounts we flag as insured have all funds insured. Accounts we flag as uninsured should have some uninsured funds in them, but it is possible that they are occasionally covered because of complex joint ownership. As a result, estimates in our regressions are lower bounds on the effects of being over the FDIC insurance limit.

TAG/DFA Eligible: A dummy variable equal to 1 if the account is eligible for additional insurance coverage from temporary guarantee schemes at the start of the period; 0 otherwise. The additional guarantee programs were in effect only in our Post-Crisis and Formal periods; in earlier periods, the dummy is assigned based on whether the account would qualify for coverage had the same programs been introduced earlier. The dummy is used in the Placebo and Pre-Crisis periods simply to establish a basis for comparison of these accounts' behavior; they did not have additional coverage before the financial crisis. The two additional guarantee schemes were the Transaction Account Guarantee (TAG) program and guarantees from by the Dodd Frank Act (DFA). TAG placed temporary but unlimited (in dollar terms) guarantees on all categories of checking accounts at this bank from October 14, 2008 until December 31, 2010. The DFA guarantees similarly provided unlimited insurance for non-interest-bearing demand deposit accounts and IOLTA accounts, but not NOW accounts from December 31, 2010 until December 31, 2012. In calculating a depositor's insurance coverage, accounts covered by these programs (while effective) did not count toward a depositor's $250,000 limit.

Direct Deposit: A dummy variable equal to 1 if the account is receiving an ACH deposit roughly every two weeks as of the start of the regression period; 0 otherwise, and always 0 for term deposits.

Log(Age): The natural log of the years since the primary account holder first appears in the bank's deposit records, as of the start of the period. If an individual was a secondary depositor on an account before becoming a primary account holder on another account, or closed an older account, we use the date at which the original account was opened. Relationship age serves as a measure of the depth of the depositor relationship. The age of the account is dated differently in the case of placed deposits; see placed deposits below for details.

Log(Days to Maturity): The natural log of the number of days until the maturity of the account, as of the start of the regression period. This is defined only for term accounts.

Prior Transactions: The proportion of days in the past year, at the start of the measurement period, in which the account holder performed at least one transaction in the account. A value of 0 thus implies no activity and 100 implies activity every day. We exclude transactions exogenous to the depositor such as monthly interest credits or fees. This serves as another measure of depositors' relationship depth. This variable is always 0 for term accounts.

Table 2: Variable Definitions for the Regressions of Section 3

Institutional-Listed/Faxed: A dummy variable equal to 1 if the deposit is owned by a bank, savings association, credit union, financial corporate, municipality, or non-financial corporation, or if it is a "business" product type as marked in the bank's records; 0 otherwise. Additionally, the deposit must have been opened via an internet listing service or facsimile as identified by the bank's records. We group faxed deposits with listed because internal bank documentation, depositor behavior, and depositor types (namely, small depository institutions making up a large portion of these deposits towards the end of the bank's life) all indicate that the faxed deposits were almost exclusively gathered from depositors who saw the rates on listing services and then faxed their deposit request to the bank. This excludes third-party deposit placement services (such as deposit brokers) as we capture these entities with a separate dummy variable.

Institutional- Other: A dummy variable exactly defined As *Institutional - Listed/Faxed* above, but we have no evidence that the deposits were received from a listing service or facsimile order.

Brokered/Placed: A dummy variable equal to 1 if the deposit was placed by a fiduciary or deposit broker; 0 otherwise and always 0 for transaction accounts. Many term deposits at the bank are not held by individuals but instead held by institutions acting as fiduciaries for others, and these fiduciaries do not consistently reveal the identity of the underlying holders of the account to the bank. These deposits reflect a less personal connection with the bank. For these accounts, the age of the account variable is dated to the start of the individual account, not the first relationship of the reported holder of the account, as the reported holder is only a fiduciary that may not make final renewal and withdrawal decisions. Note that we assume all placed deposits are insured; these services advertise that they structure their deposits so as to achieve full insurance coverage.

Trust: A dummy variable equal to 1 if the account is held by a trust and 0 otherwise. This does include Payable on Death (POD) arrangements. Trust accounts require effort to establish, and they are a useful legal device more for wealthier or more complex depositors. As such, we expect accounts held in trust to represent more sophisticated customers.

Interest Rate Spread: The spread between an account's interest rate and the market average for that deposit product. The spread is intended to reflect the pricing offered to depositors opening a new account or rolling over a CD. For transaction (non-maturity) accounts, which re-price continuously and thus reflect current offered rates, we calculate the spread as the difference between the rate on an account and the account-type-level rate average constructed from RateWatch. Term deposits reprice only periodically, so the current rate on an existing term deposit is not generally the current rate on offer for new accounts or funds being rolled over from a maturing CD. To construct the spread for a given term account, we take the difference between the average rate paid on newly opened term deposits of the same maturity within a symmetric, centered, rolling 31-day window (i.e., 15 days before to 15 days after the relevant date) and the market average rate for that product calculated from RateWatch data. Particularly since depositors tend to liquidate CDs at maturity, even in periods of stress, this is the relevant measure of pricing for the decisions of both extant depositors considering leaving the bank and newly arriving depositors considering opening an account.

Past-Month Fees: The total dollar value in the past month of all fees paid on or to the account, including reversal of old fees and signup bonuses. For some regressions, this variable is divided by account balance to obtain a "fee rate".

Table 3: Who Withdraws? Transaction Deposits; Linear Probability Model

	Placebo	*Pre-Crisis*	*Post-Crisis*	*Formal*
	(1)	(2)	(3)	(4)
Uninsured	0.0249*	-0.00117	0.0693*	0.183***
	(1.94)	(-0.09)	(1.92)	(8.45)
TAG/DFA Eligible†	-0.0446	-0.000624	-0.0944**	-0.0412
	(-1.50)	(-0.02)	(-2.00)	(-0.95)
Checking	-0.0901***	-0.105***	-0.0277***	-0.0252**
	(-8.44)	(-8.10)	(-2.64)	(-2.15)
Direct Deposit	-0.104***	-0.123***	-0.0864***	-0.0459***
	(-7.08)	(-7.47)	(-5.88)	(-2.77)
Log(Age)	-0.0194***	-0.0180***	-0.00915**	-0.0247***
	(-7.47)	(-4.34)	(-2.40)	(-4.65)
Prior Transactions	0.00793***	0.00555***	0.00263***	-0.00310***
	(14.13)	(7.62)	(4.37)	(-4.19)
Prior Transactions^2	-0.0000983***	-0.0000746***	-0.0000419***	0.0000235**
	(-12.71)	(-7.19)	(-4.88)	(2.34)
Institutional - Any	-0.0273	0.0242	0.0218	0.0215
	(-1.16)	(1.01)	(1.29)	(1.33)
Trust	0.0255	0.0248	-0.0418*	0.0698***
	(0.93)	(0.83)	(-1.90)	(3.38)
Constant	0.217***	0.313***	0.159***	0.326***
	(13.12)	(17.35)	(11.62)	(21.96)
Branch Controls	Yes	Yes	Yes	Yes
No. of Accounts	33498	34029	29865	26616
No. of Liquidations	6920	10795	4740	6218
R^2	1.3%	0.8%	0.4%	1.8%
Model P-Value	< 0.001	< 0.001	< 0.001	< 0.001

Estimates from linear probability models of the probability of account liquidation during the each of the four periods of interest. Liquidation is defined as withdrawing 75% or more of the start-of-period account balance and staying at or below 25% of the start-of-period balance for at least 61 days. T-statistics are in parentheses, calculated using asymptotically normal standard errors. Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *.

† TAG/DFA coverage was only effective in the Post-Crisis and Formal periods; eligible accounts were fully covered/insured in those periods. In earlier periods, eligibility does not imply coverage, and is shown for comparison purposes only.

Table 4: Who Withdraws? Transaction Deposits; Alternative Specifications

	Probit		***Cox P.H.***	
	Post-Crisis	*Formal*	*Post-Crisis*	*Formal*
	(1)	(2)	(3)	(4)
Uninsured	0.0655	0.170***	1.503**	1.862***
	(1.61)	(6.69)	(1.99)	(8.01)
TAG/DFA Eligible	-0.0691**	-0.0164	0.567*	0.958
	(-2.24)	(-0.42)	(-1.83)	(-0.26)
Checking	-0.0262***	-0.0280**	0.814***	0.887**
	(-2.71)	(-2.51)	(-2.72)	(-2.15)
Direct Deposit	-0.0875***	-0.0679***	0.430***	0.631***
	(-8.55)	(-4.37)	(-6.04)	(-4.32)
Log(Age)	-0.00798**	-0.0231***	0.936***	0.896***
	(-2.18)	(-4.49)	(-2.63)	(-4.72)
Prior Transactions	0.00290***	-0.00337***	1.025***	0.985***
	(4.61)	(-4.33)	(5.43)	(-3.75)
Prior Transactions^2	-0.0000518***	0.0000259**	1.000***	1.000*
	(-5.15)	(2.36)	(-5.56)	(1.68)
Institutional - Any	0.0226	0.0192	1.156	1.090
	(1.24)	(1.18)	(1.27)	(1.24)
Trust	-0.0444**	0.0601***	0.711*	1.250***
	(-2.30)	(2.73)	(-1.92)	(2.71)
Branch Controls	Yes	Yes	Yes	Yes
No. of Accounts	29865	26616	29865	26616
No. of Liquidations	4740	6218	4740	6218
Log Likelihood	-13001.0	-14236.2	-48378.0	-62351.7
Model P-Value	< 0.001	< 0.001	< 0.001	< 0.001

Estimates from Probit (columns 1 and 2) and Cox proportional hazard models (columns 3 and 4) of the probability of account liquidation during the Post-Crisis and Formal Periods. Liquidation is defined as withdrawing 75% or more of the start-of-period account balance and staying at or below 25% of the start-of-period balance for at least 61 days. Probit estimates are expressed as marginal effects (with a coefficient of 0 reflecting a variable having no effect on the probability of liquidation), and Cox estimates are expressed as hazard ratios (with 1 meaning no effect). T-statistics are in parentheses, calculated using asymptotically normal standard errors. Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *.

Table 5: Who Withdraws? Term Deposits; Linear Probability Model

	Placebo (1)	*Pre-Crisis* (2)	*Post-Crisis* (3)	*Formal* (4)
Uninsured	0.00501	0.0432***	0.0820**	0.147***
	(0.39)	(3.78)	(2.03)	(2.92)
TAG/DFA Eligible†‡	-0.333	-0.573	-0.00332	-
	(-1.12)	(-1.24)	(-0.02)	-
Log(Age)	-0.00664*	-0.0391***	-0.00379	-0.0124*
	(-1.81)	(-10.60)	(-1.01)	(-1.78)
Log(Days to Maturity)	-0.144***	-0.0695***	-0.200***	-0.0866***
	(-28.94)	(-21.01)	(-54.37)	(-15.90)
Brokered/Placed	0.254***	0.162***	0.279***	0.550***
	(13.08)	(7.64)	(21.79)	(25.76)
Institutional - Listed/Faxed	-0.159	-0.244	0.0105	-0.166***
	(-0.65)	(-0.91)	(0.10)	(-3.08)
Institutional - Other	0.0764*	0.0880*	0.0180	-0.0358
	(1.80)	(1.72)	(0.55)	(-1.15)
Trust	-0.0745***	0.00318	-0.00600	0.00651
	(-3.33)	(0.15)	(-0.26)	(0.18)
Constant	0.891***	0.815***	1.185***	0.683***
	(20.92)	(17.79)	(32.15)	(13.75)
Branch Controls	Yes	Yes	Yes	Yes
No. of Accounts	7868	10881	8509	3726
No. of Liquidations	2193	7153	2559	1736
R^2	11.4%	5.4%	31.6%	34.0%
Model P-Value	< 0.001	< 0.001	< 0.001	< 0.001

Estimates from linear probability models of the probability of account liquidation during the each of the four periods of interest. Liquidation is defined as withdrawing 75% or more of the start-of-period account balance and staying at or below 25% of the start-of-period balance for at least 61 days. T-statistics are in parentheses, calculated using asymptotically normal standard errors. Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *.

† TAG/DFA coverage was only effective in the Post-Crisis and Formal periods; eligible accounts were fully covered/insured in those periods. In earlier periods, eligibility does not imply coverage, and is shown for comparison purposes only.

‡ Note that although TAG/DFA did not directly insure term deposits, it could do so indirectly. Accounts covered by TAG/DFA were excluded in calculating a depositor's total exposure to a bank when applying standard, limited-value deposit insurance, effectively freeing up insurance coverage to be applied to other, non-TAG/DFA-covered accounts.

Table 6: Who Withdraws? Term Deposits; Alternative Specifications

	Probit		***Cox P.H.***	
	Post-Crisis	*Formal*	*Post-Crisis*	*Formal*
	(1)	(2)	(3)	(4)
Uninsured	0.110*	0.167***	1.637**	1.746***
	(1.89)	(2.80)	(2.55)	(2.99)
TAG/DFA Eligible‡	0.00446	-	0.915	-
	(0.03)	-	(-0.12)	-
Log(Age)	-0.00498	-0.0156	1.017	1.053*
	(-0.98)	(-1.52)	(0.81)	(1.92)
Log(Days to Maturity)	-0.214***	-0.115***	0.545***	0.664***
	(-43.56)	(-15.28)	(-56.75)	(-28.43)
Brokered/Placed	0.337***	0.586***	3.678***	8.565***
	(17.44)	(29.93)	(21.11)	(26.58)
Institutional - Listed/Faxed	-0.169	-0.233***	0.788	0.465**
	(-1.18)	(-3.35)	(-0.24)	(-2.14)
Institutional - Other	-0.0135	-0.0498	0.914	1.239
	(-0.31)	(-1.15)	(-0.46)	(1.50)
Trust	-0.00735	0.0147	0.985	1.220
	(-0.24)	(0.31)	(-0.11)	(1.31)
Branch Controls	Yes	Yes	Yes	Yes
No. of Accounts	8509	3726	8509	3726
No. of Liquidations	2559	1736	2559	1736
Log Likelihood	-3767.9	-1856.9	-21333.4	-12883.1
Model P-Value	< 0.001	< 0.001	< 0.001	< 0.001

Estimates from Probit (columns 1 and 2) and Cox proportional hazard models (columns 3 and 4) of the probability of account liquidation during the Post-Crisis and Formal Periods. Liquidation is defined as withdrawing 75% or more of the start-of-period account balance and staying at or below 25% of the start-of-period balance for at least 61 days. Probit estimates are expressed as marginal effects (with a coefficient of 0 reflecting a variable having no effect on the probability of liquidation), and Cox estimates are expressed as hazard ratios (with 1 meaning no effect). T-statistics are in parentheses, calculated using asymptotically normal standard errors. Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *.

‡ Note that although TAG/DFA did not directly insure term deposits, it could do so indirectly. Accounts covered by TAG/DFA were excluded in calculating a depositor's total exposure to a bank when applying standard, limited-value deposit insurance, effectively freeing up insurance coverage to be applied to other, non-TAG/DFA-covered accounts.

Table 7: Who Withdraws? Linear Probability Model; Including Interest Rates

	Transaction		***Term***	
	Post-Crisis	*Formal*	*Post-Crisis*	*Formal*
	(1)	(2)	(3)	(4)
Uninsured	0.0723**	0.190***	0.0731*	0.129**
	(2.00)	(8.72)	(1.75)	(2.57)
TAG/DFA Eligible‡	-0.0909*	-0.0520	0.00470	-
	(-1.93)	(-1.19)	(0.03)	-
Interest Rate Spread	-0.0135***	-0.0780***	-0.723***	-0.507***
	(-3.05)	(-3.18)	(-23.17)	(-5.71)
Past-Month Fees	0.00136**	0.00137***	0.0382***	-
	(2.22)	(2.60)	(2.87)	-
Checking	-0.0410***	-0.0487***		
	(-3.64)	(-3.53)		
Direct Deposit	-0.0877***	-0.0443***		
	(-5.96)	(-2.67)		
Prior Transactions	0.00284***	-0.00297***		
	(4.69)	(-4.01)		
Prior Transactions^2	-0.0000439***	0.0000217**		
	(-5.10)	(2.16)		
Log(Age)	-0.0101***	-0.0243***	0.00953**	-0.0109
	(-2.63)	(-4.57)	(2.40)	(-1.56)
Log(Days to Maturity)			-0.142***	-0.0849***
			(-28.75)	(-15.54)
Brokered/Placed			0.303***	0.537***
			(22.04)	(25.09)
Institutional - Listed/Faxed			-0.0978	-0.176***
			(-0.64)	(-3.28)
Institutional - Other	0.0116	-0.00527	-0.00492	-0.0429
	(0.68)	(-0.29)	(-0.14)	(-1.38)
Trust	-0.0407*	0.0701***	0.0184	0.000492
	(-1.85)	(3.39)	(0.77)	(0.01)
Constant	0.182***	0.382***	1.706***	1.048***
	(11.78)	(16.91)	(38.40)	(13.20)
Branch Controls	Yes	Yes	Yes	Yes
No. of Accounts	29865	26616	7800	3717
No. of Liquidations	4740	6218	2506	1734
R^2	0.4%	1.9%	35.2%	34.7%
Model P-Value	< 0.001	< 0.001	< 0.001	< 0.001

Estimates from linear probability models of the probability of account liquidation for both transaction and term deposits, focusing only on the Post-Crisis and Formal periods. Relative to the main specification discussed elsewhere, this table adds interest rates and fees, at the account level, as regressors. Liquidation is defined as withdrawing 75% or more of the start-of-period account balance and staying at or below 25% of the start-of-period balance for at least 61 days. T-statistics are in parentheses, calculated using asymptotically normal standard errors. Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *.
‡ Note that although TAG/DFA did not directly insure term deposits, it could do so indirectly. Accounts covered by TAG/DFA were excluded in calculating a depositor's total exposure to a bank when applying standard, limited-value deposit insurance, effectively freeing up insurance coverage to be applied to other, non-TAG/DFA-covered accounts.

Table 8: Uninsured Transaction Account Migration

Deposit Insurance Limit = $100,000

Bin Range	*<$1*	*$1 - 2,000*	*$2,000-48,000*	*$48,000-98,000*	*$98,000-102,000*	*>$102,000*
Placebo	4.98%	9.08%	11.42%	10.32%	11.71%	52.59%
Pre-Crisis	7.71%	9.59%	9.88%	15.59%	16.35%	40.88%

Deposit Insurance Limit = $250,000

Bin Range	*<$1*	*$1 - 2,000*	*$2,000-123,000*	*$123,000-248,000*	*$248,000-252,000*	*>$252,000*
Post-Crisis	–	6.37%	14.22%	13.73%	–	65.69%
Formal	20.79%	6.6%	22.3%	14.04%	8.05%	27.72%

For all transaction accounts which had a balance of $2,000 less than the current deposit insurance limit or higher at the beginning of each period, this table shows their distribution into various account dollar-size bins at the end of the period. Several bins are suppressed for disclosure reasons.

Table 9: Comparison of Depositors Across Periods

	Uninsured	*TAG/DFA Eligible*†	*Brokered/ Placed*	*Institutional: Listed/Faxed*	*Checking*	*CD*
Var. Type	Dummy	Dummy	Dummy	Dummy	Dummy	Dummy
	Extant Depositors					
Placebo				*Omitted Dummy*		
Pre-Crisis	0.0212***	0.00205***	-0.000476	-0.00000572	-0.00803***	0.0521***
	(15.29)	(3.82)	(-0.47)	(-0.01)	(-4.17)	(19.08)
Post-Crisis	-0.0558***	-0.00226***	0.0325***	0.000240	0.00254	0.0315***
	(-38.71)	(-4.04)	(30.92)	(0.29)	(1.27)	(11.11)
Formal	-0.0445***	-0.00188***	0.0242***	0.00197**	0.0328***	-0.0674***
	(-28.91)	(-3.15)	(21.64)	(2.23)	(15.37)	(-22.27)
Failure Date	-0.0509***	-0.00155**	-0.00707***	0.0843***	0.0543***	0.00108
	(-31.27)	(-2.46)	(-5.97)	(90.07)	(24.02)	(0.34)
	New Depositors					
Placebo	-0.00160	0.00903***	-0.0105***	-0.0000725	-0.0242***	0.271***
	(-0.42)	(6.08)	(-3.78)	(-0.03)	(-4.55)	(35.92)
Pre-Crisis	0.0221***	0.0316***	0.0220***	0.00552**	0.0674***	0.287***
	(4.91)	(18.09)	(6.70)	(2.13)	(10.77)	(32.42)
Post-Crisis	-0.0208***	0.0100***	0.209***	0.0129***	0.0987***	0.227***
	(-3.07)	(3.83)	(42.42)	(3.31)	(10.51)	(17.09)
Formal	-0.0377***	0.00230	-0.0125***	0.707***	0.0158***	0.634***
	(-9.16)	(1.44)	(-4.18)	(298.88)	(2.77)	(78.30)
Constant	0.0650***	0.00616***	0.0125***	0.0000725	0.0761***	0.190***
	(64.97)	(15.90)	(17.20)	(0.13)	(54.73)	(96.59)
No. of Obs.	188834	188834	188834	188834	188834	188834
R^2	2.4%	0.3%	1.9%	35.0%	0.7%	5.2%
Model P-value	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
F-Statistic	572.9	61.22	463.5	12708.7	161.3	1299.1

Each column corresponds to a separate account-level OLS regression of an account characteristic on the interaction of time period dummies and an indicator for extant or new depositors. The observational unit is account-time period, and with five time periods it is possible for an individual account to appear up to five times in this regression. Extant depositors are those with an existing deposit relationship at the beginning of each time period, and new depositors are those who arrive during the period. The omitted category is extant depositors in the Placebo period, so all estimates in other rows reflect differences relative to that category. T-statistics are in parentheses, calculated using asymptotically normal standard errors. Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *.

† TAG/DFA coverage was only effective in the Post-Crisis and Formal periods; eligible accounts were fully covered/insured in those periods. In earlier periods, eligibility does not imply coverage, and is shown for comparison purposes only.

Table 10: What Explains the Share of Deposits Which Are New?

	(1)	(2)	(3)	(4)
Time Period Dummies:				
Pre-Placebo	5.439***	1.337	1.925*	1.883*
	(2.90)	(1.13)	(1.65)	(1.65)
Placebo to Pre-Crisis	2.027**	2.054**	3.079***	2.889***
	(2.01)	(2.21)	(3.05)	(2.84)
Pre-Crisis	-1.442***	0.378	2.907	2.735
	(-2.72)	(0.25)	(1.58)	(1.49)
Crisis	0.188	2.069	3.417	3.157
	(0.25)	(0.92)	(1.40)	(1.30)
Post-Crisis	-0.393	3.044	8.875**	8.685**
	(-0.60)	(0.98)	(2.20)	(2.15)
Post-Crisis to Formal	-1.254**	2.230	9.264**	8.919**
	(-2.18)	(0.74)	(2.24)	(2.16)
Formal	5.821***	7.495**	14.91***	14.48***
	(2.79)	(2.14)	(2.99)	(2.90)
Economic Controls:				
Log(VIX)		1.137	-1.263	-0.806
		(0.63)	(-0.51)	(-0.32)
GDP Growth		0.339**	0.543***	0.514**
		(2.21)	(2.60)	(2.46)
Housing Starts		0.00442	0.00415	0.00430
		(1.57)	(1.46)	(1.47)
Daily S&P 500 Return		18.19	13.93	15.04
		(1.34)	(1.02)	(1.10)
AR(1)		0.390***	0.379***	0.378***
		(7.05)	(7.04)	(7.02)
OFR Financial Stress Index		0.139	0.380*	0.328
		(0.95)	(1.74)	(1.48)
Rate Spread to Market (Dollar-Weighted Average)			5.549***	5.742***
			(2.71)	(2.77)
Past-Month Fees/Deposit Balances (in Aggregate)				1083.8
				(0.96)
Constant	3.218***	-8.348	-12.01**	-13.45***
	(6.62)	(-1.62)	(-2.55)	(-2.62)
N	2079	2078	2078	2078
Model P-Value	< 0.001	< 0.001	< 0.001	< 0.001

Estimates from daily-frequency regressions of the share of deposit dollars at the bank which are new (as of that day) on various controls. All models are OLS with Newey-West standard errors of lag length 9, chosen by the Newey-West rule of thumb ($.75\sqrt[3]{T}$) (Stock and Watson, 2019). Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *.

Table 11: What Explains the Log-Level of New Deposits?

	(1)	(2)	(3)	(4)
Time Period Dummies:				
Pre-Placebo	1.152	0.410	0.673	0.662
	(1.57)	(0.54)	(0.90)	(0.89)
Placebo to Pre-Crisis	0.991	0.616	1.084	1.039
	(1.46)	(0.88)	(1.51)	(1.39)
Pre-Crisis	-1.822**	-0.123	1.064	1.023
	(-2.57)	(-0.11)	(0.95)	(0.90)
Crisis	-1.167	1.337	1.963	1.902
	(-1.30)	(0.78)	(1.15)	(1.09)
Post-Crisis	-1.066	0.718	3.440*	3.394
	(-1.17)	(0.38)	(1.67)	(1.63)
Post-Crisis to Formal	-2.225***	-0.840	2.447	2.364
	(-3.60)	(-0.46)	(1.16)	(1.09)
Formal	0.671	1.798	5.229**	5.124**
	(0.95)	(0.98)	(2.44)	(2.32)
Economic Controls:				
Log(VIX)		4.182***	3.055***	3.160***
		(4.20)	(2.72)	(2.62)
GDP Growth		-0.0225	0.0706	0.0639
		(-0.25)	(0.74)	(0.64)
Housing Starts		0.00178	0.00163	0.00167
		(1.11)	(1.01)	(1.02)
Daily S&P 500 Return		-8.577	-10.40	-10.14
		(-0.65)	(-0.78)	(-0.75)
AR(1)		0.276***	0.274***	0.274***
		(19.61)	(19.48)	(19.42)
OFR Financial Stress Index		-0.266***	-0.155	-0.167
		(-2.81)	(-1.39)	(-1.38)
Rate Spread to Market (Dollar-Weighted Average)			2.606***	2.649***
			(3.15)	(3.18)
Past-Month Fees/Deposit Balances (in Aggregate)				251.3
				(0.30)
Constant	11.09***	-6.523**	-8.184**	-8.515**
	(21.17)	(-1.97)	(-2.41)	(-2.38)
N	2079	2078	2078	2078
Model P-Value	< 0.001	< 0.001	< 0.001	< 0.001

Estimates from daily-frequency regressions of the logarithm of new deposit dollars at the bank (as of that day) on various controls. All models are OLS with Newey-West standard errors of lag length 9, chosen by the Newey-West rule of thumb ($.75\sqrt[3]{T}$) (Stock and Watson, 2019). Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *.

Table 12: Impact of Regulatory Action on Funding Shares For US Banks

	Brokered (1)	*Listed* (2)	*Sm. Term* (3)	*Med. Term* (4)	*Lg. Term* (5)
Under Reg. Action	−1.24***	0.826***	0.364***	0.466***	−0.830***
	(−22.72)	(11.40)	(5.21)	(6.25)	(−12.10)
NPL_t/A_t	0.0102**	0.00224	0.117***	−0.00903	−0.108***
	(2.38)	(0.42)	(22.32)	(−1.62)	(−20.97)
$\%\Delta A_t$	0.0238***	0.0127***	−0.0282***	0.0215***	0.00668***
	(54.53)	(18.82)	(−41.97)	(29.95)	(10.13)
$ln(A_t)$	2.83***	0.354***	1.27***	−0.837***	−0.432***
	(137.87)	(8.31)	(31.87)	(−19.66)	(−11.05)
$Deposits_t/A_t$	4.29***	1.62***	1.79***	1.81***	−3.60***
	(35.62)	(7.44)	(8.33)	(7.92)	(−17.11)
Term Dep_t/A_t	14.4***	16.2***	29.1***	39.3***	31.6***
	(173.14)	(112.02)	(211.50)	(267.68)	(234.54)
Constant	−41.9***	−11.6***	−3.58***	4.15***	−0.575
	(−176.09)	(−22.44)	(−7.40)	(8.04)	(−1.21)
Bank & Quarter FE	Yes	Yes	Yes	Yes	Yes
N	554180	162123	193306	193306	193306
R^2	13.6%	8.3%	68.8%	33.8%	24.1%
Model P-Value	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

Estimates from regressing funding shares on a regulatory action dummy and bank-level controls for all US banks from 2000 to 2016. The regulatory action dummy is based on public and confidential supervisory data; other variables are from the regulatory filings of all US banks. Dependent variables are expressed in percentage points. Observational units are bank-quarters, with brokered deposit data available from 2000 to 2016, listing service deposits from 2011 to 2016, and all other term deposit data from 2010 to 2016. Small term deposits are those with balances of $100,000 or less; medium term deposits are between $100,001 and $250,000; and large term deposits are those over $250,000. T-statistics in parentheses, calculated using asymptotically normal standard errors. Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *.

Table 13: Impact of Regulatory Action on Funding Shares For US Banks, Quarterly Dummies

	Brokered (1)	*Listed* (2)	*Sm. Term* (3)	*Med. Term* (4)	*Lg. Term* (5)
$(t-4)$	1.17***	−0.958***	0.443**	−0.857***	0.414**
	(11.71)	(−5.00)	(2.49)	(−4.51)	(2.37)
$(t-3)$	1.07***	−0.951***	0.725***	−0.863***	0.138
	(11.12)	(−5.63)	(4.68)	(−5.22)	(0.91)
$(t-2)$	0.951***	−0.633***	0.759***	−0.838***	0.0785
	(10.20)	(−4.01)	(5.29)	(−5.46)	(0.56)
$(t-1)$	0.704***	−0.535***	0.653***	−0.663***	0.00987
	(8.03)	(−3.78)	(5.03)	(−4.77)	(0.08)
(t)	0.729***	−0.260*	0.639***	−0.559***	−0.0797
	(8.33)	(−1.91)	(5.14)	(−4.21)	(−0.65)
$(t+1)$	0.512***	0.00124	1.22***	−0.743***	−0.476***
	(4.03)	(0.01)	(7.90)	(−4.51)	(−3.14)
$(t+2)$	−0.667***	0.477***	1.40***	−0.457***	−0.945***
	(−4.50)	(2.72)	(9.10)	(−2.77)	(−6.25)
$(t+3)$	−1.48***	0.594***	1.14***	−0.0210	−1.12***
	(−9.13)	(3.54)	(7.63)	(−0.13)	(−7.62)
$(t+4)$	−2.13***	0.669***	0.759***	0.284*	−1.04***
	(−12.53)	(4.10)	(5.06)	(1.77)	(−7.08)
$(t+i), i \geq 5$	−3.85***	1.21***	−0.000122	1.14***	−1.14***
	(−41.34)	(12.85)	(−0.00)	(11.19)	(−12.18)
NPL_t/A_t	0.0192***	0.00499	0.114***	−0.00804	−0.106***
	(4.43)	(0.94)	(21.74)	(−1.43)	(−20.58)
$\%\Delta A_t$	0.0233***	0.0126***	−0.0280***	0.0213***	0.00668***
	(53.55)	(18.66)	(−41.63)	(29.65)	(10.12)
$ln(A_t)$	2.79***	0.383***	1.22***	−0.761***	−0.455***
	(135.80)	(8.98)	(30.38)	(−17.78)	(−11.58)
$\text{Deposits}_t/A_t$	4.33***	1.55***	1.86***	1.65***	−3.52***
	(36.05)	(7.13)	(8.69)	(7.21)	(−16.70)
$\text{Term Dep}_t/A_t$	14.4***	16.2***	29.0***	39.3***	31.6***
	(173.11)	(112.00)	(211.38)	(267.89)	(234.61)
Constant	−41.4***	−11.8***	−3.01***	3.40***	−0.384
	(−174.03)	(−22.96)	(−6.22)	(6.56)	(−0.81)
Bank & Quarter FE	Yes	Yes	Yes	Yes	Yes
N	554180	162123	193306	193306	193306
R^2	13.9%	8.5%	68.8%	33.9%	24.1%
Model P-Value	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

Estimates from regressing funding shares on quarterly regulatory action dummies and bank-level controls for all US banks from 2000 to 2016. The regulatory action dummies are based on public and confidential supervisory data; other variables are from the regulatory filings of US banks. Dependent variables are expressed in percentage points. Observational units are bank-quarters, with brokered deposit data available from 2000 to 2016, listing service deposits from 2011 to 2016, and all other term deposit data from 2010 to 2016. T-statistics in parentheses, calculated using asymptotically normal standard errors. Small term deposits are those with balances of $100,000 or less; medium term deposits are between $100,001 and $250,000; and large term deposits are those over $250,000. Time period t is the quarter in which the regulatory action began. Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *.

Table 14: Matched Effects of Regulatory Action on Funding Shares for All US Banks, Four Quarters after Treatment

	Brokered	*Listed*	*Sm. Term*	*Med. Term*	*Lg. Term*
	(1)	(2)	(3)	(4)	(5)
Untreated	4.07	3.12	17.54	14.21	5.27
Matched Untreated	3.65	4.37	19.96	16.77	5.17
Treated	1.95	9.98	23.41	22.78	4.30
T-Stat on Differences	−3.46	3.90	3.88	4.73	−2.63
N Untreated	29611	29597	29597	29597	29597
N Treated	142	142	142	142	142

Estimates from propensity-score-matching for a regulatory treatment based on bank covariates to measure the effects on certain deposit products as a share of total deposits for all US Banks. The regulatory action dummy is based on a combination of public and confidential supervisory data; all other variables are from the regulatory filings of all US banks. Dependent variables are expressed in percentage points. Observation units are bank-quarters, with brokered deposit data available from 2000 to 2016, listing service deposits from 2011 to 2016, and all other term deposit data from 2010 to 2016. Only banks that at some time come under an enforcement action between 2000 and 2016 are used for matching. T-statistics in parentheses, calculated using asymptotically normal standard errors. Matching is done using a logistic model to generate a propensity score for being treated with regulatory action based on the covariates used in the above regressions (1 year asset growth, natural log of assets, nonperforming loans as share of assets, deposits as a share of assets) as well as all outcome variables (brokered deposits, listing service deposits, all three categories of term deposits; as shares of deposits). Then treated banks in one quarter are matched to untreated banks in the same quarter at the time of treatment based on this score. Matches are done based on normal kernel weighting, so that close matches are weighted proportionally more. We then observe the difference between treated and untreated four quarters after treatment.

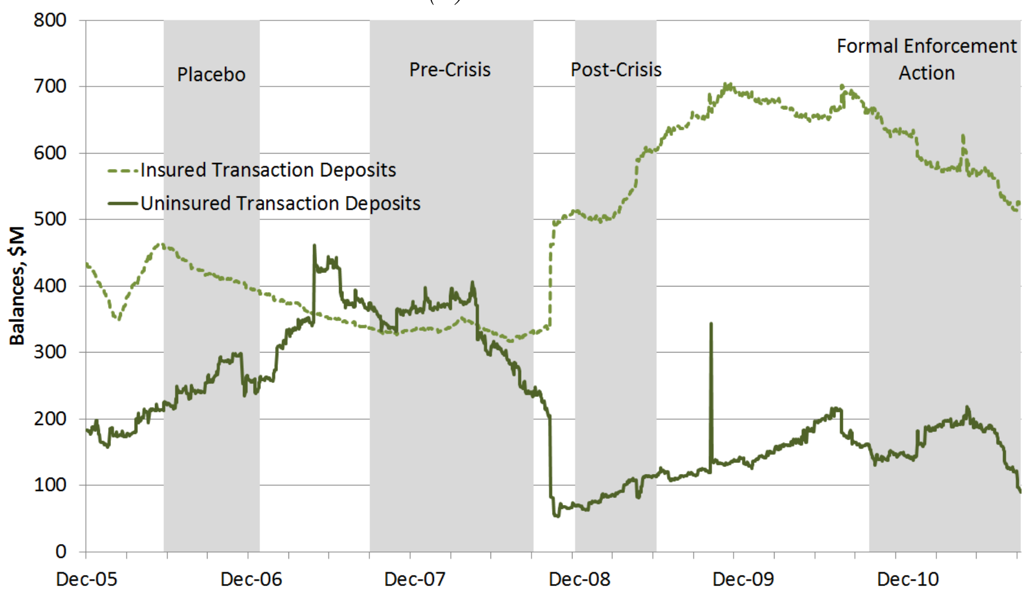
Table 15: Large Bank Deposit Rate Responses to Enforcement Actions

	\$100K, 12m CD spread
Under Reg. Action	0.4121***
	(4.48)
Constant	0.3547***
	(2.99)
Quarter FEs	Yes
N	65
R^2	6.9%
Model P-Value	< 0.001

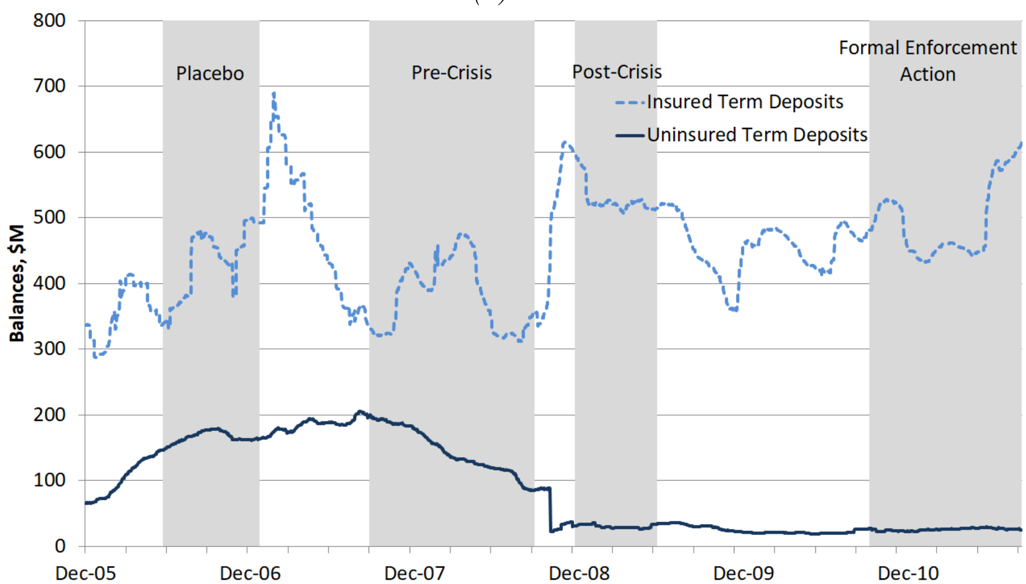
Estimates from pooled OLS regression of 12-month, \$100,000 CD rate spreads (measured against FDIC-published national average rates) on a dummy indicating the bank is currently under regulatory enforcement action, time fixed effects, and a constant. Units are in percentage points: a value of 0.01 corresponds to 1 basis point (0.01%). The sample of banks is constrained to those over \$5 billion in assets (as of 2008Q4) which are under enforcement action or will be within four quarters. The coefficient on *Under Reg. Action* can therefore be interpreted as large banks' average change in deposit rates around/following the imposition of enforcement actions. T-statistics are in parentheses, calculated using asymptotically normal standard errors. Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *.

Figure 1: Deposit Balances

(a) Transaction

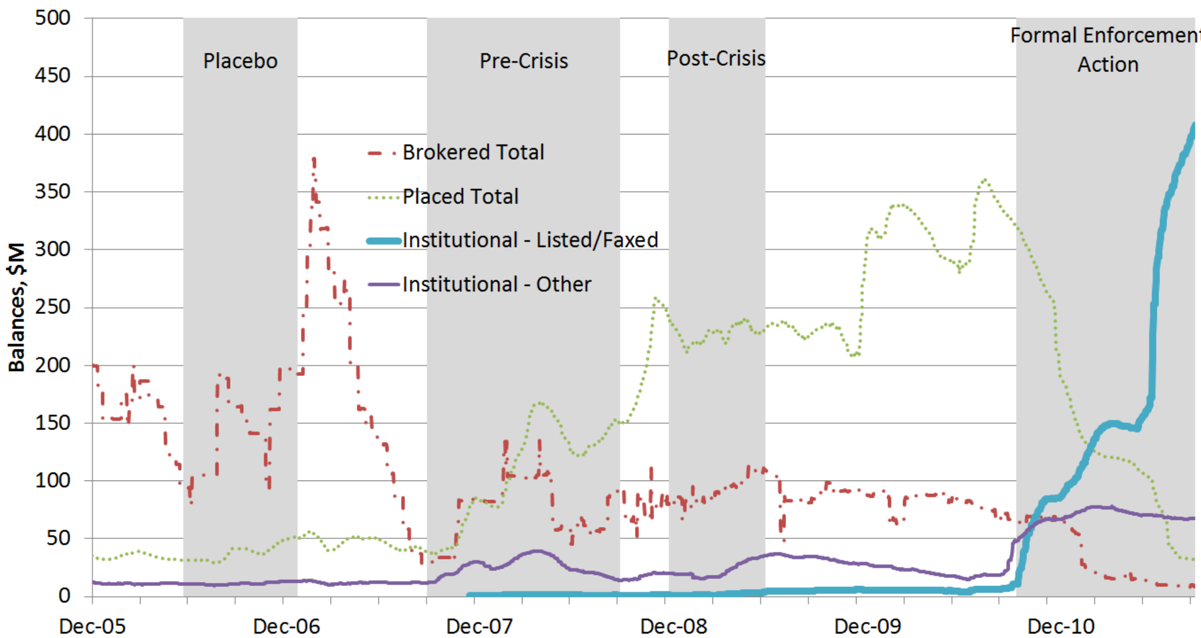


(b) Term



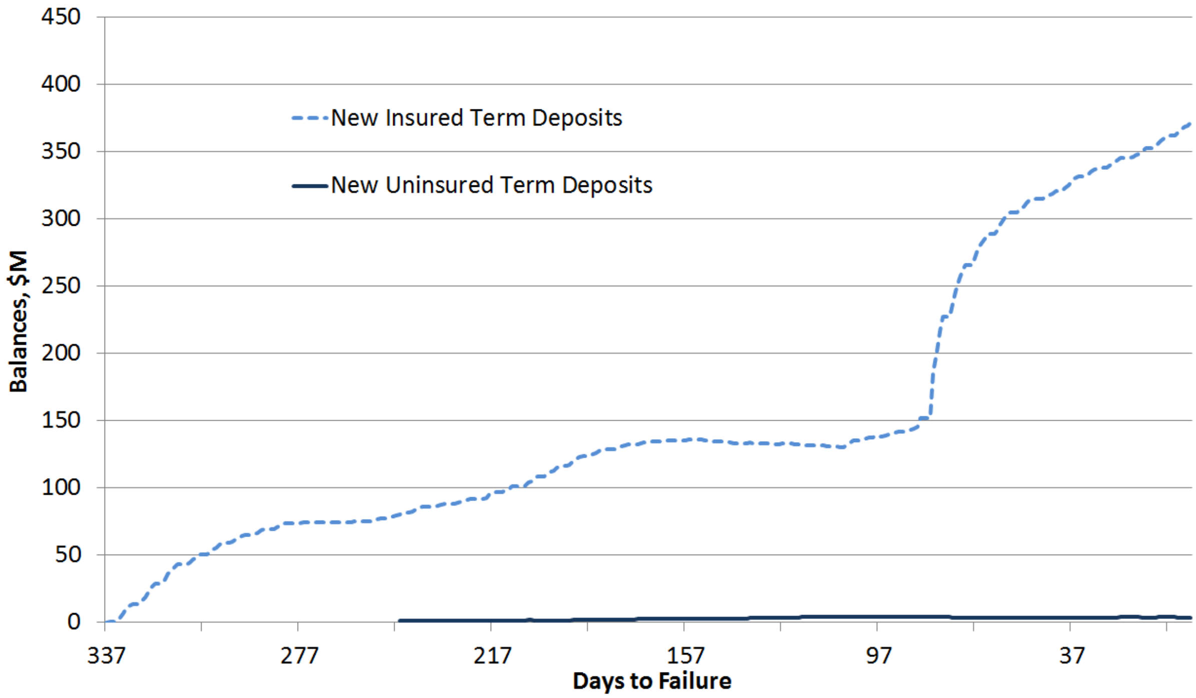
Total balances in transaction (top panel) and term (bottom panel) deposit accounts. Grey bars denote the time periods analyzed in the regressions of Section 3, and overlaid text identifies the name of each period. Note that the dramatic, brief spike in uninsured transaction deposits between the Post-Crisis and Formal periods reflects a single transaction in which another subsidiary of the bank's holding company passed funds through the bank in such a manner that they remained within the bank for a few days.

Figure 2: Term Deposit Balances in Brokered, Placed, and Institutional Accounts



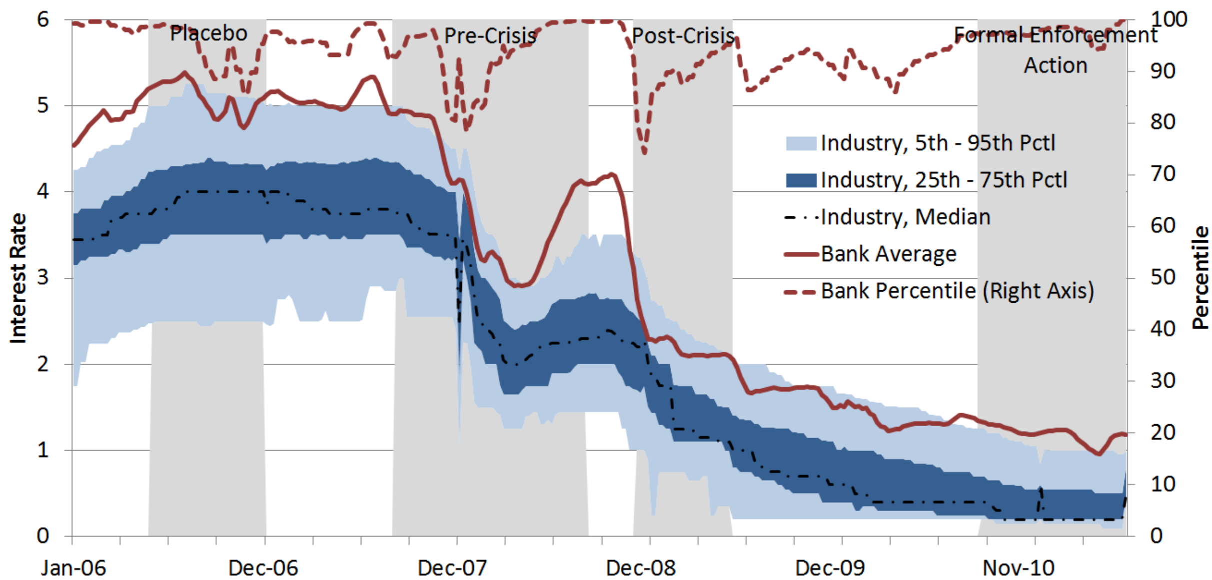
This figure shows term deposit account balances in brokered accounts (dash-dotted red), placed accounts (dotted green), institutional deposits obtained via rate listing services and faxes (bold blue), and other institutional deposits (solid, thin purple). Placed deposits are those placed by a third party on behalf the underlying depositor, where that third party does not meet the definition of deposit broker. Note that this is a different notion of placed deposits relative to that used in the regressions; here, we split placed and brokered deposits into two categories, whereas both were grouped as "placed" in the regressions. Among placed and brokered deposits, the underlying depositors are often not identified to the bank accepting the deposits. Grey bars denote the time periods analyzed in the regressions of Section 3, and overlaid text identifies the name of each period.

Figure 3: Term Deposit Balances From New Depositors



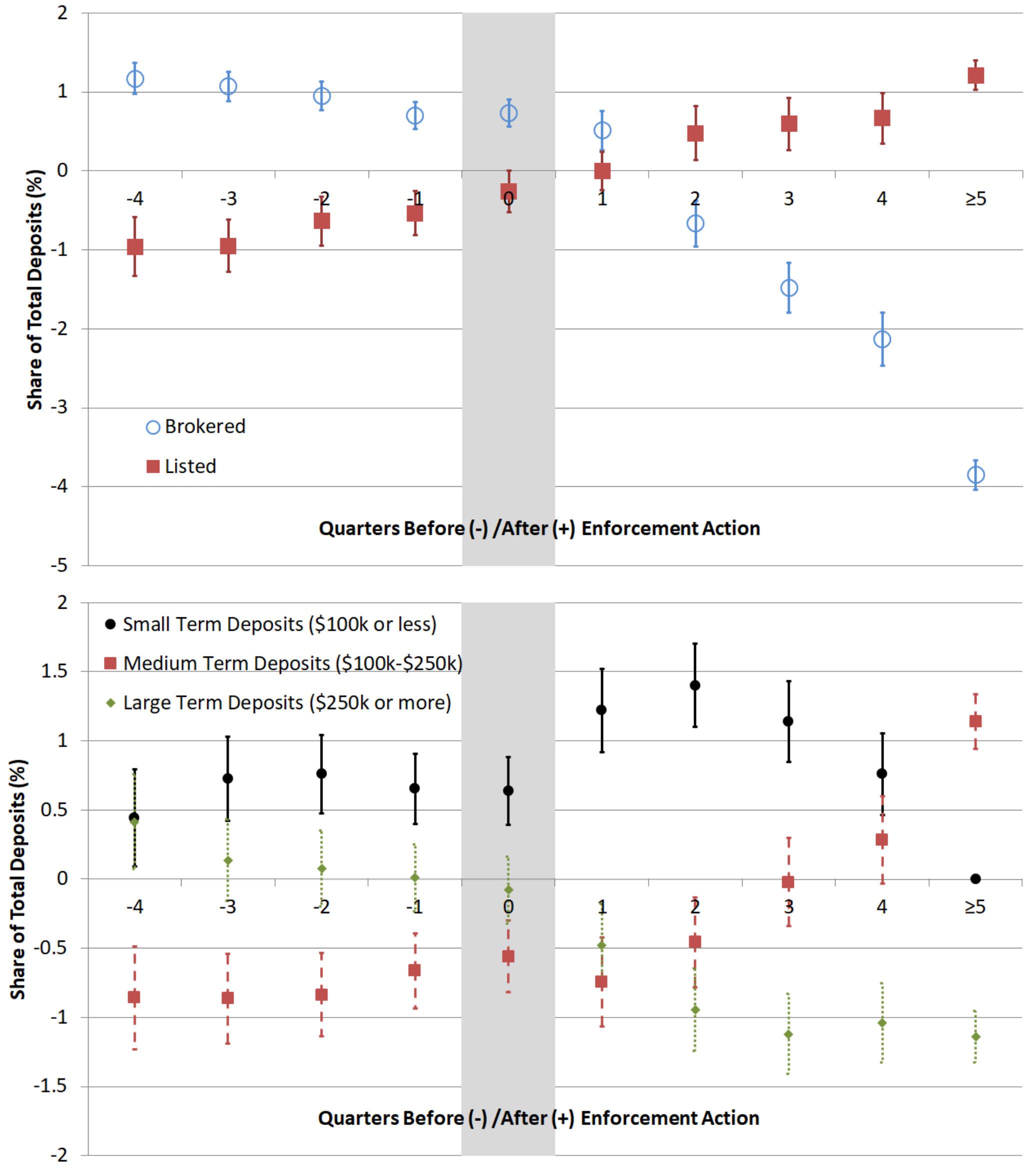
Balances in term deposit accounts from depositors who opened their first deposit account with the bank after the formal enforcement action — new depositors.

Figure 4: 12-Month CD Rates Relative to the Market Distribution



31-day moving average (fifteen days before, day of, and fifteen days after) of all rates offered by the bank on newly issued 12-month term deposits with balances below $100,000 ("Bank Average;" solid red line) is shown on the left axis, while the percentile relative to the distribution of banking industry rates (from RateWatch) for the same product is shown on the right axis. The bank average series is a measure of the rate which would have been faced by a depositor considering depositing funds at the bank that day. "Newly issued" term deposits include newly established term deposit accounts as well as rollovers of existing term deposits upon the expiration of the previous product.

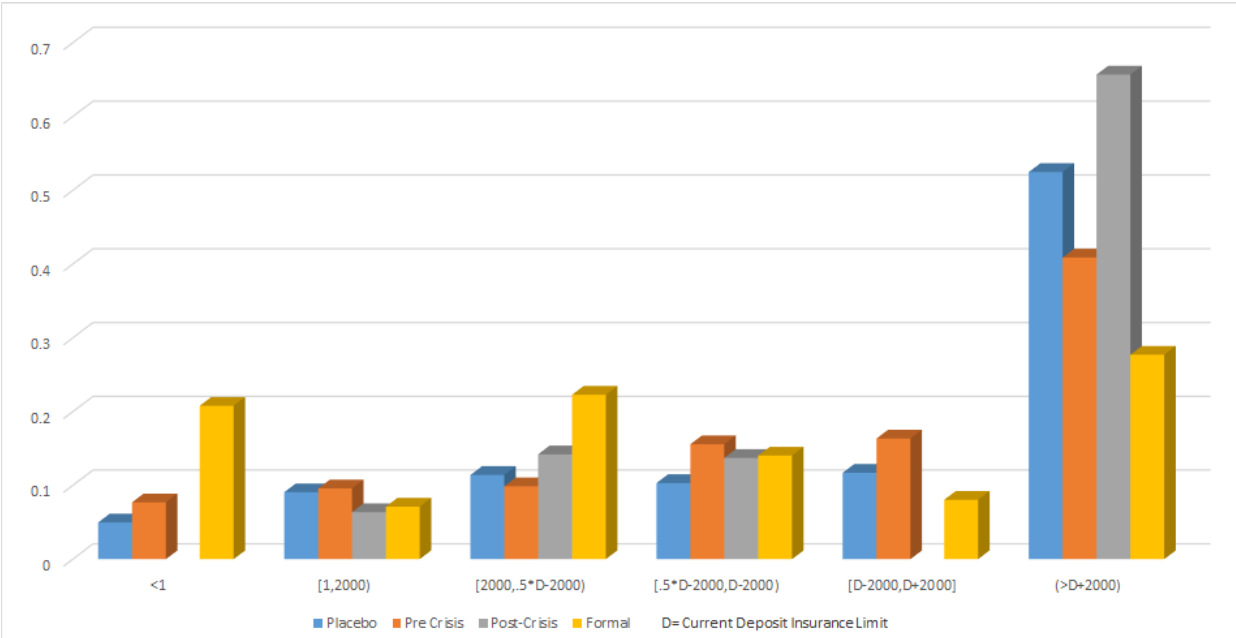
Figure 5: Impact of Regulatory Action on Funding Shares



Graphical presentation of the impact of regulatory action on funding shares, using the estimates from Table 13. Small term deposits are those with balances of $100,000 or less; medium term deposits are between $100,001 and $250,000; and large term deposits are those over $250,000. Time period t is the quarter in which the enforcement action was issued. Error bands represent 95% asymptotic confidence intervals

7 Appendix

Figure 6: Uninsured Transaction Account Migration

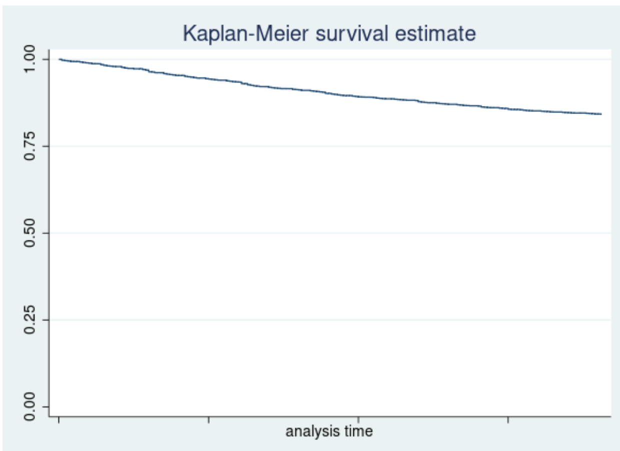


For all transaction accounts which had a balance of $2,000 less than the current deposit insurance limit or higher at the beginning of each period, this figure shows their distribution into various account dollar-size bins at the end of the period. Several bins are suppressed for disclosure reasons.

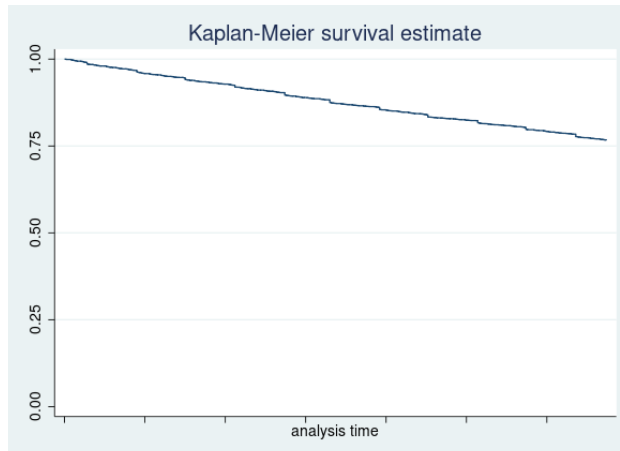
Figure 7: Kaplan-Meier Survival Curves

All Transaction Deposits

Post-Crisis

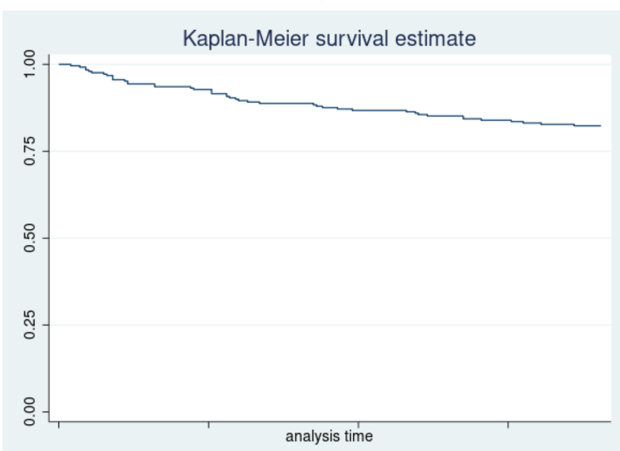


Formal

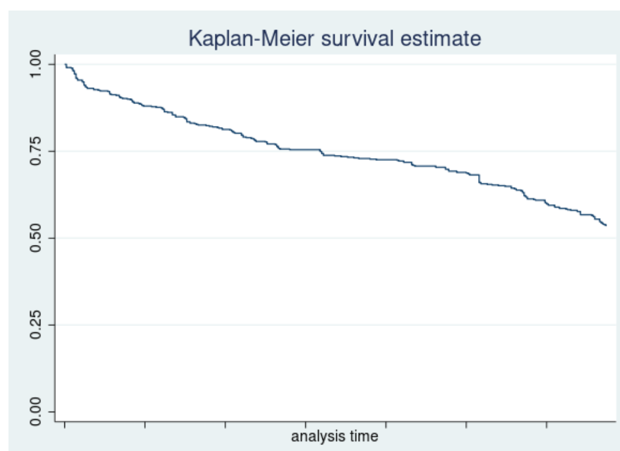


Uninsured Transaction Deposits

Post-Crisis



Formal

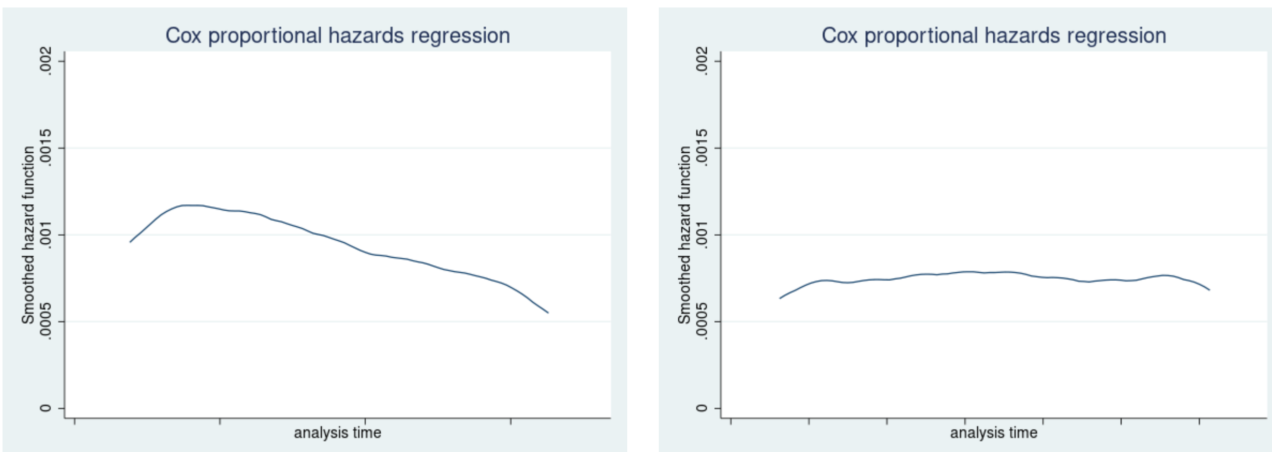


Each X-axis tick represents 50 days.

Figure 8: Cox P.H. Baseline Hazard Curves

All Transaction Deposits

Post-Crisis *Formal*



Each X-axis tick represents 50 days.

Table 16: Who Withdraws? Probit Model; Including Interest Rates

	Transaction		***Term***	
	Post-Crisis	*Formal*	*Post-Crisis*	*Formal*
	(1)	(2)	(3)	(4)
Uninsured	0.0697*	0.179***	0.0881	0.143**
	(1.69)	(6.96)	(1.40)	(2.34)
TAG/DFA Eligible‡	-0.0667**	-0.0270	0.0408	-
	(-2.12)	(-0.71)	(0.21)	-
Interest Rate Spread	-0.0137***	-0.0794***	-0.841***	-0.735***
	(-3.06)	(-3.19)	(-21.49)	(-5.85)
Past-Month Fees	0.00148**	0.00134***	-	-
	(2.52)	(2.82)	-	-
Checking	-0.0384***	-0.0498***		
	(-3.91)	(-4.01)		
Direct Deposit	-0.0882***	-0.0665***		
	(-8.67)	(-4.26)		
Prior Transactions	0.00316***	-0.00326***		
	(4.98)	(-4.18)		
Prior Transactions^2	-0.0000550***	0.0000238**		
	(-5.42)	(2.17)		
Log(Age)	-0.00915**	-0.0228***	0.0210***	-0.0161
	(-2.49)	(-4.44)	(3.54)	(-1.55)
Log(Days to Maturity)			-0.152***	-0.115***
			(-24.90)	(-15.08)
Brokered/Placed			0.409***	0.576***
			(19.52)	(28.40)
Institutional - Listed/Faxed			-0.190	-0.252***
			(-1.08)	(-3.73)
Institutional - Other	0.0123	-0.00759	0.0123	-0.0663
	(0.68)	(-0.45)	(0.24)	(-1.53)
Trust	-0.0438**	0.0602***	0.0264	0.00249
	(-2.26)	(2.73)	(0.74)	(0.05)
Branch Controls	Yes	Yes	Yes	Yes
No. of Accounts	29865	26616	7798	3717
No. of Liquidations	4740	6218	2506	1734
Log Likelihood	-12993.0	-14226.8	-3395.6	-1832.1
Model P-Value	< 0.001	< 0.001	< 0.001	< 0.001

Estimates from probit models of the probability of account liquidation for both transaction and term deposits, focusing only on the Post-Crisis and Formal periods. Liquidation is defined as withdrawing 75% or more of the start-of-period account balance and staying at or below 25% of the start-of-period balance for at least 61 days. T-statistics are in parentheses, calculated using asymptotically normal standard errors. Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *.
‡ Note that although TAG/DFA did not directly insure term deposits, it could do so indirectly. Accounts covered by TAG/DFA were excluded in calculating a depositor's total exposure to a bank when applying standard, limited-value deposit insurance, effectively freeing up insurance coverage to be applied to other, non-TAG/DFA-covered accounts.

Table 17: Who Withdraws? Cox P.H. Model; Including Interest Rates

	Transaction		***Term***	
	Post-Crisis	*Formal*	*Post-Crisis*	*Formal*
	(1)	(2)	(3)	(4)
Uninsured	1.538**	1.915***	1.480**	1.655***
	(2.10)	(8.30)	(2.01)	(2.69)
TAG/DFA Eligible‡	0.581*	0.921	0.944	-
	(-1.75)	(-0.50)	(-0.08)	-
Interest Rate Spread	0.914***	0.737***	0.114***	0.245***
	(-2.91)	(-2.65)	(-17.70)	(-4.27)
Past-Month Fees	1.009**	1.004***	-	-
	(2.57)	(2.86)	-	-
Checking	0.744***	0.813***		
	(-3.67)	(-3.19)		
Direct Deposit	0.427***	0.638***		
	(-6.10)	(-4.21)		
Prior Transactions	1.026***	0.986***		
	(5.72)	(-3.66)		
Prior Transactions^2	1.000***	1.000		
	(-5.77)	(1.52)		
Log(Age)	0.931***	0.897***	1.184***	1.053*
	(-2.82)	(-4.70)	(7.26)	(1.94)
Log(Days to Maturity)			0.651***	0.669***
			(-28.68)	(-27.66)
Brokered/Placed			4.612***	8.203***
			(21.53)	(25.84)
Institutional - Listed/Faxed			1.406	0.448**
			(0.34)	(-2.24)
Institutional - Other	1.088	0.993	1.061	1.212
	(0.72)	(-0.09)	(0.30)	(1.34)
Trust	0.718*	1.255***	1.065	1.180
	(-1.87)	(2.76)	(0.45)	(1.09)
Branch Controls	Yes	Yes	Yes	Yes
No. of Accounts	29865	26616	7800	3717
No. of Liquidations	4740	6218	2506	1734
Log Likelihood	-48371.0	-62344.9	-21340.1	-12850.8
Model P-Value	< 0.001	< 0.001	< 0.001	< 0.001

Estimates from Cox proportional hazard models of the probability of account liquidation for both transaction and term deposits, focusing only on the Post-Crisis and Formal periods. Liquidation is defined as withdrawing 75% or more of the start-of-period account balance and staying at or below 25% of the start-of-period balance for at least 61 days. T-statistics are in parentheses, calculated using asymptotically normal standard errors. Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *.

‡ Note that although TAG/DFA did not directly insure term deposits, it could do so indirectly. Accounts covered by TAG/DFA were excluded in calculating a depositor's total exposure to a bank when applying standard, limited-value deposit insurance, effectively freeing up insurance coverage to be applied to other, non-TAG/DFA-covered accounts.

Table 18: Who Withdraws? Transaction Deposits; Linear Probability Model; Lower (50%) Liquidation Threshold

	Placebo (1)	*Pre-Crisis* (2)	*Post-Crisis* (3)	*Formal* (4)
Uninsured	0.0295**	0.0301**	0.109***	0.219***
	(2.12)	(2.28)	(2.78)	(9.51)
TAG/DFA Eligible†	-0.0226	-0.0165	-0.106**	-0.0764*
	(-0.70)	(-0.55)	(-2.09)	(-1.66)
Checking	-0.130***	-0.152***	-0.0595***	-0.0525***
	(-11.19)	(-11.25)	(-5.24)	(-4.21)
Direct Deposit	-0.109***	-0.123***	-0.111***	-0.0507***
	(-6.76)	(-7.21)	(-6.99)	(-2.89)
Log(Age)	-0.0111***	-0.00936**	-0.00235	-0.0187***
	(-3.93)	(-2.17)	(-0.57)	(-3.31)
Prior Transactions	0.0130***	0.0122***	0.00791***	0.00350***
	(21.34)	(16.08)	(12.13)	(4.46)
Prior Transactions^2	-0.000159***	-0.000160***	-0.000105***	-0.0000603***
	(-18.85)	(-14.79)	(-11.32)	(-5.65)
Institutional - Any	-0.0164	0.0358	0.0167	0.00351
	(-0.64)	(1.43)	(0.92)	(0.20)
Trust	-0.00403	0.0231	-0.0613**	0.0601***
	(-0.13)	(0.74)	(-2.57)	(2.74)
Constant	0.262***	0.369***	0.205***	0.382***
	(14.56)	(19.61)	(13.82)	(24.23)
Branch Controls	Yes	Yes	Yes	Yes
No. of Accounts	33498	34029	29865	26616
No. of Liquidations	8911	12949	5825	7499
R^2	1.8%	1.2%	0.7%	2.0%
Model P-Value	< 0.001	< 0.001	< 0.001	< 0.001

Estimates from linear probability models of the probability of account liquidation during the each of the four periods of interest. Liquidation is defined as withdrawing 50% or more of the start-of-period account balance and staying at or below 50% of the start-of-period balance for at least 61 days. Recall that in most of the paper, a threshold of 75% was used for defining liquidation. Estimates are expressed as hazard ratios. T-statistics are in parentheses, calculated using asymptotically normal standard errors. Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *. † TAG/DFA coverage was only effective in the Post-Crisis and Formal periods; eligible accounts were fully covered/insured in those periods. In earlier periods, eligibility does not imply coverage, and is shown for comparison purposes only.

Table 19: Who Withdraws? Transaction Deposits; Linear Probability Model; Higher (80%) Liquidation Threshold

	Placebo	*Pre-Crisis*	*Post-Crisis*	*Formal*
	(1)	(2)	(3)	(4)
Uninsured	0.0325***	-0.00282	0.0780**	0.177***
	(2.60)	(-0.22)	(2.20)	(8.27)
TAG/DFA Eligible†	-0.0525*	0.00259	-0.101**	-0.0245
	(-1.81)	(0.09)	(-2.18)	(-0.57)
Checking	-0.0750***	-0.0996***	-0.0168	-0.0217*
	(-7.19)	(-7.76)	(-1.64)	(-1.87)
Direct Deposit	-0.0989***	-0.116***	-0.0872***	-0.0412**
	(-6.86)	(-7.12)	(-6.06)	(-2.53)
Log(Age)	-0.0208***	-0.0178***	-0.0108***	-0.0260***
	(-8.22)	(-4.34)	(-2.89)	(-4.95)
Prior Transactions	0.00687***	0.00392***	0.00164***	-0.00414***
	(12.54)	(5.45)	(2.78)	(-5.68)
Prior Transactions^2	-0.0000865***	-0.0000525***	-0.0000295***	0.0000383***
	(-11.44)	(-5.11)	(-3.51)	(3.86)
Institutional - Any	-0.0314	0.0241	0.00881	0.0273*
	(-1.36)	(1.02)	(0.53)	(1.70)
Trust	0.0266	0.0259	-0.0312	0.0742***
	(0.99)	(0.88)	(-1.45)	(3.64)
Constant	0.206***	0.305***	0.153***	0.310***
	(12.75)	(17.09)	(11.44)	(21.18)
Branch Controls	Yes	Yes	Yes	Yes
No. of Accounts	33498	34029	29865	26616
No. of Liquidations	6500	10338	4502	5978
R^2	1.2%	0.8%	0.4%	1.8%
Model P-Value	< 0.001	< 0.001	< 0.001	< 0.001

Estimates from linear probability models of the probability of account liquidation during the each of the four periods of interest. Liquidation is defined as withdrawing 80% or more of the start-of-period account balance and staying at or below 20% of the start-of-period balance for at least 61 days. Recall that in most of the paper, a threshold of 75% was used for defining liquidation. Estimates are expressed as hazard ratios. T-statistics are in parentheses, calculated using asymptotically normal standard errors. Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *. † TAG/DFA coverage was only effective in the Post-Crisis and Formal periods; eligible accounts were fully covered/insured in those periods. In earlier periods, eligibility does not imply coverage, and is shown for comparison purposes only.

Table 20: Who Withdraws? Term Deposits; Linear Probability Model; Lower (50%) Liquidation Threshold

	Placebo	*Pre-Crisis*	*Post-Crisis*	*Formal*
	(1)	(2)	(3)	(4)
Uninsured	0.00660	0.0445***	0.0768*	0.154***
	(0.51)	(3.90)	(1.90)	(3.05)
TAG/DFA Eligible†‡	-0.338	-0.583	-0.00402	-
	(-1.13)	(-1.26)	(-0.03)	-
Log(Age)	-0.00619*	-0.0389***	-0.00353	-0.0130*
	(-1.68)	(-10.58)	(-0.94)	(-1.86)
Log(Days to Maturity)	-0.148***	-0.0701***	-0.202***	-0.0876***
	(-29.64)	(-21.24)	(-54.81)	(-16.08)
Brokered/Placed	0.253***	0.160***	0.278***	0.546***
	(13.01)	(7.58)	(21.65)	(25.58)
Institutional - Listed/Faxed	-0.159	-0.245	0.0102	-0.169***
	(-0.65)	(-0.92)	(0.09)	(-3.13)
Institutional - Other	0.0684	0.0843*	0.0148	-0.0399
	(1.61)	(1.66)	(0.45)	(-1.28)
Trust	-0.0699***	0.000762	-0.00178	0.00645
	(-3.12)	(0.04)	(-0.08)	(0.18)
Constant	0.940***	0.826***	1.206***	0.707***
	(22.06)	(18.07)	(32.71)	(14.22)
Branch Controls	Yes	Yes	Yes	Yes
No. of Accounts	7868	10881	8509	3726
No. of Liquidations	2212	7176	2574	1743
R^2	11.7%	5.5%	31.8%	33.9%
Model P-Value	< 0.001	< 0.001	< 0.001	< 0.001

Estimates from linear probability models of the probability of account liquidation during the each of the four periods of interest. Liquidation is defined as withdrawing 50% or more of the start-of-period account balance and staying at or below 50% of the start-of-period balance for at least 61 days. Recall that in most of the paper, a threshold of 75% was used for defining liquidation. Estimates are expressed as hazard ratios. T-statistics are in parentheses, calculated using asymptotically normal standard errors. Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *.
† TAG/DFA coverage was only effective in the Post-Crisis and Formal periods; eligible accounts were fully covered/insured in those periods. In earlier periods, eligibility does not imply coverage, and is shown for comparison purposes only.
‡ Note that although TAG/DFA did not directly insure term deposits, it could do so indirectly. Accounts covered by TAG/DFA were excluded in calculating a depositor's total exposure to a bank when applying standard, limited-value deposit insurance, effectively freeing up insurance coverage to be applied to other, non-TAG/DFA-covered accounts.

Table 21: Who Withdraws? Term Deposits; Linear Probability Model; Higher (80%) Liquidation Threshold

	Placebo (1)	*Pre-Crisis* (2)	*Post-Crisis* (3)	*Formal* (4)
Uninsured	0.00470	0.0429***	0.0821**	0.147***
	(0.37)	(3.76)	(2.03)	(2.92)
TAG/DFA Eligible†‡	-0.333	-0.573	-0.00336	-
	(-1.11)	(-1.24)	(-0.02)	-
Log(Age)	-0.00668*	-0.0388***	-0.00380	-0.0124*
	(-1.82)	(-10.52)	(-1.01)	(-1.78)
Log(Days to Maturity)	-0.144***	-0.0695***	-0.200***	-0.0866***
	(-28.96)	(-20.99)	(-54.36)	(-15.90)
Brokered/Placed	0.254***	0.162***	0.279***	0.550***
	(13.09)	(7.67)	(21.80)	(25.76)
Institutional - Listed/Faxed	-0.159	-0.244	0.0107	-0.166***
	(-0.65)	(-0.91)	(0.10)	(-3.08)
Institutional - Other	0.0777*	0.0882*	0.0181	-0.0358
	(1.83)	(1.73)	(0.56)	(-1.15)
Trust	-0.0740***	0.00143	-0.00588	0.00651
	(-3.31)	(0.07)	(-0.25)	(0.18)
Constant	0.885***	0.815***	1.185***	0.683***
	(20.77)	(17.79)	(32.14)	(13.75)
Branch Controls	Yes	Yes	Yes	Yes
No. of Accounts	7868	10881	8509	3726
No. of Liquidations	2192	7150	2558	1736
R^2	11.4%	5.4%	31.6%	34.0%
Model P-Value	< 0.001	< 0.001	< 0.001	< 0.001

Estimates from linear probability models of the probability of account liquidation during the each of the four periods of interest. Liquidation is defined as withdrawing 80% or more of the start-of-period account balance and staying at or below 20% of the start-of-period balance for at least 61 days. Recall that in most of the paper, a threshold of 75% was used for defining liquidation. Estimates are expressed as hazard ratios. T-statistics are in parentheses, calculated using asymptotically normal standard errors. Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *.
† TAG/DFA coverage was only effective in the Post-Crisis and Formal periods; eligible accounts were fully covered/insured in those periods. In earlier periods, eligibility does not imply coverage, and is shown for comparison purposes only.
‡ Note that although TAG/DFA did not directly insure term deposits, it could do so indirectly. Accounts covered by TAG/DFA were excluded in calculating a depositor's total exposure to a bank when applying standard, limited-value deposit insurance, effectively freeing up insurance coverage to be applied to other, non-TAG/DFA-covered accounts.

Table 22: Who Withdraws? Transaction Deposits; Linear Probability Model; Errors Clustered at Branch Level

	Placebo	*Pre-Crisis*	*Post-Crisis*	*Formal*
	(1)	(2)	(3)	(4)
Uninsured	0.0249	-0.00117	0.0693***	0.183***
	(0.91)	(-0.07)	(4.57)	(4.36)
TAG/DFA Eligible†	-0.0446**	-0.000624	-0.0944**	-0.0412
	(-4.97)	(-0.06)	(-3.82)	(-1.13)
Checking	-0.0901***	-0.105***	-0.0277**	-0.0252***
	(-43.36)	(-4.93)	(-3.15)	(-3.86)
Direct Deposit	-0.104***	-0.123***	-0.0864***	-0.0459***
	(-6.69)	(-6.61)	(-6.85)	(-7.49)
Log(Age)	-0.0194***	-0.0180**	-0.00915***	-0.0247
	(-12.21)	(-4.34)	(-11.27)	(-1.70)
Prior Transactions	0.00793***	0.00555**	0.00263	-0.00310***
	(10.59)	(3.38)	(1.96)	(-5.78)
Prior Transactions^2	-0.0000983***	-0.0000746***	-0.0000419**	0.0000235*
	(-15.68)	(-7.11)	(-2.80)	(2.32)
Institutional - Any	-0.0273	0.0242	0.0218	0.0215
	(-2.24)	(1.28)	(0.83)	(0.87)
Trust	0.0255**	0.0248	-0.0418***	0.0698**
	(4.65)	(1.10)	(-5.34)	(2.50)
Constant	0.217***	0.313***	0.159***	0.326***
	(69.66)	(50.15)	(29.80)	(24.64)
Branch Controls	Yes	Yes	Yes	Yes
No. of Accounts	33498	34029	29865	26616
No. of Liquidations	6920	10795	4740	6218
R^2	1.3%	0.8%	0.4%	1.8%

Estimates from linear probability models of the probability of account liquidation during the each of the four periods of interest. Liquidation is defined as withdrawing 75% or more of the start-of-period account balance and staying at or below 25% of the start-of-period balance for at least 61 days. Estimates are expressed as hazard ratios. T-statistics are in parentheses, calculated using standard errors clustered at the branch level. Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *.

† TAG/DFA coverage was only effective in the Post-Crisis and Formal periods; eligible accounts were fully covered/insured in those periods. In earlier periods, eligibility does not imply coverage, and is shown for comparison purposes only.

Table 23: Who Withdraws? Term Deposits; Linear Probability Model; Errors Clustered at Branch Level

	Placebo (1)	*Pre-Crisis* (2)	*Post-Crisis* (3)	*Formal* (4)
Uninsured	0.00501***	0.0432***	0.0820	0.147***
	(7.12)	(13.17)	(0.86)	(3.73)
TAG/DFA Eligible†‡	-0.333***	-0.573***	-0.00332	-
	(-365.06)	(-76.33)	(-0.04)	-
Log(Age)	-0.00664***	-0.0391***	-0.00379*	-0.0124**
	(-11.16)	(-126.27)	(-2.35)	(-2.96)
Log(Days to Maturity)	-0.144***	-0.0695***	-0.200***	-0.0866***
	(-18.68)	(-131.29)	(-141.89)	(-20.26)
Brokered/Placed	0.254***	0.162***	0.279***	0.550***
	(24.71)	(90.76)	(96.46)	(49.76)
Institutional - Listed/Faxed	-0.159***	-0.244***	0.0105***	-0.166***
	(-21.30)	(-312.72)	(4.55)	(-17.62)
Institutional - Other	0.0764***	0.0880*	0.0180	-0.0358
	(13.31)	(2.34)	(0.55)	(-1.03)
Trust	-0.0745*	0.00318	-0.00600	0.00651
	(-3.16)	(1.61)	(-0.53)	(0.13)
Constant	0.891***	0.815***	1.185***	0.683***
	(30.25)	(129.02)	(46.77)	(24.20)
Branch Controls	Yes	Yes	Yes	Yes
No. of Accounts	7868	10881	8509	3726
No. of Liquidations	2193	7153	2559	1736
R^2	11.4%	5.4%	31.6%	34.0%

Estimates from linear probability models of the probability of account liquidation during the each of the four periods of interest. Liquidation is defined as withdrawing 75% or more of the start-of-period account balance and staying at or below 25% of the start-of-period balance for at least 61 days. T-statistics are in parentheses, based on standard errors clustered at the branch level. Estimates significant at 99% are denoted with ***, 95% with **, and 90% with *.

† TAG/DFA coverage was only effective in the Post-Crisis and Formal periods; eligible accounts were fully covered/insured in those periods. In earlier periods, eligibility does not imply coverage, and is shown for comparison purposes only.

‡ Note that although TAG/DFA did not directly insure term deposits, it could do so indirectly. Accounts covered by TAG/DFA were excluded in calculating a depositor's total exposure to a bank when applying standard, limited-value deposit insurance, effectively freeing up insurance coverage to be applied to other, non-TAG/DFA-covered accounts.